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# Accumulation mechanism of opinion leaders' social interaction ties in virtual communities: Empirical evidence from China

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## ABSTRACT

Considering both personal and social perspectives, self-identity and reciprocity were analyzed to identify the underlying mechanisms used by opinion leaders to accumulate their social interaction ties in virtual communities. As a key factor in maintaining the operation of virtual communities, knowledge contribution is employed in our route model. An online survey conducted in several different virtual communities, yielded 666 useable responses. The research findings indicate that opinion leaders accumulate their social interaction ties through different routes such as self-identity, knowledge contribution, and reciprocity. We also observe that both knowledge contribution and reciprocity have a mediating effect on the relation between opinion leader status and social interaction ties. In addition, knowledge contribution has a mediating effect on the relationship between self-identity and social interaction ties; and on the relationship between reciprocity and social interaction ties. The indications and implications of our findings, as well as the limitations of our study, are discussed.

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## 1. Introduction

With the development of information technology and increased opportunities for Internet access, communication and information technology is becoming increasingly diverse. Through the use of computers and networks, online forums and social websites have extended people's traditional social contexts and their personal learning networks (PLNs). Online communication has improved the scope of people's interactions; and contributed to knowledge sharing, people's learning (Trust, Krutka, & Carpenter, 2016) and the dissemination of important information. For example, people who have similar interests or goals often enjoy interacting and sharing knowledge with each other, and with the help of online forums, their personal relationship networks have expanded into cyberspace and resulted in the formation of different types of virtual communities (VCs). The increasing use of VCs has also attracted considerable attention and created a new educational platform for academic researchers (Cheng & Guo, 2015).

Although one of the important features of VCs is delayering, some studies show that there still exist differences on the status among members of VCs (Mutter & Kundisch, 2014). For example,

some Facebook users who have millions of followers are undoubtedly much more influential than those who have only a few. In the field of social network studies, the most influential members in communities are often called opinion leaders (Trusov, Bodapati, & Bucklin, 2010). Many studies suggest that opinion leaders can influence others a lot (Cheng, Xiong, & Xu, 2016). They have more power on influencing other people's opinions because of their expertise, or position in society (Chen, Glass, & McCartney, 2016), and along with that they can also guide the purchasing behavior of consumers (Cho, Keum, & Shah, 2015). In the online context, opinion leaders usually have the features of high trust and reputation (Chiregi & Navimipour, 2016). Some studies indicate that opinion leaders play an important role in the formation of public opinion in VCs (Luarn, Yang, & Chiu, 2014), and it is their superior status, leadership, and social prestige that enables them to influence followers (Li, Ma, et al., 2013). Therefore, it is of great significance for the field of virtual community studies to understand the development mechanism of opinion leaders within virtual communities.

As opinion leaders play a critical role in the dissemination of information according to an increasing number of contemporary studies that have analyzed the issue of opinion leaders in VCs. However, most studies on opinion leader in VCs take it as a static concept, suggesting that most studies have focused on the identification of opinion leaders in VCs and on their influence over others

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in this context (Eck, Jager, & Leeﬂang, 2011; Momtaz, Aghaie, & Alizadeh, 2011). Unlike formal organizations, opinion leaders in virtual communities are not formally appointed. On the contrary, they are usually identified or developed through the process of interacting with various members of VCs. In this sense, the formation and development of opinion leaders in virtual communities are dynamic processes, and with the development of VCs, some members have gradually become the opinion leaders among their followers. That said, being an opinion leader does not necessarily mean the individual will hold that status forever. With the development of virtual communities, some opinion leaders may continue to be opinion leaders within their social groupings, while others may become common members of the community again (Lazarsfeld, Berelson, & Gaudet, 1994). However, few studies have studied the mechanisms that underlie the development of opinion leaders in VCs.

Most relevant studies have identified that one of the most important features of opinion leaders in VCs is the great influence over their followers (Rhee, Kim, & Kim, 2007; Weng, Lim, Jiang, & He, 2010). Accordingly, numbers of connections a member has and the degree of one's interactions with others are critical criteria in identifying opinion leaders of virtual communities (Agarwal, Liu, Tang, & Yu, 2008; Cha, Haddadi, Benevenuto, & Gummadi, 2010). For example, Momtaz et al. (2011) suggested that social network analysis, which considers the centrality, structural holes, and indegree, can be used to identify opinion leaders. The social network perspective with respect to studying opinion leaders in VCs is consistent with the social capital theory. Social capital theory has been defined as “the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit (Nahapiet & Ghoshal, 1998)”. Social capital theory also advocates the use of weak ties, structural holes, and social resources to analyze the structure of people in their social networks and the resources available in that structure (Lin, 2002). Thus, it is reasonable to argue that opinion leaders of virtual communities are those members who have more social capital in the community, and the amount of social capital they have will have an impact on their status as opinion leader in that community. However, few studies have revealed the mechanism that underlies the dynamic process of opinion leaders in VCs from the social capital theory.

Social capital theory primarily aims to identify how the social structure of an individual serves as a resource that creates a rich output (Coleman, 1988). Nahapiet and Ghoshal (1998) proposed that social capital consists of three distinct dimensions: structural, relational, and cognitive. The structural dimension, which is manifested as a social interaction tie, refers to the impersonal configuration of linkages between members in a social network and the extent to which the members are connected with each other (Chiu, Hsu, & Wang, 2006). This means that social interaction ties are at the core of social capital (Granovetter, 1985). In addition, virtual community members only communicate with each other through online interactions, and, thus, the relational and cognitive dimensions of social capital are mainly developed based on the social interaction ties created online (Chiu et al., 2006). For these reasons, we use social interaction ties instead of social capital as the variable for analyzing opinion leaders' social capital dynamics in VCs. This is consistent with Hsiao and Chiou (2012), who also used social interaction ties instead of social capital in their study on VCs. Overall, the purpose of this study is to propose a more comprehensive understanding of the accumulation mechanism of opinion leaders' social interaction ties in VCs by constructing a conceptual model that links opinion leaders and their social interaction ties and subsequently identifying that mechanism empirically.

## 2. Theoretical background

### 2.1. Opinion leaders and their influence

The study on opinion leaders are derived from Lazarsfeld, Berelson & Gaudes's work of the two-step flow theory (Lazarsfeld, Berelson & Gaudet, 1994): compared with gather information from mass communications, most of the voters get their information from other part of voters who pay more attention to information from media. Thus, more influential voters are called opinion leaders. The two-step flow theory proposed that opinion leaders connected to the public through mass media, play a large role in filtering and re-disseminating information. Earlier studies about opinion leaders concentrated on the field of communication, and many studies after that identified the relationship between opinion leaders and followers exists in many other fields (Shoham & Ruvio, 2008). With the development of the Internet and the advent of the Web 2.0, people found that opinion leaders also exist in VCs. In recent studies, opinion leaders are defined as engaged and competent individuals who are viewed as honest and trustworthy by opinion followers, with whom they frequently discuss issues with in general (Turcotte, York, et, al., 2015). Compared to the traditional context where opinion leaders only have a limited influence on their friends; in the online context opinion leaders can influence many more Internet users due to the ease of access for their followers (Lyons & Henderson, 2005). Some studies have identified that leaders have the critical influences on VCs' development. Leaders in VCs can foster members' interactions, participation, as well as the density, reciprocity and transitivity of their followers, which indicates how members form an interactive, cohesive, and equally-distributed community (Ouyang & Scharber, 2017). However, Zhang, Liu, Chen, Wang, and Huang (2017) pointed out that the online interactivity of its members in a VC does not always automatically promote members' interactive networks and the cohesion of the community. Thus, the mechanism of how opinion leaders expand their interactive networks in VCs has not yet been identified.

Opinion leaders demonstrate their influence, not only on other people's opinions but also on other people's attitudes and behaviors (Valente & Pumpuang, 2007). Based on the analysis of previous studies, the formation of opinion leaders and their influence are mainly related to their expertise in a field, involvement, and social ties (Li & Du, 2011). Besides, members' perceived risk and their trust in opinion leaders are also considered to play important roles in the process that opinion leaders have their influence over the followers (Awad & Ragowsky, 2008; Ruvio & Shoham, 2007). The underlying dimensions of opinion leadership have often been assessed using questionnaires and self-reports, and some measurements of opinion leadership included the ability to persuade your audience (Nisbet & Kotcher, 2009).

### 2.2. Social interaction ties

Coming from the theory of social capital, the concept of “social interaction ties” is very important. As one of the three dimensions of social capital, individual's social interaction ties refer to the network of relationships possessed by him or her. One of the important perspectives on social capital theory is the social network analysis, which analyses social capital from the relationship among individuals. Social network analysis suggests that social capital is embedded in the network formed by individuals through all kinds of social relationships and interactions within these networks. Based on the concepts of embedded, structural hole, and centrality, social network analysis constructs the core of social capital theory. These concepts define the features of individuals in

their network, which reflects the existing or potential resources of an individual in their social network.

As a new kind of media, the Internet broke restrictions on the traditional way people interacted. The Internet organizes and constructs individuals' relationships which gradually supplemented or even substituted the traditional, face-to-face, social relationships people have (Dijk, 2006). The Internet can help individuals to explore and develop their social resources, which means that their social capital and chance of social involvement will increase as well (Shah, Kwak, & Holbert, 2001). Online social relationships and social resources developed the social capital theory, and individuals' social relationships that formed online also became part of that social capital. Therefore, many studies begin to pay attention to individuals' online social capital (Hau, Kim, Lee, & Kim, 2013), and social ties which are considered the foundation of online social capital (Ellison, Vitak, Gray, & Lampe, 2014).

### 3. Research model and hypotheses

#### 3.1. Knowledge contribution

People with similar interests, goals, and experiences often need and are willing to discuss or share their experiences (Chiu et al., 2006), and as an online forum, virtual communities are not restricted by time nor location. When people prefer talking online, virtual communities become the main platform for their interactions (Wu & Chiang, 2009). In a virtual community, the interactions among members are mainly online posting or sending messages, and the most attractive posts and messages are usually those novel and interesting ones with substantial contents, which can attract lots of attention and prompts members to participate in the discussion (Wellman, Salaff, et al., 1996). In academic research, such information posting behavior in virtual communities is regarded as knowledge contribution. Knowledge contribution is a kind of behavior when someone disseminates his or her knowledge and experience to someone else (Kumar & Thondikulam, 2005). For virtual communities, different kinds of knowledge sharing activities are very important for those communities to survive (Butler, 2001). Thus, knowledge contribution can be considered as one of the key factors, which maintains the running of virtual communities. The core role of knowledge contribution in VCs' self-running mechanism has been identified in many studies. For these reasons, we use knowledge contribution as the mediating variable between the status of opinion leader and the social interaction ties.

Many studies have also shown that knowledge contribution of members in virtual communities has an impact on their social interaction ties (Cheng & Guo, 2015). The topics discussed in different virtual communities may be different, but all these topics are often initiated by a member's own understanding on a particular issue. Therefore, knowledge contribution can be regarded as the important determinant of the interactions among group members (Carmel, Roitman, & Yom-Tov, 2012). Those who post in VCs often receive others' replies, and the original posters', or even different repliers, who may also positively respond to their comments and communicate online with one other. Thus, social interaction ties can be shaped (Ma & Yuen, 2009). Therefore, we hypothesize the following:

**H1.** Members' knowledge contribution positively affects their social interaction ties in VCs.

Some studies have identified that opinion leaders are found to exhibit a positive relationship with the provision of information (Feick & Price, 1987). Because opinion leaders are considered to be sharing important information to disseminators in their social network (Chaney, 2001), some forms of online information like

posting, forwarding, chatting, and so on become the natural behavior of opinion leaders in the context of VCs (Phelps, Lewis, et al., 2004). In many cases, this kind of information provision in VCs is also a kind of knowledge contribution. VCs are highly interactive and can be anonymous forums; thus individuals are more assertive and confident to post and raise a topic in these communities. Opinion seekers will tend to pursue needed information from others within an online community in which similar interests converge (Sun, Youn, et al., 2006). These inquiring posts will push opinion leaders to demonstrate more behavioral consequences of knowledge contribution. Thus the following hypotheses are proposed:

**H2.** Members' status of opinion leaders positively affects their knowledge contribution in VCs.

**H3.** Members' knowledge contribution is likely to mediate the relationship between their status of opinion leaders and their social interaction ties in VCs.

#### 3.2. Self-identity

The concept of self-identity is also known as role identity, which comes from the identity theory (Stryker & Serpe, 1982). Self-identity proposes that an individual's self-concept is defined by the special role he or she occupies in the social structure. According to identity theory, people always classify themselves in certain social roles, and these roles guide their intentions and behaviors so that people spontaneously act in accordance with their self-identities (De Bruijn, Verkooijen, et al., 2012). The expectations and meanings of roles result in a set of criteria that guide people's behaviors. Thus, people identify with their roles, which usually refers to the special behaviors in their self-concepts. Certain roles take the dominant positions in their minds, and to fulfill these behaviors is an important part of that self-concept or role development. The higher the self-identity, the more likely the individual is to act out the expectations of that role in society (Sparks & Shepherd, 1992). This indicates that self-identity can predict people's behavior. Therefore, in this study, we introduce self-identity as the personal perspective to analyze the accumulation mechanism of opinion leaders' social interaction ties in virtual communities.

Roles in VCs can be classified as active members, moderate members, and peripheral members (lurkers) (Tsiotakis & Jimoyiannis, 2016). However, these roles are not assigned, but formed by members' behaviors. Once someone notices his or her role in the community, their behaviors relating to that role will be enhanced; different roles demonstrate different behaviors. For opinion leaders, the roles they perform in VCs are determined by their own characteristics. Stern and Gould (1988) argued that opinion leaders are the members who have more credible information in virtual communities, and having more credible knowledge is believed to be one of the main qualifications of opinion leaders (Gnams & Batinic, 2013; Trepte & Scherer, 2010). If the information disseminated by individuals is not authentic and credible, their status in the community will be negatively affected, and may no longer influence others in the community (Hazeldine, Southern, & Miles, 2010; Yong & Tran, 2013). Members in VCs are not familiar with, or have no idea whom others are, which means that there is little basis for trust to build between different members. Thus, having more credible knowledge is extremely important for opinion leaders in VCs as he or she can build up their reputation through honesty. Therefore, opinion leaders must take the role of contributor, and in doing so, must also contribute credible knowledge in their VCs. Based on these analysis, we proposed the following hypotheses:

**H4.** Members' status of opinion leaders positively affects their self-identity as the contributor in VCs.

According to the identity theory, when individuals identify their roles in a social community, they will gradually form behaviors based on those social expectations (Stryker & Serpe, 1982). Similarly, when an individual's role in a community is noticed by others, other people will form the expectations to the individual's behaviors according to that role; those expectations eventually conduct the individual's role-relevant behaviors. When these role identities are formed, people's different roles will then be embedded in different environmental contexts, which will in turn guide members' different behaviors in virtual communities respectively (Hagger & Chatzisarantis, 2006). Thus, when some of the members begin to identify their roles as the contributor of virtual communities, their contribution behaviors to the virtual community will increase, and the higher the degree of self-identity as the contributor of the community, the more likely they will contribute to that community. As mentioned above, the main form for members to contribute to VCs is knowledge contribution, so it is reasonable to believe that members' self-identity as the contributor will lead to their knowledge contribution. Based on these analyses, we hypothesize the following:

**H5.** Members' self-identity as the contributor positively affects their knowledge contribution in VCs.

**H6.** Members' knowledge contribution is likely to mediate the relationship between their self-identity as the contributor and their social interaction ties in VCs.

### 3.3. Reciprocity

The concept of reciprocity comes from social exchange theory. Reciprocity is regarded as the mechanism of social exchange (Blau, 1967); it is a concept about social compensation. Gouldner (1960) defined reciprocity as a set of criteria that the beneficiaries have the obligation to return the benefactors after they receive the benefactors' help. He also argued that these criteria are widely accepted by people in social communities; since reciprocity is a kind of moral norm, it exists in the interpersonal relationships of many kinds of cultures. Therefore, we introduce reciprocity as the other social perspective to analyze the accumulation mechanism of opinion leaders' social interaction ties in virtual communities.

As we have discussed before, the opinion leaders in virtual communities are not assigned. The status of opinion leaders are established based on the approval of most members who offer their trust to the members as opinion leaders in VCs. Social exchange, distinct from economic exchange, establishes bonds of friendship and unspecified obligations over others (Organ & Konovsky, 1989). In social communities, when other people express their kindness to you, you will return your goodwill back to others (Trivers, 1971). In the weak-tie context of VCs where the trust level among members is low, the opinion leaders would have a strong reciprocity in order to develop trust in others. Therefore, we hypothesize the following:

**H7.** Members' status of opinion leaders positively affects their reciprocity in VCs.

In the field of organizational behavior, reciprocity is often considered as the expectation (Brock, Zmud, Kim, & Lee, 2005). Kankanhalli, Tan, and Wei (2005) proposed reciprocity is the expectation that individuals contribute their current knowledge in order to learn and use that new knowledge in the future. This indicates that reciprocity is a mechanism that underlies people's exchange behavior. Individuals will determine their contribution by calculating the risks and the potential earnings they will receive

(Kachra & White, 2008). Therefore, the higher the level expectation on reciprocity of members, the more motivation they have to contribute their current knowledge. Besides, many studies have identified that reciprocity is positively associated with knowledge contribution (Wasko & Faraj, 2005). Thus, we propose the following hypothesis:

**H8.** Members' reciprocity positively affects their knowledge contribution in VCs.

Constant, Kiesler, and Sproull (1994) argue that when two individuals are influenced by their social and organizational contexts, the social exchange relationship will be a major determinant of their attitudes. Huber (2001) also argues that based on people's desire for fairness and reciprocity, members in a society believe their mutual relationships with one another will improve. That means when members in VCs have a higher level of reciprocity, their awareness and evaluation of the relationships with other members in that community is more positive. Meanwhile, in virtual communities, when members have a higher level of reciprocity expectation, they will be more likely to believe that their contribution in the community will receive feedback from others. Thus, the connections between different members will be enhanced. These result in the following hypotheses.

**H9.** Members' reciprocity positively affects their social interaction ties in VCs.

**H10.** Members' knowledge contribution is likely to mediate the relationship between their reciprocity and their social interaction ties in VCs.

**H11.** Members' reciprocity is likely to mediate the relationship between their status of opinion leaders and their social interaction ties in VCs.

### 3.4. Research model

Based on the above analyses, we developed a route model as our research model, which is depicted in Fig. 1.

## 4. Method

### 4.1. Sample and procedure

We conducted an online survey to test our hypotheses among participants who were recruited from Baidu Post Bar and Wechat groups to complete an online questionnaire, thus ensuring the generalizability of the findings. Actually, these two VCs are different types of VCs. As the most comprehensive and popular online interest community in China (Cheng & Guo, 2015), Baidu Post Bar can be categorized as an interest VC in which members

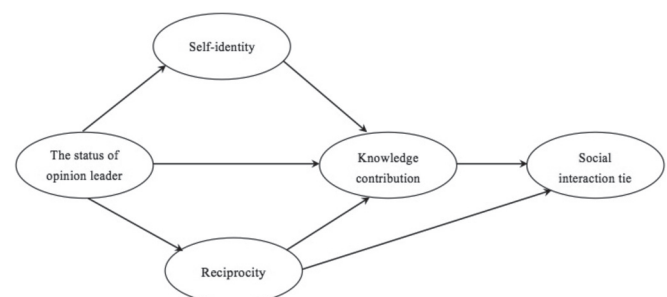


Fig. 1. Research model.



**Table 1**  
Demographic information.

Variables	Items	%
Gender	Male	64.8
	Female	35.2
Age	<18	3.6
	18–25	64.7
	26–30	7.4
	31–40	17.9
	41–50	3.8
	>50	2.6
Educational level	Lower than high school	6.6
	Bachelor's degree	63.1
	MSc or PhD degree	30.3
Income	Less than 1000 yuan	29.0
	1001–5000 yuan	37.7
	5001–10000 yuan	23.2
	More than 10000 yuan	10.1
Membership history	Less than 6 months	26.3
	6–12 months	12.9
	1–3 years	32.2
	More than 3 years	28.5

spontaneously gather to discuss their common interests. As for Wechat groups, they can be deemed to be problem-solving VCs, because many work teams will launch Wechat groups and discuss their tasks in them. Besides, the total amount of members in a Wechat group quite different from that of a Baidu Bar. The maximum member in a Wechat group is 500 according to the latest version, whereas the number of members in a Baidu Bar is usually substantially more than 500. For example, the NBA Bar (one group of the Baidu Post Bar) has more than 4.8 million numbers.

The process of data collection lasted for one month during which time, 759 responses were collected. After eliminating the invalid responses, i.e., those that were not completed, those that had the same answer for all items and those that were completed in less than 10 s, the final sample consisted of 666 participants, representing a response rate of 88%. Of the participants, 174 were from Baidu Post Bar, and 492 were from Wechat groups. The demographic statistics of the participants of this study are presented in Table 1. The data demonstrate that the participants in our survey correspond with the users of the Internet.

#### 4.2. Measures

Unless otherwise indicated, all variables are measured by participants' responses to questions on a five-point Likert-type scale ranging from "strongly disagree" to "strongly agree". For English measurements, backward translation (with the material translated from English into Chinese, and back into English; versions compared; discrepancies resolved) is used to ensure consistency between the Chinese and the original English version of the instrument (Mullen, 1995; Singh, 1995).

**Perceived opinion leader status (POLs).** There is no consent measurement regarding perceived opinion leader status in VCs. However, some measurements about opinion leadership for specific product or service domains have been developed (Flynn, Goldsmith, & Eastman, 1996). Based on these literature, some studies in the field of marketing have analyzed the opinion leadership in VCs, which is defined by their status and personal influence in VCs (Schreier, Oberhauser, & Prüggl, 2007). Members' status and personal influence in VCs can usually be reflected by their prestige, high-ranking posts and their posting and replying in VCs (Chang, Qiu, Yan, & Zhang, 2011), and members can also perceive the status and influence of both themselves and other members by these indicators. According to that, Chang et al. (2011)

developed the measurement of the information providers' status in the context of Chinese VCs. Because the features of the information providers' status in VCs is similar to members' perceived opinion leader status in VCs, we adapt that measurement, which has three items: "I have posted many high-ranking posts in the community"; "I have high prestige in the community"; and "I am enthusiastic about posting or replying to posts." We conduct a principal component factor analysis to test whether one factor can be extracted from these three items. Bartlett's test of sphericity reveals that the KMO statistic of 0.731 is significant at a level of 0.001, indicating it is appropriate to use a principle component factor analysis on the data. Only one factor, which explains 79.1% of the variance, is extracted; item loadings are 0.885, 0.908 and 0.875, all of which are above the required threshold of 0.5. The Cronbach alpha coefficient is 0.87.

**Self-identity.** A three-item scale to measure self-identity is adapted from Yun and Silk's (2011) self-identity measure and Smith et al.'s (2007) self-identity measure. The items are as following: "I think of myself as a contributor in this group"; "I hardly make any contributions to this group"; and "I think of myself as a member who is concerned with making contributions to this group." The Cronbach alpha coefficient for the measure in this study is 0.78.

**Reciprocity.** Reciprocity is measured with five items were adapted from Bock et al.'s anticipated reciprocal relationships (Trivers, 1971). The items are as follows: "My knowledge contribution would strengthen the ties between existing members in the group and myself"; "My knowledge contribution would get me well-acquainted with new members in the group"; "My knowledge contribution would expand the scope of my association with other members in the group"; "My knowledge contribution would draw smooth cooperation from outstanding members in the future"; and "My knowledge contribution would create strong relationships with members who have common interests in the group." The Cronbach alpha coefficient is 0.94.

**Knowledge contribution.** Knowledge contribution is measured using the following three items from the work of Cheng and Guo, 2015: "I contribute my knowledge often to others in the group which I joined"; "I post my knowledge often in this group"; and "How many knowledge (sharing) posts do you create per month in this group?" According to Cheng et al., the last item is answered to calculate the average volume of knowledge contributions per month, and in order to make it correspond to and consistent with the two other items of the measurement of knowledge contribution, we followed their instruction and transformed the volume of knowledge contributions per month to a five-point scale where 1 = less than one per month, 2 = approximately 1–5 per month, 3 = approximately 6–10 per month, 4 = approximately 11–20 per month, and 5 = more than 20 per month. The Cronbach alpha coefficient is 0.74.

**Interaction tie.** The interaction tie refers to the strength of online social relations based on social interactions, and it is measured using the following three items adapted from Chiu et al. (2006): "I maintain close relationships with some members in this group"; "I have frequent communication with some members in this group"; and "I know some members in this group on a personal level." The Cronbach alpha coefficient is 0.93.

#### 4.3. Data analysis

The Mplus 7 software is employed for data analysis. We first tested the reliability and validity of the measurement model using confirmatory factor analysis (CFA). Based on the reliability and validity of the measurement, we then examined the research model by structural equation modeling (SEM). Finally, we tested the hypotheses of the mediating effects proposed in Section 3. To gauge

the model fit, chi-square ( $X^2$ ) values, comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR) are reported. We adapted  $X^2/df < 5$ , CFI  $> 0.90$ , TLI  $> 0.90$ , RMSEA  $< 0.08$  and SRMR  $< 0.05$  as the criteria for model fitness (Wen, Hau, & Marsh, 2004; Zhang & Bartol, 2010).

4.4. Test for common method variance

Data collected via a single self-report are susceptible to common method variance (CMV). Thus, to avoid CMV, we used a one-factor model approach to test for CMV (Liang, Saraf, Hu, & Xue, 2007). We connected all items to one latent variable and constructed a one-factor model, and we subsequently tested this model with confirmatory factor analysis (CFA). The overall fit indices of this one-factor model performed very poorly: RMSEA = 0.174, SRMR = 0.088, CFI = 0.715, TLI = 0.674,  $X^2 = 2526.671$ ,  $df = 119$ ,  $X^2/df = 21.23$ . These indices are far beyond the acceptable range. Taken together, these results suggest that CMV did not pose a significant threat to the interpretation of our present findings (Harris & Mossholder, 1996).

5. Results

Table 2 presents the results of the *t*-test for the differences in self-identity, knowledge contribution, social interaction ties, reciprocity, and POLS on gender. As evidenced in Table 2, self-identity, knowledge contribution, reciprocity, and POLS indicate no difference with respect to gender; however, the level of social interaction ties in VCs differs between males and females, and the level of females' social interaction ties in VCs exceeds those of males.

The correlations of some of the demographic information, i.e., age, educational level, income and membership history, and self-identity, knowledge contribution, social interaction ties, reciprocity, and POLS are presented in Table 3. Table 3 infers that the membership history has significant positive correlations with all five variables in our study, which indicates that the longer the history of an individual's membership in a VC, the closer the individual's relationship with the community. As educational level demonstrates no significant correlation with any of the five variables, is concluded that there is no relationship between the individual's educational level and any of the five variables. It is of interest to note that members' incomes are significantly positively correlated with their POLS in VCs. That is, the higher an individual's

Table 2 Differences of the variables with respect to gender.

	Gender	n	Mean	S. D.	t	S. E.
POLS	Male	432	2.35	1.02	-0.84	0.081
	Female	234	2.42	0.95		
Self-identity	Male	432	2.90	0.96	0.35	0.078
	Female	234	2.87	0.95		
Reciprocity	Male	432	3.22	1.07	-0.60	0.086
	Female	234	3.27	1.04		
Knowledge contribution	Male	432	2.56	0.90	-1.52	0.074
	Female	234	2.68	0.94		
Social interaction ties	Male	432	2.75	1.22	-3.93***	0.099
	Female	234	3.14	1.23		

\*p ≤ .05; \*\*p ≤ .01, \*\*\*p ≤ .001.

<sup>1</sup> The combined indirect effect was a sum of the four specific indirect effects mentioned above.

Table 3 Correlations of the demographic information and the variables of this study (n = 666).

	Age	Educational level	Income	Membership history
POLS	0.064	0.059	0.118**	0.107**
Self-identity	0.043	0.021	0.043	0.185**
Reciprocity	-0.078*	0.025	-0.016	0.144**
Knowledge contribution	-0.010	0.008	0.044	0.169**
Social interaction ties	0.030	0.070	0.091*	0.144**

\*p ≤ .05; \*\*p ≤ .01, \*\*\*p ≤ .001.

Table 4 Descriptive statistics, correlations, and reliabilities (n = 666)<sup>a</sup>.

Constructs	Mean	S. D.	1	2	3	4	5
1. POLS	2.37	1.00	(0.87)				
2. Self-identity	2.89	0.95	0.59**	(0.78)			
3. Reciprocity	3.24	1.06	0.54**	0.50**	(0.94)		
4. Knowledge contribution	2.60	0.92	0.65**	0.65**	0.55**	(0.74)	
5. Social interaction ties	2.88	1.23	0.67**	0.55**	0.61**	0.63**	(0.93)

\*p ≤ .05; \*\*p ≤ .01, \*\*\*p ≤ .001.

<sup>a</sup> Internal reliabilities (alpha coefficients) for the overall constructs are given in parentheses on the diagonal.

income, the greater the probability that the individual will become an opinion leader in VCs.

Table 4 provides the descriptive statistics, correlations, and scale reliabilities for the variables in the study. The results reveal that all variables in this study are significantly positively correlated with each other.

5.1. Measurement model

The measurement model results indicate a good fit to the data ( $X^2 [109] = 277.210$ ,  $p \leq .001$ ; CFI = 0.980, TLI = 0.975, SRMR = 0.028, RMSEA = 0.048), which indicates that the validity of this study is acceptable and further examination of the structural model is justified. Although the chi-square test is statistically significant, this statistic is well known to be sensitive to sample size and may be significant even when the differences between observed and model-implied covariance are relatively small (Kline, 1998). Thus, we report multiple indices in assessing model fit, as generally suggested by SEM scholars and as previously outlined.

Additionally, as displayed in Table 5, the composite reliabilities range from 0.749 to 0.952, which are greater than 0.7 and thus indicate adequate reliability (Hatcher, 1994). The average variance extracted (AVE) from every construct except knowledge contribution, is greater than 0.5, and the AVE from knowledge contribution is also close to 0.5. This suggests good convergent validities of the constructs (Bagozzi & Yi, 1988).

Table 6 reports the loadings of the items in our research model. As expected, all item loadings are significantly higher than 0.5 (Teo & King, 1996).

Table 5 Composite reliability and AVE.

Constructs	Composite reliability	AVE
POLS	0.913	0.689
Self-identity	0.780	0.555
Reciprocity	0.952	0.761
Knowledge contribution	0.749	0.497
Social interaction ties	0.931	0.820

**Table 6**  
Measurement loadings.

Constructs	Items	Standard loading
Self-identity	Q1	0.833
	Q2	0.608
	Q3	0.775
Knowledge contribution	Q4	0.783
	Q5	0.713
	Q6	0.607
Social interaction ties	Q7	0.904
	Q8	0.917
	Q9	0.895
Reciprocity	Q10	0.842
	Q11	0.864
	Q12	0.907
	Q13	0.867
POLS	Q14	0.880
	Q15	0.811
	Q16	0.880
	Q17	0.797

5.2. Structural model

The overall fit indices of the research model are presented (as baseline model) in Table 7. As presented, all overall fit indices of the baseline model perform well: the CFI and TLI both perform above the threshold values, and the RMSEA and SRMR are less than 0.05. There is no direct connection between the two variables, self-identity and social interaction ties, in the baseline model. So it is of interest to identify whether self-identity directly affects social interaction tie. Hence we connected the path from self-identity to social interaction ties and tested the rival model. As indicated in Table 7, the goodness of fit indices for the rival model are not much better than those of the baseline model. Meanwhile, the path coefficient of the relationship between self-identity and social interaction ties is still not significant, thus indicating that our baseline model is acceptable.

Fig. 2 presents the overall structural model with path coefficients. The results of the SEM analyses for our research model support the majority of our hypotheses. First, hypotheses H1, H4

and H5 are supported. The path coefficient of the relationship between knowledge contribution and social interaction ties is 0.65 ( $p \leq .001$ ). With respect to the relationship between POLS and self-identity, the path coefficient is 0.75 ( $p \leq .001$ ), and the path coefficient of the relationship between self-identity and knowledge contribution is 0.47 ( $p \leq .001$ ). These results indicate the significance of the individual perspective regarding the accumulation mechanism of opinion leaders' social interaction ties in VCs.

Second, hypotheses H7, H8 and H9 are also supported as POLS is positively associated with reciprocity (H7: path coefficient = 0.62,  $p \leq .001$ ). Reciprocity exerts a positive effect on both knowledge contribution and social interaction ties (H8: path coefficient = 0.16,  $p \leq .001$ ; H9: path coefficient = 0.22,  $p \leq .001$ ). These positive relationships indicate the significance of the social perspective. Furthermore, the direct relationship between POLS and knowledge contribution is also supported (H2: path coefficient = 0.41,  $p \leq .001$ ).

The results of our analyses indicate that the specific indirect effects through the path of "POLS - knowledge contribution - social interaction ties" and "POLS - reciprocity - social interaction ties" are 0.270 ( $p \leq .001$ ) and 0.134 ( $p \leq .001$ ) respectively. The specific indirect effects through the path of "POLS - self-identity - knowledge contribution - social interaction ties" and "POLS - reciprocity - knowledge contribution - social interaction ties" are 0.230 ( $p \leq .001$ ) and 0.065 ( $p \leq .01$ ) respectively. So the combined indirect effect<sup>2</sup> on social interaction ties is 0.698 ( $p \leq .001$ ).

The explained variances of self-identity, reciprocity, knowledge contribution, and social interaction ties are 56.7%, 37.8%, 86.0% and 65.3%, respectively, indicating that the model has a good predictive validity (Straub, Boudreau, & Gefen, 2004).

5.3. Mediating effect

As studies indicate that bootstrapping is the most powerful and reasonable method for obtaining confidence limits for specific indirect effects under most conditions (Preacher & Hayes, 2008), the bootstrapping method is used to test the mediation effects.

Table 4 indicates that the POLS, self-identity, reciprocity, knowledge contribution, and social interaction ties are significantly correlated with each other, which provides us the basis for further tests of the hypotheses regarding mediating effects (Baron & Kenny, 1986). We first test H3, and Table 8 presents the results. Table 8 indicates that the indirect effect of POLS on social interaction tie through knowledge contribution is 95% likely to range from 0.171 to 0.263, and the estimated effect is 0.217, which lies between these two values. Zero does not occur between the lower and upper limits and the  $p$  value is much smaller than 0.001. Therefore we conclude that the indirect effect is significant and that knowledge contribution partially mediates the relation between POLS and social interaction ties. Moreover, the indirect effect accounts for 32.3% of the total effect. Thus, H3 is supported.

Table 9 indicates that the indirect effect of self-identity on social interaction ties through knowledge contribution is 95% likely to range from 0.254 to 0.350, and the estimated effect is 0.302, which lies between these two values. Zero does not occur between the lower and upper limits and the  $p$  value is much smaller than 0.001. Therefore, we conclude that the indirect effect is significant and that knowledge contribution partially mediates the relation between self-identity and social interaction ties. Moreover, the indirect effect accounts for 54.7% of the total effect. Hence, H6 is supported as expected.

Table 10 suggests that the indirect effect of reciprocity on social interaction ties through knowledge contribution is 95% likely to range from 0.191 to 0.267, and the estimated effect is 0.229, which lies between these two values. Zero does not occur between the

**Table 7**  
Goodness of fit indices for the structural model.

Goodness of fit indices	Baseline model	Rival model	Desired levels
$\chi^2$	257.719	253.358	Smaller
df	112	111	–
$\chi^2/df$	2.301	2.283	<5
CFI	0.975	0.975	>0.90
TLI	0.969	0.979	>0.90
SRMR	0.040	0.040	<0.05
RMSEA	0.044	0.044	<0.08

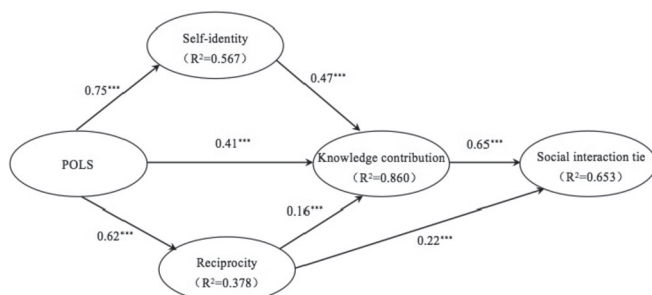


Fig. 2. Model testing results.

**Table 8**  
Mediating effect of knowledge contribution between POLS and social interaction tie.

	Knowledge contribution		Social interaction ties		Estimate	S.E.	Bootstrapping BC 95% CI	
	Estimate	S.E.	Estimate	S.E.			Lower limit	Upper limit
POLS	0.647***	0.027	0.455***	0.050				
Knowledge contribution			0.335***	0.055				
R <sup>2</sup>	0.419		0.516					
Indirect effect					0.217***	0.028	0.171	0.263
Direct effect					0.455***	0.038	0.392	0.518
Total effect					0.672***	0.021	0.636	0.707

\* $p \leq .05$ ; \*\* $p \leq .01$ , \*\*\* $p \leq .001$ .

S.E. = standard error, BC = bias corrected confidence intervals, 1000 bootstrap samples.

**Table 9**  
Mediating effect of knowledge contribution between self-identity and social interaction ties.

	Knowledge contribution		Social interaction ties		Estimate	S.E.	Bootstrapping BC 95% CI	
	Estimate	S.E.	Estimate	S.E.			Lower limit	Upper limit
Self-identity	0.645***	0.027	0.250***	0.054				
Knowledge contribution			0.468***	0.058				
R <sup>2</sup>	0.416		0.432					
Indirect effect					0.302***	0.039	0.254	0.350
Direct effect					0.250***	0.054	0.182	0.318
Total effect					0.552***	0.040	0.507	0.596

\* $p \leq .05$ ; \*\* $p \leq .01$ , \*\*\* $p \leq .001$ .

1000 bootstrap samples.

**Table 10**  
Mediating effect of knowledge contribution between reciprocity and social interaction ties.

	Knowledge contribution		Social interaction ties		Estimate	S.E.	Bootstrapping BC 95% CI	
	Estimate	S.E.	Estimate	S.E.			Lower limit	Upper limit
Reciprocity	0.547***	0.030	0.384***	0.047				
Knowledge contribution			0.419***	0.055				
R <sup>2</sup>	0.299		0.499					
Indirect effect					0.229***	0.023	0.191	0.267
Direct effect					0.384***	0.040	0.318	0.450
Total effect					0.613***	0.030	0.565	0.662

\* $p \leq .05$ ; \*\* $p \leq .01$ , \*\*\* $p \leq .001$ .

1000 bootstrap samples.

lower and upper limits and the  $p$  value is much smaller than 0.001. Therefore, we conclude that the indirect effect is significant and that knowledge contribution partially mediates the relation between reciprocity and social interaction ties. Moreover, the indirect effect accounts for 37.4% of the total effect. Thus, H10 is supported.

Table 11 indicates that the indirect effect of POLS on social interaction tie through reciprocity is 95% likely to range from 0.149

to 0.234, and the estimated effect is 0.192, which lies between these two values. Zero does not occur between the lower and upper limits and the  $p$  value is much smaller than 0.001. Therefore, we conclude that the indirect effect is significant and that reciprocity partially mediates the relation between POLS and social interaction ties. Moreover, the indirect effect accounts for 28.6% of the total effect. Thus, H11 is also supported.

It is of interest to see whether these mediating effects are

**Table 11**  
Mediating effect of reciprocity between POLS and social interaction ties.

	Reciprocity		Social interaction ties		Estimate	S.E.	Bootstrapping BC 95% CI	
	Estimate	S.E.	Estimate	S.E.			Lower limit	Upper limit
POLS	0.543***	0.038	0.480***	0.046				
Reciprocity			0.353***	0.044				
R <sup>2</sup>	0.295		0.539					
Indirect effect					0.192***	0.026	0.149	0.234
Direct effect					0.480***	0.035	0.442	0.537
Total effect					0.672***	0.021	0.636	0.707

\* $p \leq .05$ ; \*\* $p \leq .01$ , \*\*\* $p \leq .001$ .

1000 bootstrap samples.



**Table 12**

Indirect effects of self-identity and reciprocity on social interaction tie through knowledge contribution.

	Estimate	S. E.	Bootstrapping BC 95% CI	
			Lower limit	Upper limit
Self-identity	0.213	0.034	0.162	0.270
Reciprocity	0.116	0.021	0.085	0.152
C1	0.097	0.031	0.050	0.153

C1 = contrast of the two indirect effects, 1000 bootstrap samples.

**Table 13**

Indirect effects of POLS on social interaction tie through knowledge contribution and reciprocity.

	Estimate	S. E.	Bootstrapping BC 95% CI	
			Lower limit	Upper limit
Knowledge contribution	0.191	0.035	0.132	0.249
Reciprocity	0.192	0.031	0.140	0.239
C2	-0.002	0.055	-0.092	0.095

C2 = contrast of the two indirect effects, 1000 bootstrap samples.

different. Table 12 presents the comparison of the indirect effects of self-identity and reciprocity on social interaction ties through knowledge contribution. An examination of the contrast of these two indirect effects (C1) indicates that the indirect effect of self-identity on social interaction ties is significantly greater than the indirect effect of reciprocity on social interaction ties, with a BC 95% CI between 0.050 and 0.153 being observed.

Table 13 presents the comparison of the indirect effects of POLS on social interaction ties through knowledge contribution and reciprocity. An examination of the contrast of these two indirect effects (C2) reveals that there is no significant difference between these two indirect effects because zero lies between the lower and upper limits (-0.092, 0.095).

## 6. Discussion

In this article, we have analyzed how opinion leaders of VCs accumulate their social interaction ties in their communities. Prior to testing the conceptual model, an analysis of the differences in the demographics among all participants of the study was conducted and yielded interesting results.

First, the social interaction ties of the participants revealed that gender plays a significant role. Females' social interaction ties in VCs are significantly higher than that of males; however, this result differs from gender roles offline. Some studies have identified that social capital accumulation along the life cycle is different between men and women, and men accumulate more social capital at all ages (Addis & Joxhe, 2017). However, when considering the fact that females are more likely to present self-disclosure than males (Hargie, Tourish, & Curtis, 2001), especially online (Kays, Gathercoal, & Buhrow, 2012), it is reasonable to understand that females can accumulate more social interaction ties than males in VCs. Furthermore, when comparing gender roles in a wider context, males are often expected to be non-sensitive and non-emotional (Jourard, 1971). This strengthens the results of our findings that females are able to generate more social interactions in VCs than males.

Our results also indicate that membership history has a significantly positive correlation with all the five variables of this study, and these results are consistent with many previous studies (Lyons & Henderson, 2005). It is not surprising that in VCs not only the social interaction tie but also the status of opinion leaders need

time to accumulate, and during the time of accumulation, people contribute their knowledge more and more, and thus form their self-identity and reciprocity in VCs. Besides, our results demonstrate that people's income correlated with their status of opinion leaders positively in VCs. In General, people's income level can represent their status in society to some extent. This means that when an individual is already an elite offline, he or she has a higher possibility of becoming an opinion leader in VCs.

In our study, we proposed a route model to explain how opinion leaders in virtual communities accumulated their social capital and maintained their status. Because knowledge contribution is believed to be the core factor running VCs, we introduced this variable as an important mediating factor in our analysis. Knowledge contribution was also a large contributing factor to the accumulation mechanism of opinion leaders' social interaction ties in VCs. Our results indicate that the influence of knowledge contribution on improving social interaction ties is 65%. This means that knowledge contribution is undoubtedly an important way for opinion leaders to maintain their social capital in virtual communities.

Our results identified two paths that lead to the accumulation of opinion leaders' social interaction ties in VCs. From the personal perspective, a member's perceived opinion leader status has a significantly positive effect on self-identity as a contributing factor in VCs, which then positively influences the opinion leader's knowledge contribution and eventually contributes to the leader's social interaction ties in VCs. In the route model, the indirect effect of POLS on social interaction ties from this path is 23%. It is further noted that the path coefficient between POLS and self-identity is as high as 0.75. On the one hand, this result suggests that POLS has a very large influence on their self-identity as community contributors, which has not been mentioned in earlier studies. On the other hand, this result indicates that in virtual communities, opinion leaders are often considered the community contributors, which is consistent with earlier studies (Coulter, Feick, & Price, 2002; Lyons & Henderson, 2005). Because members' self-identity as community contributors in VCs is an important characteristic of opinion leaders, POLS may also have a direct effect on knowledge contribution in VCs. Furthermore, the model testing results indicate that self-identity does not have a significant influence on social interaction ties in VCs; however, the subsequent tests of mediation effect suggest that self-identity both directly and indirectly affects social interaction ties through knowledge contribution. Although the mediation effect analysis indicates that self-identity directly influences social interaction ties, when other variables are introduced to explain the social interaction ties, as reciprocity did in this study, the direct relationship between self-identity and social interaction ties gradually disappears. This is noteworthy because the existing literature does not provide strong support for causality between self-identity and social interaction ties (Ashforth, 2001; Cheng & Guo, 2015).

From the social perspective, the status of opinion leaders in VCs leads to the improvement of their reciprocity in VCs. As the core of social exchange theory, the formation of reciprocity demonstrates the social characters of online individuals (Gouldner, 1960). Regardless of the different perspectives from the various disciplines, such as biology (Trivers, 1971) and economics (Berger, 2005), the many studies of reciprocity still indicate that it is constructed based on specific social structures. Our results also noted that reciprocity among individuals does not always involve the exchange of materials, but rather can occur simply when people treat other kindly. This aligns with many studies that have found that friendliness contributes to an individual's level of reciprocity (Henrich, 2000; Schoorman, Mayer, & Davis, 2007). When some members of a virtual community are treated as opinion leaders in

the community, they sense other members' trust and friendliness, which in turn improves their level of reciprocity. The results of this study indicate that the status of opinion leaders in VCs has an important effect on opinion leaders' degree of reciprocity as well.

In virtual communities, the improvement of some members' reciprocity will lead to two results. One of the results is they will take action to return to the community. As discussed before, the key factor of the prosperity and development of VCs is knowledge contribution. Therefore, members' higher reciprocity will lead them to contribute more knowledge to the community, which will then promote the development of VCs. Another factor improves members' reciprocity in VCs is they are more willing to interact with other members when being responded to in a friendly manner. This leads to the improvement of social interaction tie among members in VCs (Xiao, Li, et al., 2012). Both of them are identified by this study.

The examination of mediation effects shows that knowledge contribution plays a significant role between self-identity and social interaction ties, as well as between reciprocity and social interaction ties. We compared these two mediation effects and the results show that the mediating role of knowledge contribution between self-identity and social interaction ties is significantly different from that between reciprocity and social interaction ties. The indirect effect from self-identity to social interaction ties through knowledge contribution is significantly larger than that from reciprocity to social interaction ties through knowledge contribution, and the difference is about 9.7%. This indicates the effect of self-identity on social interaction ties through knowledge contribution as being much more important than that of reciprocity, and we can further infer that the path from personal perspective is much more important than that from social perspective in opinion leaders' accumulation of their social interaction ties in VCs.

In addition, our model reflects the influence of both behavioral and psychological factors on the accumulation mechanism of opinion leaders' social interaction ties in VCs. Our results indicate that knowledge contribution mediates the relationship between POLS and social interaction ties, which means that knowledge contribution behaviors of opinion leaders in VCs leads to the improvement of their social interaction ties in these communities. Furthermore, we find that reciprocity mediates the relationship between POLS and social interaction ties. This path in our model can be regarded as forming of the psychological factor during the process of the interactions that occur between opinion leaders and other members in VCs. In turn, this leads to the improvement of the social interaction ties in these communities. Although both variables of knowledge contribution and reciprocity are the mediation variables between POLS and social interaction ties, the mechanisms of their influence on the relationship between POLS and social interaction ties are distinct. A comparison of these two types of mediation effects reveals that there is no significant difference between them. This suggests that the influence of POLS on social interaction ties through the behavioral mechanism of knowledge contribution is similar to that achieved through the psychological mechanism of reciprocity.

As mentioned in Section 4.1, the participants in this study are from Baidu Post Bars and Wechat groups, which can be regarded as different types of VCs. Furthermore, we contend that these two types of VCs are typical of online forum sites. Although Wechat is an instant messaging service application for smartphones, its mobile social networking service is extremely popular among its users. Similar to Facebook and Twitter, Wechat allows its users to share photos, publish status updates with illustrations, "like" their contacts' posts or other content via comments, retweets or forwarding in their friend space (i.e., Moments) (Gan, 2017). Baidu Post Bar is a

more general online forum site where every registered member can launch a group on a topic in which he or she is interested, including movie, music, and news/hotspots, and any other registered members who are also interested in that topic can browse, post and reply in this group. Because Wechat and Baidu Post Bar are the most popular social medias in China (CNNIC, 2016a; Cheng & Guo, 2015), their impact extends beyond online activities (CNNIC, 2016b) and has an important influence in, for instance, education (Zhang, 2015), academia (Xu, Kang, Song, & Clarke, 2015), business (Guillet, Kucukusta, & Liu, 2016), and everyday life (Skuse, 2014).

## 7. Implications and limitations

### 7.1. Theoretical implications

This study makes several theoretical contributions to the literature. We investigate the accumulation of opinion leaders' social interaction ties in VCs, which contributes to the research on opinion leader. First, prior studies mainly focused on the characteristics of opinion leaders and the way they influenced virtual communities, whereas this study extends the line of research by considering the status of opinion leaders in VCs as a dynamic process and then explored the evolution mechanisms of opinion leaders in VCs. Second, although the virtual community differs from traditional communities, the essence of virtual communities is still a type of social structure in which individuals interact. Thus, this study introduces the concept of self-identity and reciprocity to explain the accumulation mechanism of opinion leaders' social interaction ties in VCs. We contend that this can provide some insight for future studies on opinion leaders in virtual communities. Third, our results identified that the mediation effect of reciprocity between POLS and social interaction ties is no less than the mediation effect of knowledge contribution, which has long been considered a key variable in maintaining virtual communities. Accordingly, this concept provides some inspirations for future theoretical studies on VCs from the social perspective.

### 7.2. Practical implications

Because our study investigated opinion leaders' social interaction ties in VCs, the results provide several practical implications for individuals who are currently action as opinion leaders in VCs. Our study discovered that the status of opinion leaders in VCs is not permanent. Because some opinion leaders have little knowledge to contribute to the VCs, they gradually lose their status in their VCs. Accordingly, opinion leaders must remain active in the VCs and continue to accumulate their social capital in the VCs. Furthermore, a new trend has been observed that involves VCs attempts to combine their online members offline, which means members in VCs will be increasingly more familiar with each other in the future. This may be good news for those who are not skilled at social face-to-face interactions because, by contributing their knowledge to VCs, they can accumulate their social capital and become popular offline among the members of their VCs.

Although opinion leaders are only a small part of the VC, they play a very important role in the development of the VC because they contribute the most knowledge to the VC. This means that maintaining and developing opinion leaders is an essential issue for the prosperity of the VC. Hence, certain implications of our study indicate that for opinion leaders to maintain their status in VCs, operators of VCs should offer some types of convenience and offline assistance for opinion leaders to interact with other members of VCs. Operators should also provide moral encouragements, such as virtual credits and ranking, to create a better community environment in which all members can actively communicate. In this way,

they not only maintain the activity of VCs, but they also encourage members to contribute more knowledge to the VC and attract more newcomers.

### 7.3. Limitations and future research

There are several limitations to this study, the greatest of which is the generalizability of our results, in other word, whether our results are applicable to other types of online forum sites. Although the VCs we selected for this study are typical, there are also some difference between them and other VCs. For example, the contents posted in one's Wechat Moment can only be seen by their contacts, whereas people can focus on news/hotspots, and interesting people in Microblogs such as Twitter (Gan, Wang, 2015). Furthermore, prior studies have found that one social medium does not completely replace another (Ku, Chu, & Tseng, 2013). Therefore, the model proposed in this study should be empirically tested in other types of VCs. Another issue concerns whether our theoretical framework is applicable under different contexts. All participants of this study are from one country, China. Thus, the theoretical framework should also be verified under different contexts, for example, western or even global contexts, to test its applicability and explanation of the mechanism discussed in this study. Meanwhile, as cross-cultural studies may generate different results and interesting research findings, future work should test the robustness of our results in different cultural contexts using larger samples from other cultural settings. Additionally, there could be other factors that affect the social interaction ties of opinion leaders in VCs. Although the perspectives and variables selected for our study were accommodating to our research purposes, factors such as opinion leaders' personalities and their motivations may also be conducive to their social interaction ties in VCs. Finally, the credibility dimensions of POLS in VCs should also be explored to form a generalized measurement for future research as a theoretical contribution.

## 8. Conclusions

This paper discussed and identified the accumulation mechanism of opinion leaders' social interaction ties in virtual communities from both personal and social perspectives. Our results show that knowledge contribution is an important factor for opinion leaders to accumulate their social interaction ties in VCs. Knowledge contribution is another important factor as it not only mediates the relationship between POLS and social interaction ties, but also influences opinion leaders' social interaction ties through self-identity and reciprocity. Besides, reciprocity played an important mediating role between POLS and social interaction ties, but self-identity did not.

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