Self-Sacrificing Behavior of the Sponsoring Company and Participation Behavior of Community Members in the Crowdsourcing

Shaobo Wei
University of Science and Technology of China, shaobow@ustc.edu.cn

Xiaofan Tang
University of Science and Technology of China, xiaofan@mail.ustc.edu.cn

Weiling Ke
Clarkson University, wke@clarkson.edu

Lingfei Zou
Hua Technologies Co., Ltd., 315451683@qq.com

Kwok Kee Wei
National University of Singapore, sleweikk@nus.edu.sg

Self-Sacrificing Behavior of the Sponsoring Company and Participation Behavior of Community Members in the Crowdsourcing

Completed Research Paper

Shaobo Wei
International Institute of Finance
School of Management
University of Science and Technology of China
96 Jinzhai Road, Hefei, Anhui, China
shaobow@ustc.edu.cn

Xiaofan Tang
School of Management
University of Science and Technology of China
96 Jinzhai Road, Hefei, Anhui, China
xiaofan@mail.ustc.edu.cn

Weiling Ke
School of Business
Clarkson University
8 Clarkson venue, Potsdam, USA
wke@clarkson.edu

Lingfei Zou
Huawei Technologies Co., Ltd
Huawei Base, Bantian, Longgang District, Shenzhen, China
315451683@qq.com

Kwok Kee Wei
School of Computing
National University of Singapore
8 College Avenue West #02-16, Educational Resource Centre, Singapore
sleweikk@nus.edu.sg

Abstract

Self-sacrificing behavior of the sponsoring company in the community is increasingly important to improve the active participation and organizational citizenship behavior of community members. However, our understanding of how self-sacrificing behavior influence the participation and behavior of community members remains limited. This study investigates the underlying influencing mechanism of the self-sacrificing behavior of the sponsoring company on the knowledge management process of community members in crowdsourcing communities and further examines the mediating effect of organizational identification. Based on 286 community members surveyed from the crowdsourcing communities of eight high-tech companies, we find that the self-sacrificing behavior of the company can help community members develop organizational identification, which leads to knowledge innovation and integration. Furthermore, we find that knowledge integration of crowdsourcing community members mediates the relationship between their organizational identification and knowledge innovation.

Keywords: Self-sacrificing behavior, sponsoring company, knowledge management

Introduction

With the expansion of economic globalization and fierce market competition that lead to product homogenization, product innovation has become an important business strategy to achieve competitive advantages (Johne 2018). However, given the increasingly sophisticated technology and rapidly changing customer needs, firms can hardly develop new products by simply relying on their own capability and resources (Nylén et al. 2015). Therefore, many firms are increasingly turning to external partners for innovation activities (Segarra-Ciprés et al. 2018). Crowdsourcing is an important channel for companies to capture external intelligence and resources. Many leading companies collaborate with crowdsourcing community members to generate ideas for new product designs or improve current products. These community members can provide fresh ideas that can be hardly generated by the internal staff (Fuger et al. 2017).

Recognizing the huge potential of online crowds, many companies began to establish their own crowdsourcing communities or participate in third-party crowdsourcing platforms (Brown 2018). However, several studies have found that many crowdsourcing communities cannot effectively obtain creative ideas because community members do not actively participate in tasks (Zhang et al. 2013). The industrial consulting report also suggests that many seekers are dissatisfied with crowdsourcing because of the small amount of ideas generated (Shao et al. 2012). The growing literature on crowdsourcing suggests that community members help companies generating creative ideas through two activities: knowledge integration and knowledge innovation (Bullinger et al. 2010). Knowledge integration emphasize that community members integrate knowledge from different areas and units for the purpose of obtaining new combination for further innovation. This activity can help improve existing products because it advances incremental innovation (Yang 2005). Knowledge innovation focuses on developing cognition of a particular object from a completely new perspective. This activity can help companies generate ideas for new products because it stimulates disruptive innovation (Yang 2005). Thus, in the present study, we aim to investigate how crowdsourcing community members can be encouraged to participate actively in these two activities that generate creative ideas.

The essence of crowdsourcing is that internal staff and external community members form a virtual team to conduct innovation activities (Ståhlbröst et al. 2015). On the one hand, crowdsourcing community members voluntarily participate in company innovation activities and they can drop out at any time. On the other hand, sponsoring companies, as the initiator and beneficiary of the entire innovation activities, organize and guide crowdsourcing activities, and ensure that they are running effectively (Ståhlbröst et al. 2015). A leader is a person or organization who encourages followers to strive for specific goals (Burns et al. 1999). These goals typically embody the common pursuit, motivation, and ambition of a leader. In the crowdsourcing context, sponsoring companies actually act as a leader in the community. They assign tasks to community members and set up a reward system to encourage participation. After the deadline, sponsoring companies will evaluate the creativity of ideas, decide which ideas to adopt, and provide reward to relevant members (Wang et al. 2018a). Apart from the reward system and evaluation process, sponsoring companies also offer technical support or requisite resource to encourage members to generate expected creative ideas (Kohler et al. 2016). However, after reviewing current studies, we find that scholars mainly focus on the effect of interpersonal, team, and organizational factors on member participation behavior in crowdsourcing (Kucherbaev et al. 2016). Chacko (1985) discuss that structural determinants and the beliefs, attitudes, and perceptions of members would have important effect on their participation; Metochi (2002) also hold that member participation depends on attitudes, union loyalty and union instrumentality. Only a few studies have focused on the effect of the leadership of the sponsoring company. Given that leader behavior strongly influences subordinates, scholars have constantly called for research on the effect of leader behavior in online communities (Huffaker 2010). In the crowdsourcing context, based on the leadership theory, the sacrificing behavior of the sponsoring company is one type of leadership that will be effective in improving the active participation and organizational citizenship behavior of community members (De Cremer et al. 2009; Matteson et al. 2006). When sponsoring companies exhibit self-sacrificing behavior, they will set an example and model for community members and improve their participation in knowledge management behavior (Mostafa et al. 2018). However, only a few studies have paid attention to the relationship between leader self-sacrificing behavior and community member

participation behavior in knowledge management. To address this research gap, we will investigate the effect of the self-sacrificing behavior of a sponsoring company on the participation behavior of crowdsourcing community members.

At present, scholars have confirmed the effect of the self-sacrificing behavior of a leader on subordinates, found the boundary conditions of its influence (De Cremer et al. 2006; van Knippenberg et al. 2005), but ignore the underlying influencing mechanism. In addition, we cannot simply link the self-sacrificing behavior of a sponsoring company with the participation effort of community members because crowdsourcing is distinguished from the physical organization context (Bessai et al. 2016). The effect of organizational identification on the belongingness of community member and the organization itself has been already recognized (O'Reilly et al. 1986). Mael et al. (1992) describe organizational identification as "a perceived oneness with an organization and the experience of the organization's successes and failures as one's own" (p. 1). Therefore, organizational identification can explain the participation degree of community members when their community merges into a new entity, and if they have high identification with the new entity, they would be more effective to discover their own value to work hard for the purpose of obtaining performance and innovation (Mael et al. 1992). Given that some scholars have suggested that organizational identification will mediate leader behavior on subordinates (O.Walumbwa et al. 2008), we investigate the effect of the self-sacrificing behavior of a sponsoring company on the knowledge innovation and knowledge integration of community members from the organizational identification perspective.

Research Model and Hypotheses

Self-Sacrificing Behavior of Sponsoring Company and Participative Behavior of Members

When community members participate in crowdsourcing, it means they are willing to share their creative ideas and allow others to use it (Baldwin et al. 2011; Chatterji et al. 2012). This latent rule has inhibited the effective participation of many community members because sponsoring companies are only required to pay relatively small compensation for the intellectual property (IP) rights of these ideas (Manzini et al. 2016). This situation is unfair to community members. In fact, crowdsourcing has long been criticized for taking advantage of community members with low payment (Manzini et al. 2016). Collaboration is developed based on equal relations. Community members sacrifice their time, effort, and IP to contribute ideas. In return, sponsoring companies should also sacrifice some interests to maintain the collaborative relationship (Tavanapour et al. 2017).

Through self-sacrificing behavior, sponsoring companies can demonstrate their dedication to the crowdsourcing community and concern for member interest, thereby encouraging community members to shift their focus from self-interest to community interest (van Knippenberg et al. 2005). Self-sacrificing behavior is defined as leaders ignoring personal interests, refusing personal comfort and security, restricting privileges, and sharing both happiness and woe with subordinates (Tajfel 1982). According to Oldham et al. (2012), self-sacrifice typically consists of seven characters, namely, generosity, service, consideration, acceptance, humility, endurance, and artlessness. The first three are the most important characters of self-sacrifice. Generosity refers to individuals who actively share benefits with others. Service indicates individuals who always help others and respond to their requirements. Consideration denotes individuals who are considerate when interacting with others. Based on this well-accepted definition, we define the self-sacrificing behavior of a sponsoring company as behavior in which the company voluntarily takes actions accompanied by risks to achieve the goal of crowdsourcing communities (Tajfel 1982). In the crowdsourcing context, the self-sacrificing behavior of a sponsoring company is mainly exhibited in three aspects. (1) IP. The sponsoring company is willing to let community members retain the IP of the knowledge they contributed. (2) Interaction effort. The sponsoring company is willing to exert effort to interact with community members, help them in generating creative ideas, and satisfy their requirements. (3) Benefit allocation. The sponsoring company is willing to share the profit derived from selling new products that were developed based on the ideas of the members. A few studies have indicated that leader self-sacrificing behavior, which has been considered effective in leadership, has a strong effect on subordinates (De Cremer et al. 2006; van Knippenberg et al. 2005). With self-sacrificing leadership, subordinates tend to exhibit more

organizational citizenship and pro-social behavior (De Cremer et al. 2009; De Cremer et al. 2006). However, the relationship between leader self-sacrificing behavior and subordinate knowledge integration and innovation lacks empirical evidence.

Knowledge is the basis of knowledge management. Knowledge integration and innovation are two key activities related to this type of management (Yang 2005). Knowledge integration is the process of acquiring, assimilating, and applying knowledge (Dick et al. 2007). By contrast, knowledge innovation indicates that individuals develop and explore new knowledge (Tell 2011). Both knowledge management activities emphasize the collaboration between the sponsoring company and the community members to identify and develop various types of R&D knowledge and apply this to the entire R&D process (Tell 2011). The goal of knowledge integration and innovation in a crowdsourcing community is to utilize completely the explicit and tacit knowledge of the external community members and create new knowledge from them. In this process, the sponsoring company acts as the leader to guide and encourage the behavior of community members. Therefore, the sponsoring company plays an indispensable role in the knowledge management process (De Cremer et al. 2006). If the sponsoring company exhibits an inappropriate behavior, then such behavior may inhibit the enthusiasm of community members to participate in knowledge integration and innovation (Manzini et al. 2016). With self-sacrificing behavior, the sponsoring company intends to work for the interest of the crowdsourcing community (including its own interest and that of the community members). Hence, this behavior can stimulate positive emotion among community members, which will motivate them to work hard, participate actively in knowledge management activities, and contribute to crowdsourcing communities (De Cremer et al. 2006). The sponsoring company sets a good example in working for the interest of the community while ignoring its personal interest. Community members are encouraged to participate in activities, such as knowledge integration and innovation, which can improve the community (Tavanapour et al. 2017). Therefore, we propose the following hypotheses:

> **H1a:** *The self-sacrificing behavior of the sponsoring company will positively influence the knowledge integration of community members.*

> **H1b:** *The self-sacrificing behavior of the sponsoring company will positively influence the knowledge innovation of community members.*

Self-Sacrificing Behavior of Sponsoring Company and Member Organizational Identification

Organizational identification refers to community members who consider themselves part of the sponsoring company and believe that they belong to this company (O.Walumbwa et al. 2008). Based on self-concept theory, no person is born with a self-concept. The perception of an individual of himself/herself is dynamic and affected by environmental factors (G.Lord et al. 2001). If the members of a crowdsourcing community want to obtain their personal interest, then they have to obey the rules of the sponsoring company and satisfy their requirements for creative ideas (Mostafa et al. 2018). In this situation, members are more likely to perceive themselves as subordinates rather than partners of the company. G.Lord et al. (2001) suggest that leaders have a strong and constant effect on subordinates and influence their organizational identification. This relationship is also supported by Olkkonen et al. (2006). However, previous studies that have examined the relationship between leadership and organizational identification mainly focused on leader positive behavior, such as transformational leadership. In the crowdsourcing context, only a few studies have explored the influence of the leadership of the sponsoring company on the performance of community members (Walumbwa et al. 2011). In crowdsourcing communities, the sponsoring company can convey its objectives and core values to community members and convince them that working for the company is a worthwhile undertaking (Bessai et al. 2016). Promoting the values and image of the sponsoring company facilitates the strength of the organizational identification of community members. When the sponsoring company exhibits self-sacrificing behavior, it frequently tends to be concerned with the concerns and requirements of community members, provide feedback for their R&D activities, and share profit derived from crowdsourcing. Through these behaviors, the company can set an example for community members and improve their organizational identification (van Knippenberg et al. 2005). Thus, we propose the following hypothesis:

H2: The self-sacrificing behavior of the sponsoring company will have a positive effect on the organizational identification of crowdsourcing community members.

Organizational Identification and Participative Behavior of Community Members

The self-sacrificing behavior of the sponsoring company has significant effects on the organizational identification of community members. Organizational identification is manifested in three aspects (Edwards et al. 2010): (1) identify with the company values and goals, (2) be willing to exert extra effort for the company, and (3) aspire to continue to work in the company crowdsourcing community. Most scholars believe that organizational identification can explain individual work behavior. When community members highly identify with company values and culture, they can obtain high satisfaction with work and consider the crowdsourcing task a realization of their value. They will also exhibit a strong willingness to work and endeavor to achieve organizational goals and values (Jones 2010). Therefore, community members will exhibit improved performances with a strong organizational identification (Sivadas et al. 2000). In a crowdsourcing community, the knowledge integration and innovation of members play an important role in supporting company success. When numerous community members identify with the sponsoring company, then many members will be willing to participate in knowledge management activities (Tell 2011). Nahapiet and Ghosha (1998) explain that organizational identification will increase individual information integration and exchange. Olkkonen et al. (2006) also argue that individual organizational identification can motivate members to develop knowledge to improve performance. Therefore, when comes to talking about how to improve the knowledge integration and innovation of community members, we may not be able to measure the direct relationship between the two, but as a consequence of self-sacrificing behavior and the antecedent of knowledge integration, we consider organizational identification as an important mediating role to influence the relationship between self-sacrificing behavior and knowledge management. Thus, we propose the following hypotheses:

H3a: The organizational identification of crowdsourcing community members mediates the relationship between the self-sacrificing behavior of the sponsoring company and member knowledge integration.

H3b: The organizational identification of crowdsourcing community members mediates the relationship between the self-sacrificing behavior of the sponsoring company and member knowledge innovation.

Knowledge integration and innovation, which are two key knowledge management activities, are closely related to each other. Sivadas et al. (2000) argue that many companies cannot achieve the goals of knowledge innovation because of the lack of knowledge integration capacity. To improve the knowledge innovation of community members, the sponsoring company should make them realize the importance of knowledge integration (Wang et al. 2018b). When community members understand and master related knowledge, they are likely to realize the deficiency in existing knowledge, and thus, attempt to develop knowledge to cover this deficiency (Ritala et al. 2015). Therefore, we propose the following hypotheses:

H4: The knowledge integration of crowdsourcing community members is positively related to their knowledge innovation.

H5: The knowledge integration of crowdsourcing community members mediates the relationship between their organizational identification and knowledge innovation.

Research Methodology

Data Collection

We conducted our survey in the crowdsourcing communities of eight high-tech companies to collect data. With the increase in competition within the high-tech equipment manufacturing industry in recent years, companies in this industry have endeavored to attract customers and Internet users to participate in their knowledge management activities. Leaders have also realized the difficulties encountered by

these companies in crowdsourcing and recognized the value of this study. Consequently, they were willing to assist us with our survey. Based on our communication with community members, we determined that the leadership of sponsoring companies has considerably influenced their psychological state and behavior. Community members also prefer companies that actively share the benefits with them and provide feedback regarding their performance. We communicated first with the administrators of crowdsourcing communities and then sent out questionnaires via e-mail. Thereafter, the administrators sent out questionnaires to their members. The administrators informed the respondents of the objectives of the survey and assured them that their personal information would be kept confidential. The respondents filled out the questionnaires and sent them to the administrators. To encourage community members to participate in this survey, we offered 10 Yuan to each respondent who completed the questionnaire. We conducted our survey in two stages to avoid common method bias. First, the administrators sent the respondents one questionnaire to evaluate the self-sacrificing behavior of sponsoring companies. After one week, the administrators sent another questionnaire to measure the organizational identification and knowledge management activities of the respondents.

Finally, we sent 400 questionnaires and got back 312 matched questionnaires; thus, the response rate was 78%. Then, 26 unqualified questionnaires were excluded because of incomplete or repetitive answers; thus, the effective response rate was 71.5%. Among this sample, 53% of the respondents are male and 47% are female. Most of the respondents are less than 40 years old (80.4%), hold a bachelor's degree or above (69.1%), and have worked in crowdsourcing communities for less than 4 years (87.5%).

Measurement

All measurement items were adopted from validated scales used in previous studies. To ensure validity and reliability, we took standard translation and back translation methods to translate the items into Chinese because the aforementioned scales were developed in the Western cultural context. Before we sent the questionnaires to the community members, we invited the crowdsourcing community administrators to examine our measurement items and provide us with comments and feedback. All the items were measured using a six-point Likert scale that ranged from "strongly disagree" to "strongly agree."

Self-sacrificing behavior of sponsoring company. The sponsoring company is willing to sacrifice some of its interests to achieve the goals of crowdsourcing communities. Based on Conger et al. (1987), De Cremer et al. (2006) have developed self-sacrificing behavior scales, which have been extensively used. Thus, we adopted De Cremer's scales, which included three items. A sample item reads "To achieve community goals, the sponsoring company has made numerous sacrifices."

Organizational identification. (Tajfel 1982) explained organizational identification as individuals considering themselves components of an organization and having a strong sense of belonging to it. We measured this construct based on Schmidt's scales. A sample item reads, "I am proud to participate in the company's crowdsourcing community."

Knowledge integration. This construct refers to the effort of community members to acquire, assimilate, and apply knowledge in completing tasks (Dick et al. 2007). We adopted Han's scales to measure this construct. A sample item reads, "I would adopt an established practice to complete common tasks."

Knowledge innovation. This construct indicates that crowdsourcing community members create new knowledge related to R&D in crowdsourcing activities. Based on the definition of new knowledge, we adjusted Yang's scales to measure knowledge innovation. A sample item reads, "In the process of participating in crowdsourcing, I usually introduce new knowledge."

Control variables. Based on past knowledge management literature, the gender, age, education, and community tenure of an individual will also influence his/her knowledge management behavior. Therefore, we controlled these four variables in this study.

Data Analysis and Results

This study adopted structural equation modeling (Houlfort et al. 2002) using PLS-Graph 3.0 to test our research model. Based on the suggestion of (Anderson et al. 1988), we employed two steps to perform data analysis. First, we performed a confirmatory factor analysis (McFarlin et al. 1992) to examine the reliability and validity of the measurement. Second, we used SEM to test the structural model.

Measurement Model

Reliability and validity are the two criteria used to examine the measurement. Reliability refers to the consistency of the measurement scales, and validity refers to the extent to which the scales reflect the items we expect to measure. Reliability is assessed using Cronbach's alpha and composited reliabilities. Table 3-1 presents the results. The Cronbach's alpha and composite reliability of all the constructs are above 0.7. This result indicates that our measurement exhibits good reliability.

To test for the convergent validity, we conducted exploratory factor analysis (Kucherbaev et al.) to calculate the loadings of each item on its corresponding construct. As shown in Table 1, the loading of each item is higher than 0.7, which is a threefold value. The average variance extracted (Cravens et al. 1993) of each construct is higher than 0.5, which indicates that our measurement has good convergent validity. To test for the discriminant validity, we first compared the square root of AVEs and the correlation between the constructs. Table 2 shows that the square roots of AVEs that are presented on the diagonal are significantly higher than the correlations between the constructs. Thus, our measurement demonstrates good discriminant validity.

Table 1. Results of Reliability and Validity

Constructs	Items	Loading	Cronbach Alpha	Composited Reliability	AVE
Self-sacrifice behavior	SCB1	0.91	0.90	0.84	0.62
	SCB2	0.87			
	SCB3	0.91			
Organizational identification	OI1	0.86	0.87	0.76	0.56
	OI2	0.87			
	OI3	0.84			
	OI4	0.83			
	OI5	0.85			
Knowledge integration	KIT1	0.84	0.73	0.72	0.67
	KIT2	0.85			
	KIT3	0.76			
	KIT4	0.77			
Knowledge innovation	KIN1	0.88	0.91	0.81	0.72
	KIN2	0.86			
	KIN3	0.93			
	KIN4	0.89			

Table 2. Results of Discriminant Validity and Correlations among Constructs

Constructs	Mean	S.D.	1	2	3	4
Self-sacrifice behavior	4.82	1.20	0.78			
Organizational identification	4.56	0.90	0.58	0.74		
Knowledge integration	4.80	0.60	0.18	0.33	0.82	
Knowledge innovation	4.70	0.83	0.22	0.32	0.39	0.84

Structural Model

To test our hypotheses, we ran PLS-Graph to calculate the coefficients of the structural model. Figure 1 shows the results of the analysis. This model provides the variances of 0.362, 0.354, and 0.463 on organizational identification, knowledge integration, and knowledge innovation, respectively. All four control variables do not have significant effects on the knowledge integration and innovation of community members. In particular, the results indicate that the hypotheses are mainly supported. The self-sacrificing behavior of the sponsoring company is positively related to organizational identification, which supports H2 ($\beta = 0.482$, $p < 0.001$). The relationship between knowledge integration and innovation is also supported ($\beta = 0.353$, $p < 0.001$). Thus, H4 is proven.

The direct relationship between the self-sacrificing behavior of the sponsoring company and knowledge integration and innovation is insignificant in the previous step. We utilized the procedures of Baron et al. (1986) to determine whether organizational identification mediates this relationship or whether the self-sacrificing behavior of the sponsoring company has an influence on the knowledge innovation and integration of community members. Table 3 presents the mediation analysis results. The self-sacrificing behavior of the sponsoring company is significantly related to both knowledge integration ($\beta = 0.154$, $p < 0.05$) and innovation ($\beta = 0.263$, $p < 0.001$), which supports H1a and H1b. The organizational identification of community members completely mediates the influence of the sponsoring company on knowledge integration and innovation, which supports H3a and H3b. Furthermore, knowledge integration partially mediates the effects of organizational identification on knowledge innovation, which supports H5.

Table 3. Mediation Analysis of Organizational Identification and Knowledge Integration

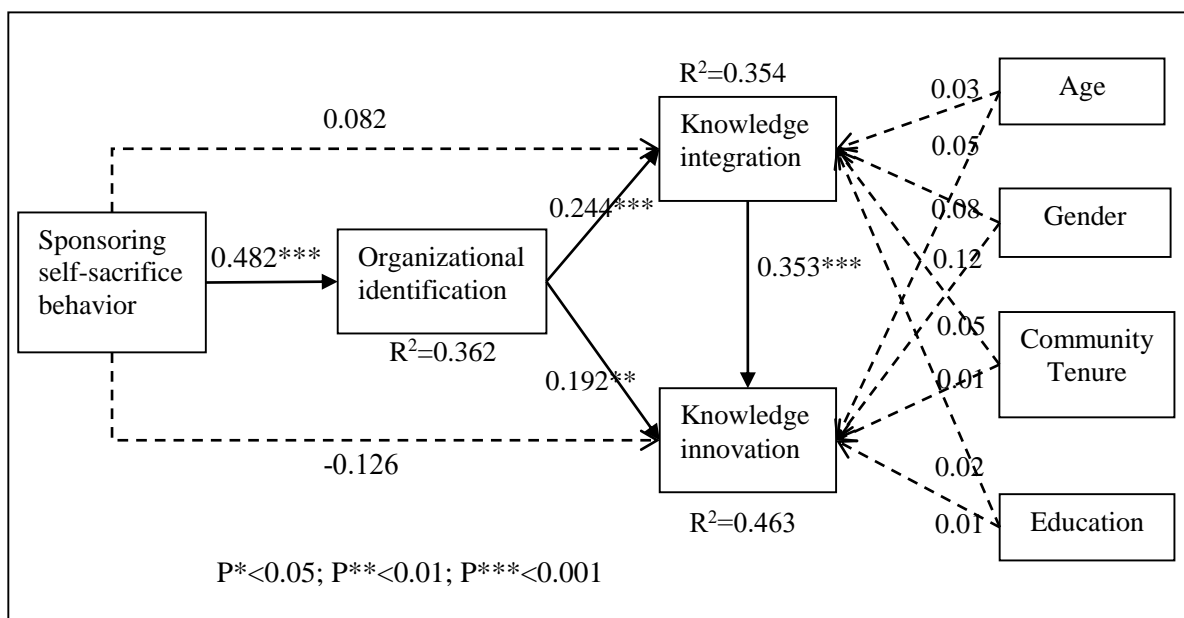| IV	M	DV	IV→DV	IV→M	IV + M → DV	
					IV	M
SCB	OI	KIT	0.154*	0.563***	0.037	0.324***
SCB	OI	KIN	0.263**	0.563***	0.108	0.533***
OI	KIT	KIN	0.234**	0.354***	0.193*	0.268***

Figure 1. Result of Hypotheses Test

Discussion and Contribution

General Discussion

This study investigated the underlying influencing mechanism of the leadership of the sponsoring company on the participation in the knowledge management process of community members in crowdsourcing communities and examined the mediating effects of organizational identification. The findings suggest that the self-sacrificing behavior of the company can help community members develop organizational identification, which leads to knowledge innovation and integration. The organizational identification of community members completely mediates the effects of the self-sacrificing behavior of the company. Moreover, when community members exhibit strong identification with the sponsoring company, they are likely to participate in knowledge integration, which generates new knowledge for the innovation activities of the company.

Although most hypotheses have been supported by our results, this study also has several limitations. First, the data were collected from single respondents. This condition may cause common method bias. Given that we can only communicate with respondents through community administrators, we cannot check the ideas they generated in crowdsourcing communities. Thus, evaluating their creative performance using an objective measurement is difficult. We conducted our survey in two stages to reduce the potential bias. Second, we only selected eight crowdsourcing communities in China. The research results may be influenced by the industry and cultural contexts. Future research should consider industry type and culture in investigating the effective participation of crowdsourcing community members. Such procedure can enhance the generalizability of the research results. Third, this study only investigated the effective participation of members from the perspective of the sponsoring company. Future research can also focus on the link between effective participation and the strength of member relationship. Online community research has long acknowledged the importance of social influence, which indicates that member behavior and performance are susceptible to other members. Thus, the strength of the relationship of members may play an important role in their effective participation.

Theoretical and Practical Implications

This study also makes several contributions to crowdsourcing literature. First, we provide a novel perspective to promote the effective participation behavior of community members. This study suggests that the self-sacrificing behavior of the sponsoring company is effective in stimulating the knowledge innovation and integration behaviors of community members. Although studies have investigated the different antecedents of knowledge management activities, such as organizational factors, team characteristics, interpersonal relationship, and individual motivations, only a few studies have linked leadership with knowledge management (Conger et al. 1987). Although the self-sacrificing behavior of the leader can improve the pro-social and organizational citizenship behaviors of the subordinates (De Cremer et al. 2006; van Knippenberg et al. 2005), whether it will influence the knowledge management behavior of community members remains unknown. The current study finds that the self-sacrificing behavior of the sponsoring company can improve the knowledge integration and innovation of community members. This conclusion proves the effects of the self-sacrificing behavior of the sponsoring company on the knowledge management effort of individuals, which extends the boundary of self-sacrifice theory.

Second, previous studies that investigated leadership have focused on the direct relationship between the behavior of both the leader and the subordinates. However, the underlying influencing mechanism is frequently mentioned but not investigated. The current study applies organizational identification theory to determine the relationship between the self-sacrificing behavior of the sponsoring company and the knowledge management behavior of crowdsourcing community members. Our results indicate that the self-sacrificing behavior of the sponsoring company increases the knowledge integration and innovation of community members by stimulating their organizational identification. Knowledge integration also mediates the effects of organizational identification on knowledge innovation. Community members can strengthen their understanding and application of existing knowledge through knowledge integration. By contrast, knowledge innovation depends on the understanding and mastery

of knowledge of an individual. Therefore, the self-sacrificing behavior of the sponsoring company plays an important role in influencing the organizational identification of community members, which can motivate them to integrate different types of knowledge and create additional ones.

This study also provides several practical implications for companies that intend to rely on crowdsourcing communities to improve their innovation activities. At present, companies tend to nominate employees with online community management experience or IT knowledge to organize crowdsourcing communities. However, these community managers actually act as leaders who interact with members in crowdsourcing communities. Their personality and behavior actually represent the leadership of sponsoring companies. Thus, sponsoring companies should nominate employees who typically exhibit a self-sacrificing spirit to manage crowdsourcing communities. Community managers are likely to dedicate themselves to community interests, such as satisfying community member requirements, establishing policies to guarantee community member interest, or helping community members generate creative ideas. Community managers will realize that their self-sacrificing behavior will be most effective in inspiring community member identification with both the company and the community. Community members will be willing to integrate different types of knowledge and contribute new ones for the innovation activities of the company.

Furthermore, knowledge integration is helpful in incrementing innovation, whereas knowledge innovation can only produce radical innovation. Our results indicate that knowledge integration mediates the relationship between organizational identification and knowledge innovation. Community managers should develop a convenient communication tool for community members to create revolutionary products. When community members with different expertise levels interact with one another, they can learn different types of knowledge from their peers. Thus, they are likely to integrate this knowledge into a new one and contribute to the radical innovation of the company.

Acknowledgements

References

Anderson, J. C., and Gerbing, D. W. 1988. "Structural equation modeling in practice: A review and recommended two-step approach," *Psychological Bulletin* (103:3), p 411.

Baldwin, C., and von Hippel, E. 2011. "Modeling a Paradigm Shift: From Producer Innovation to User and Open Collaborative Innovation," *Organization Science* (22:6), pp 1399-1417.

Baron, R. M., and Kenny, D. A. 1986. "The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations," *Journal of personality and social psychology* (51:6), pp 1173-1182.

Bessai, K., and Charoy, F. Year. "Business process tasks-assignment and resource allocation in crowdsourcing context," 2016 IEEE 2nd International Conference on Collaboration and Internet Computing (CIC), IEEE2016, pp. 11-18.

Brown, T. 2018. "An evolution of crowdsourcing: Implications for marketing,").

Bullinger, A. C., Neyer, A.-K., Rass, M., and Moeslein, K. M. 2010. "Community-Based Innovation Contests: Where Competition Meets Cooperation," *Creativity and Innovation Management* (19:3), pp 290-303.

Burns, J. Z., and Otte, F. L. 1999. "Implications of leader‐member exchange theory and research for human resource development research," *Human Resource Development Quarterly* (10:3), pp 225-248.

Chacko, T. I. 1985. "Member participation in union activities: Perceptions of union priorities, performance, and satisfaction," *Journal of Labor research* (6:4), pp 363-373.

Chatterji, A. K., and Fabrizio, K. 2012. "How Do Product Users Influence Corporate Invention?," *Organization Science* (23:4), pp 971-987.

Conger, J. A., and Kanungo, R. N. 1987. "Toward a behavioral theory of charismatic leadership in organizational settings," *Academy of management review* (12:4), pp 637-647.

Cravens, D. W., Ingram, T. N., LaForge, R. W., and Young, C. E. 1993. "Behavior-based and outcome-based salesforce control systems," *Journal of Marketing* (57:4), pp 47-59.

De Cremer, D., Mayer, D. M., van Dijke, M., Bardes, M., and Schouten, B. C. 2009. "When does self-sacrificial leadership motivate prosocial behavior? It depends on followers' prevention focus," *Journal of Applied Psychology* (94:4) Jul, pp 887-899.

De Cremer, D., van Knippenberg, D., van Dijke, M., and Bos, A. E. R. 2006. "Self-sacrificial leadership and follower self-esteem: When collective identification matters," *Group Dynamics: Theory, Research, and Practice* (10:3), pp 233-245.

Dick, R., Hirst, G., Grojean, M. W., and Wieseke, J. 2007. "Relationships between leader and follower organizational identification and implications for follower attitudes and behaviour," *Journal of Occupational and Organizational Psychology* (80:1), pp 133-150.

Edwards, M. R., and Peccei, R. 2010. "Perceived organizational support, organizational identification, and employee outcomes," *Journal of Personnel Psychology*).

Fuger, S., Schimpf, R., Füller, J., and Hutter, K. 2017. "User roles and team structures in a crowdsourcing community for international development–a social network perspective," *Information Technology for Development* (23:3), pp 438-462.

G.Lord, R., and J.Brown, D. 2001. "Leadership, values, and subordinate self-concept," *Leadership Quarterly* (12:2), pp 133-152.

Houlfort, N., Koestner, R., Joussemet, M., Nantel-Vivier, A., and Lekes, N. 2002. "The Impact of Performance-Contingent Rewards on Perceived Autonomy and Competence," *Motivation and Emotion* (26:4) 2002/12/01, pp 279-295.

Huffaker, D. 2010. "Dimensions of Leadership and Social Influence in Online Communities," *Human Communication Research* (36:4), pp 593-617.

Johne, F. A. 2018. *Industrial product innovation*, (Routledge.

Jones, D. A. 2010. "Does serving the community also serve the company? Using organizational identification and social exchange theories to understand employee responses to a volunteerism programme," *Journal of Occupational and Organizational Psychology* (83:4), pp 857-878.

Kohler, T., Stribl, A., and Stieger, D. 2016. "Innovation for volunteer travel: Using crowdsourcing to create change," in *Open tourism*, Springer, pp. 435-445.

Kucherbaev, P., Daniel, F., Tranquillini, S., and Marchese, M. 2016. "Crowdsourcing processes: a survey of approaches and opportunities," *IEEE Internet Computing* (20:2), pp 50-56.

Mael, F., and Ashforth, B. E. 1992. "Alumni and their alma mater: A partial test of the reformulated model of organizational identification," *Journal of organizational Behavior* (13:2), pp 103-123.

Manzini, R., and Lazzarotti, V. 2016. "Intellectual property protection mechanisms in collaborative new product development," *R&D Management* (46:S2), pp 579-595.

Matteson, J. A., and Irving, J. A. 2006. "Servant versus self-sacrificial leadership: A behavioral comparison of two follow-oriented leadership theories," *International Journal of Leadership Studies* (2:1), pp 36-51.

McFarlin, D. B., and Sweeney, P. D. 1992. "RESEARCH NOTES. DISTRIBUTIVE AND PROCEDURAL JUSTICE AS PREDICTORS OF SATISFACTION WITH PERSONAL AND ORGANIZATIONAL OUTCOMES," *Academy of Management Journal* (35:3), pp 626-637.

Metochi, M. 2002. "The influence of leadership and member attitudes in understanding the nature of union participation," *British Journal of Industrial Relations* (40:1), pp 87-111.

Mostafa, A. M. S., and Bottomley, P. A. 2018. "Self-Sacrificial Leadership and Employee Behaviours: An Examination of the Role of Organizational Social Capital," *Journal of Business Ethics*), pp 1-12.

Nylén, D., and Holmström, J. 2015. "Digital innovation strategy: A framework for diagnosing and improving digital product and service innovation," *Business Horizons* (58:1), pp 57-67.

O'Reilly, C. A., and Chatman, J. 1986. "Organizational commitment and psychological attachment: The effects of compliance, identification, and internalization on prosocial behavior," *Journal of applied psychology* (71:3), p 492.

O.Walumbwa, F., Avolio, B. J., and Zhu, W. 2008. "How Transformational Leadership Weaves Its Influence on Individual Job Performance: the Role of Identification and Efficacy Beliefs," *Personnel Psychology* (61:4), pp 793-825.

Oldham, J., and Morris, L. B. 2012. *The new personality self-portrait: Why you think, work, love and act the way you do*, (Bantam.

Olkkonen, M.-E., and Lipponen, J. 2006. "Relationships between organizational justice, identification with organization and work unit, and group-related outcomes," *Organizational Behavior and Human Decision Processes* (100:2), pp 202-215.

Ritala, P., Olander, H., Michailova, S., and Husted, K. 2015. "Knowledge sharing, knowledge leaking and relative innovation performance: An empirical study," *Technovation* (35), pp 22-31.

Segarra-Ciprés, M., and Bou-Llusar, J. C. 2018. "External knowledge search for innovation: the role of firms' innovation strategy and industry context," *Journal of Knowledge Management* (22:2), pp 280-298.

Shao, B. J., Shi, L., Xu, B., and Liu, L. 2012. "Factors affecting participation of solvers in crowdsourcing: an empirical study from China," *Electronic Markets* (22:2), pp 73-82.

Sivadas, E., and Dwyer, F. R. 2000. "An examination of organizational factors influencing new product success in internal and alliance-based processes," *Journal of marketing* (64:1), pp 31-49.

Ståhlbröst, A., and Lassinantti, J. 2015. "Leveraging living lab innovation processes through crowdsourcing," *Technology Innovation Management Review* (5:12).

Tajfel, H. 1982. "Social Identity and Intergroup Relations Cambridge University Press," *Cambridge, UK*).

Tavanapour, N., and Bittner, E. A. C. 2017. "Collaboration among Crowdsourcees: Towards a Design Theory for Collaboration Process Design,").

Tell, F. 2011. "Knowledge integration and innovation: a survey of the field," *Knowledge Integration and Innovation: Critical challenges facing international technology-based firms* (25), p 69.

van Knippenberg, B., and van Knippenberg, D. 2005. "Leader self-sacrifice and leadership effectiveness: the moderating role of leader prototypicality," *J Appl Psychol* (90:1) Jan, pp 25-37.

Walumbwa, F. O., Mayer, D. M., Wang, P., Wang, H., Workman, K., and Christensen, A. L. 2011. "Linking ethical leadership to employee performance: The roles of leader–member exchange, self-efficacy, and organizational identification," *Organizational Behavior and Human Decision Processes* (115:2), pp 204-213.

Wang, K., Nickerson, J., and Sakamoto, Y. 2018a. "Crowdsourced idea generation: The effect of exposure to an original idea," *Creativity and Innovation Management* (27:2), pp 196-208.

Wang, M.-C., Chen, P.-C., and Fang, S.-C. 2018b. "A critical view of knowledge networks and innovation performance: The mediation role of firms' knowledge integration capability," *Journal of Business Research* (88), pp 222-233.

Yang, J. 2005. "Knowledge integration and innovation: Securing new product advantage in high technology industry," *The Journal of High Technology Management Research* (16:1), pp 121-135.

Zhang, C., Hahn, J., and De, P. 2013. "Continued Participation in Online Innovation Communities: Does Community Response Matter Equally for Everyone?," *Information Systems Research* (24:4), pp 1112-1130.