Understanding Members' Active Participation in a DAO: An Empirical Study on Steemit

Research-in-Progress

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Abstract

One of Blockchain's great potential is to enable the decentralized autonomous organizations (DAOs), whose organizational structure and operational mechanism fundamentally distinct from traditional organizations. This revolutionary nature of DAOs will definitely influence peoples' behavior. Steemit is an online community like Reddit, but it's a DAO enabled by STEEM blockchain. This nature makes Steemit fans both users and owners. As users, people can enjoy social capital from using Steemit, just like using any other social media. As owners, people can get some economic incentives by earning and holding Steem Power, and Steem Power can be seen a kind of share capital. This paper attempts to explore the participation behavior of people in the Steemit community from two perspectives—social capital and share capital. Social feedback and economic feedback received by members also have an impact on participation behavior.

Keywords: Steemit, Blockchain, DAO, UGC, participation

Introduction

Blockchain is known as the most promising new technology after big data, artificial intelligence and virtual reality. It consists of distributed data storage, peer-to-peer transmission, consensus mechanism, encryption algorithm, etc., which is essentially a decentralized tamper-proof digital ledger. The rise of blockchain has driven a paradigm shift in organizational structure and it enables a novel form of organization—the decentralized autonomous organizations(Hsieh and Vergne 2018). Hsieh and Vergne (2018) define DAOs as nonhierarchical organizations that perform and record routine tasks on a distributed, cryptographically secured, public ledger; and that rely on the voluntary contributions of their internal stakeholders to operate, manage, and evolve the organization through a democratic consultation process. A DAO's financial transaction record and program rules are maintained on blockchain. The development of blockchain has made DAO a reality such as Steemit, which is the first blockchain-based UGC community. Traditionally centralized user generated content(UGC) platforms use users' traffic and value to generate revenue, while Steemit gives cryptocurrency rewards to users who create value.

Steemit is a Reddit-like UGC community that pays users for posting and curating content. Steemit aims to support online communities by providing cryptocurrency-based returns to users who provide valuable

contributions. Valuable contributions include: (1) posting, commenting. The rewards for posting and commenting are determined by the number of upvotes (means likes) received and the number of Steem Power of the voters; (2) upvoting. The reward for upvoting is called curation reward, which is the reward for finding quality content. The blockchain is characterized by the issuance of cryptocurrencies, and the more people who recognize the development of the community, the higher the value of the cryptocurrencies. Steemit cryptocurrencies include STEEM, Steem Power, and Steem Dollar. STEEM is the currency in Steemit. It differs from the internal currencies of other online communities, such as Second Life's Linden currency, because it can be traded externally. Steem Dollar anchors the dollar, which is similar to the design of debts. The Steemit platform guarantees that 1Steem Dollar can always be exchanged for $1. Steemit designs a share-based mechanism, which allows community users to hold community shares. Steem Power (SP) is the share in Steemit. Members holding SP have the following rights: (1) right to equity. They can get a dividend based on the proportion of shares they hold; and (2) right to control. The more SP they hold, the greater the weight when they upvote on posts.

Table 1 is a comparison of Steemit and Reddit. Compared with Reddit, Steemit has the following differences: (1) Steemit is a DAO based on the STEEM blockchain. There is no core authority in Steemit, and the community belongs to every user. Users get revenue from valuable contributions and shares. For platform developers, they are the original owners of tokens. They make a profit by holding great amount of tokens, and the more users there are, the more valuable their tokens are. Reddit is a centralized community with a well-organized management structure. Users' information and transaction information in Steemit are stored in the blockchain and cannot be deleted, and the security is high. (2) In Reddit, although users can choose to give other members Reddit coins, the rewards come from other users. In Steemit, the member's contribution reward comes from the platform itself, and other members do not have to pay. (3) Steemit allows members to hold community shares, which is a feature that blockchain enables. Therefore, we argue that users have two kinds of capital in Steemit: social capital and share capital.

Table 1. Comparison of Steemit and Reddit

	Reddit	Steemit
Organization Type	Traditional centralized organization	Decentralized autonomous organization
Community Owner	Platform founders/Runners	All users
System Architecture	Client/Server or Browser/Server	Blockchain
Users' Reward Source	Platform	Other members
Users' Capital	Social capital	Social capital and share capital

Active Participation(ACP, e.g., posting, commenting, upvoting) is a key success factor for online communities (Ardichvili et al. 2003). Prior researches have shown that members' ACP leads to positive organizational outcomes, such as sharing knowledge between peers for collaboration (Yang and Chen 2008), facilitating new product diffusion(Thompson and Sinha 2008), providing ideas for product innovation (Nambisan and Baron 2009),or reducing customer service costs(Dou and Krishnamurthy 2007). Although ACP has been studied in various traditional communities, the shareholding mechanism adopted by Steemit is unique. There are currently few studies on blockchain-based DAOs. We argue that users have two kinds of capital in the Steemit community: social capital and share capital. Social capital comes from the resources contained in the social networks created by users interacting with others. Share capital comes from the resources contained in the shares (SP) held by the users in Steemit. Based on these gaps, we propose research questions: *(1) What impact does members' social capital have on their active participation behavior in the blockchain-based community? (2)What impact does members' share capital have on their active participation behavior in the blockchain-based community? (3)How does social feedback, economic feedback moderate these relationships?*

Based on prior researches, we conclude that social capital affects the participation behavior of members. In the field of business management, it is verified that employee stock ownership will affect their

behavior in the organization. This effect has not been confirmed in the IS field. Therefore, in view of the uniqueness of share design in Steemit, we integrates two theoretical perspectives (social capital, share capital) to propose a research model to understand the factors affecting ACP. In addition, the social feedback and economic feedback received in Steemit also have an impact on ACP.

Literature Review and Theoretical Background

Active Participation Behavior in UGC Communities

A large number of studies have examined the participation behavior of members in various types of online communities including online Q&A community(Chiu et al. 2006; Khansa et al. 2015), online travel community(Wang and Fesenmaier 2004), social media(Rishika et al. 2013),B2B e-commerce community(Gharib et al. 2017), etc. Previous researchers mainly explore the antecedents of ACP from the following aspects: (1) users' motivation; (2) personality traits; (3) website design and policies; (4) interaction with others. Although ACP is very important for community development, the definition and measurement standards of ACP are not unified. For example, Khansa et al. (2015) measure ACP by the number of questions and answers that a community member posts each week. Chiu et al. (2006) measure ACP based on the number of knowledge sharing monthly. Rishika et al. (2013) use the number of posts and comments to measure ACP in social media. In addition, Wang and Fesenmaier (2004) use the average time in the community to measure ACP in the online travel community. In this paper, since the Steemit community is centered on posts and topic discussions. To explore members' ACP levels, we focused on the number of posts that each member contributes during the period under consideration.

Social Capital Theory

Social capital 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 and Ghoshal 1998). Nahapiet and Ghoshal (1998) define social capital with three distinct dimensions: structural capital (the overall pattern of connections between actors), relational capital (the kind of personal relationships people have developed with each other through a history of interactions), and cognitive capital (those resources providing shared representation, interpretations, and systems of meaning among parties).

In recent years, with the rapid development of online UGC communities, social capital has been used to explain various prosocial behaviors, including knowledge sharing behavior, community engagement, and knowledge consumption. Chung et al. (2016) explore the influencing factors of member knowledge sharing behavior in social networks from the perspective of knowledge contributors. According to Kang et al. (2017),social capital, as reflected by the number of followers of a crowdfunding project's advocates, is positively related to funding performance as reflected by the amount of funds solicited. Specifically, Chen et al. (2016) argue that community identification directly affects a member's site use continuance and that perceived member trust and perceived member reciprocity indirectly affect one's continued site use through community identification as a mediator.

ESOP and Psychological Ownership

The employee stock ownership plan (ESOP) is a plan to provide the company's employees with the company's ownership interest, which means that employees hold a certain percentage of the company's internal shares. The source of these shares is generally that the company directly donates to employees. There are also companies that provide employees with preferential purchases of internal shares and provide company employees with ownership rights. Enterprises expect to effectively promote corporate management and improve corporate performance through this incentive.

In Steemit community, community cryptocurrency incentives allow members to hold community shares Steem Power. When members hold SP, they can enjoy three rights similar to the company's shares: (1) right to earnings. 15% of the cryptocurrencies released each time in the STEEM blockchain will be awarded to members with Steem Power proportionally; (2) right to information. The holder may

supervise the management of the community, make recommendations or inquiries; (3) right to control. When upvoting on posts/comments, the more the SP members hold, the greater the weight is.

Furby (1980) proposes that psychology of possession is the theoretical basis of psychological ownership. Pierce et al. (1991) define psychological ownership as an individual's cognition of the target, and to what extent the individual considers the target or thing to be his/her own. So how does psychological ownership arise? Pierce et al. (1991) propose the main way of generating psychological ownership, one of which is personal input. Researchers elaborate on the positive relationship between psychological ownership and personal attitudes, self-concepts and personal responsibility. Organ (1990) has found that psychological ownership has a positive impact on the organization development. If employees has strong psychological ownership of the organization, they are more likely to have an organization-friendly behavior than others, and can afford more responsibility(Druskat and Kubzansky 1995).

Research Model and Hypotheses

Similar to other content communities, Steemit members form and accumulate personal social capital through diverse interpersonal interactions such as content sharing, topic and circle discussion. Steemit is a DAO which enabled by blockchain. This nature makes Steemit fans both users and owners. As users, people can enjoy social capital from using Steemit, just like using any other social media. As owners, people can get some economic incentives by earning and holding SP, and SP can be seen a kind of share capital. These two capital will in turn affect people's thinking and actions. Furthermore, the social feedback and economic feedback members received in Steemit can also have moderation effect. Next, this paper will discuss how individuals' social capital, share capital, social feedback and economic feedback can influence active participation.

Social Capital and ACP

Structural capital is characterized by social interaction and reflects the structural characteristics of individual social networks. Nahapiet and Ghoshal (1998) argue that "The fundamental proposition of the Social Capital Theory is that network ties provide access to resources". Wang et al. (2013) believe that Weibo members with more fans have higher structural capital. They will receive more likes and readings, and are easier to gain the attention of other users. Steemit has the characteristics of social network. Members can get interesting content in time by actively following others. That is to say, members can share and spread content through their followers, which can attract more people to upvote for themselves or content support. This forms a social network connection relationship and determines their own node location and influence in the network according to the number of connections. Kang et al. (2017) verify the structural capital based on the number of followers of crowdfunding project advocates, has a significant positive impact on the amount of funds raised and the financing performance of the project. Therefore, this paper uses the number of member's followers as an indicator to measure structural capital, and proposes:

H1a: The number of followers of a member will have a positive impact on the number of posts in Steemit.

The relational dimension of social capital refers to the interpersonal relationship of actors in social interaction, such as trust, reciprocity. Among them, trust is considered one of the core components of relational capital. Because members are often anonymous and virtual in Steemit, there is no guarantee of the reliability of the other's actions and commitments. Trust has been viewed as a set of specific beliefs dealing primarily with the integrity, benevolence, and ability of another party in the management literature(Chiu et al. 2006). Nahapiet and Ghoshal (1998) find that the higher the degree of trust in the group, the more individuals are willing to participate in group-level interactions and are more willing to share information. When members have low levels of trust towards other members in the community, they are unlikely to disclose many personal information. On the contrary, when they trust other people, they will disclose personal information with confidence. Therefore, this paper uses the amount of personal information disclosed by individuals on their home page to measure their level of trust.

H1b: The number of personal information disclosed of a member will have a positive impact on the number of posts in Steemit.

Cognitive capital refers to those resources that make possible shared interpretations and meanings within a collective(Wasko and Faraj 2005). Engaging in a meaningful exchange of knowledge requires at least some level of shared understanding between parties (Nahapiet and Ghoshal 1998). Wasko and Faraj (2005) use expertise to represent cognitive capital. Expertise can help individuals understand shared goals and visions in the community. Researchers have found that individuals with a high level of expertise are more likely to provide useful advice on computer networks (Wasko and Faraj 2005). In addition, in a content community, even if a person wants to post, contribution is still unlikely unless he or she has the ability to post. In Steemit community, expertise can be expressed in terms of reputation scores. Reputation score is determined by the number of votes received through posts. Therefore, people with high reputation scores are better able to share information with others. Thus, we hypothesize:

H1c: *The expertise of a member will have a positive impact on the number of posts in Steemit.*

Share Capital and ACP

In this paper, share capital refers to the individual's share of the community and the resources it contains. Similar to the ESOP program, Steemit designs the shareholding mechanism so that members can hold shares in the community and enjoy corresponding rights. We use the number of shares (SP) held by members and the proportion of shares (SP) in their total assets as indicators of share capital. In Steemit, the more shares (SP) members holds, the more they input in the community. According to the theory of possession, members will generate psychological ownership of the community. Then they will act in favor of community development and make more posts. Pierce et al. (1991) propose the positive effect of the ESOP on employee organizational behavior, and point out the mediating role of psychological ownership in it. In addition, Steemit is a DAO with no absolute authority in the community. Members with community shares actually own the Steemit community. Holding Steem Power is a high-income and high-risk thing. On the one hand, holding SP can bring a steady stream of dividends to members. On the other hand, according to the Steemit white paper, we know that SP cannot be directly converted into currency. Members need to convert SP to STEEM first, which takes 13 weeks. After converted to STEEM, STEEM can be converted into money. These members will not harm the interests of the Steemit community, because ultimately it will hurt the members' own interests. Thus, we hypothesize:

H2a: *The amount of a member's SP will have a positive impact on the number of posts in Steemit.*

H2b: *The proportion of a member's SP will have a positive impact on the number of posts in Steemit.*

Social Feedback, Economic Feedback and ACP

In this paper, social feedback refers to the mechanism in which members in the community give positive feedback to other members' participation behavior. Economic feedback refers to the community's economic incentives for member participation behavior. The feedback could be encouragement to users for their contribution behavior. Since upvoting is the main form of member recognition of content in Steemit, we use it to represent social feedback. Post rewards and upvotes rewards are used to express recognition of their ACP. Reciprocity theory and reinforcement theory all show that feedback received can affect their subsequent behavior(Guan et al. 2018). Research has found that the more positive feedback a user get, the more likely he will participate in community activities continuously(Guan et al. 2018). Based on the above analysis, we hypothesize:

H3a: *Social feedback received will have a positive impact on the number of posts in Steemit.*

H3b: *Economic feedback received will have a positive impact on the number of posts in Steemit.*

Moderating Role of Social Feedback and Economic Feedback

In Steemit, social capital comes from the interaction among members, and the share capital comes from their own input. Similarly, social feedback comes from other members, and economic feedback comes from the community and is the result of personal efforts. Therefore, we argue that social feedback is relation based, and economic feedback is personal based. When members receive social feedback, they will link this benefit to the result of active interaction with others, rather than the share capital.

Conversely, when members receive economic feedback, they will link this benefit to their active inputs, rather than the impact of social capital. Therefore, we put forward the hypotheses:

H4a-c: The positive effect of social ties (H1a), trust (H1b) and expertise (H1c) on ACP is negatively moderated by economic feedback.

H5a-c: The positive effect of social ties (H1a), trust (H1b) and expertise (H1c) on ACP is positively moderated by social feedback.

H6a-b: The positive effect of SP amount (H2a), SP proportion (H2b) on ACP is positively moderated by economic feedback.

H7a-b: The positive effect of SP amount (H2a), SP proportion (H2b) on ACP is negatively moderated by social feedback.
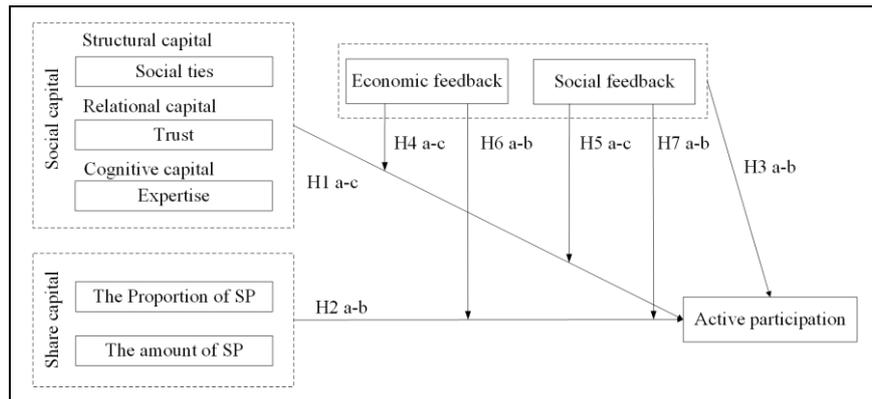

Figure 1. Research Model

Data Collection and Preliminary Analysis

To validate the research model, we separately crawl the independent and dependent variables in two consecutive periods to avoid endogeneity. We observe the independent variables from September 7 to November 7, 2018 and the dependent variable from November 8, 2018 to January 8, 2019. The final data set includes 39257 users.

Table 2. Variable Table

Variable	Measure item	Description
Active Participation(DV)	$post_{it}$	The number of posts provided by user i during period t
Share Capital(IV)	sp_num_{it}	The number of SP held by user i during period t-1
	sp_pro_{it}	The proportion of SP held by user i during period t-1
Structural Capital(IV)	$follower_{it}$	The number of followers of user i from registration to current period t-1
Relational Capital(IV)	$relation\_num_{it}$	The number of personal information disclosed by user i during period t-1
Cognitive Capital(IV)	$reputation_{it}$	The reputation score of user i during period t-1
Social Feedback(MV)	$social\_fe_{it}$	The number of upvotes that user i gets during period t-1
Economic Feedback(MV)	$economic\_fe_{it}$	The economic rewards of posts that user i gets during period t-1
Others (Control Variable)	$tenure_{it}$	The number of weeks that user i stays in Steemit after period t-1

The dependent variable is a count variable, and researchers usually use Poisson regression and negative binomial regression. The Poisson regression assumes that the mean of the dependent variable is equal to the variance while the negative binomial regression model does not assume that the mean and the variance are equal(Jahn-Eimermacher 2008). In our study, the variance of DV is greater than the mean, so we adopt the negative binomial regression model to explore ACP in Steemit .Table 3 shows the preliminary results, which presents interesting findings about the moderation variables in the research model. Next, we will further explore the model by using complex models and panel data.

Table 3. Negative Binomial Model Results

Variable	Model 1	Model 2	Model 3	Model 4
tenure	0.036287***	-0.064381***	-0.061918***	-0.053038***
relation_num		0.006543***	0.008338***	0.009520***
log_reputation		0.004797***	0.010879***	-0.006198***
log_follower		0.006340***	0.000008***	0.003931**
sp_pro		0.075712***	0.049174***	-0.000840
log_sp_num		0.030698***	0.004964***	-0.002153
log_economic_feedback		0.114226***	0.123793***	-0.185005***
log_social_feedback		0.034150***	0.071358***	0.048928***
log_economic_follower			0.008707***	0.009767***
log_economic_reputation			-0.013797***	-0.003090***
log_economic_relation			-0.013432***	-0.017645***
log_economic_sp_pro			0.095984***	0.074761***
log_economic_sp_num			0.116083***	0.065665***
log_social_follower				-0.007312***
log_social_reputation				-0.005212
log_social_relation				-0.000048***
log_social_sp_pro				0.042997***
log_social_sp_num				-0.013335***
_cons	1.54018	1.513617	1.557365	1.729538
Wald chi2(d.f.)	101.45	9184.84	13884.44	16945.81
Prob > chi2	0.000000	0.000000	0.000000	0.000000
Pseudo R^2	0.0004	0.023196	0.034386	0.044332

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Potential Contribution

This study focus on the blockchain-based UGC community Steemit, we compare the differences between Steemit and traditional UGC communities. The characteristics of the DAO makes the participation behavior of users in this community very unique, and there is no research on this new DAO in IS field. We attempt to explore the antecedents of ACP in Steemit. Secondly, prior researchers have found the effect of social capital in traditional communities. The Steemit community uses Steem Power's share design. We propose that users hold two types of capital in the Steemit community: social capital and share capital. Thirdly, this study explains in detail how the two kinds of capital affect the users' participation behavior through two different mechanisms. In addition, the psychological ownership theory is mainly used to explain the behavior of employees in the organization. This study is also the first to apply the theory of psychological ownership to IS field.

Acknowledgements

References

Ardichvili, A., Page, V., and Wentling, T. 2003. "Motivation and Barriers to Participation in Virtual Knowledge-Sharing Communities of Practice," *Journal of knowledge management* (7:1), pp. 64-77.

Chen, R., Sharma, S. K., and Rao, H. R. 2016. "Members' Site Use Continuance on Facebook: Examining the Role of Relational Capital," *Decision Support Systems* (90), pp. 86-98.

Chiu, C.-M., Hsu, M.-H., and Wang, E. T. 2006. "Understanding Knowledge Sharing in Virtual Communities: An Integration of Social Capital and Social Cognitive Theories," *Decision support systems* (42:3), pp. 1872-1888.

Chung, N., Nam, K., and Koo, C. 2016. "Examining Information Sharing in Social Networking Communities: Applying Theories of Social Capital and Attachment," *Telematics Informatics* (33:1), pp. 77-91.

Dou, W., and Krishnamurthy, S. 2007. "Using Brand Websites to Build Brands Online: A Product Versus Service Brand Comparison," *Journal of Advertising Research* (47:2), pp. 193-206.

Druskat, V., and Kubzansky, P. 1995. "Measuring the Psychological Sense of Ownership in the Workplace," *Annual Meeting of the Academy of Management, Vancouver, Canada*.

Furby, L. 1980. "The Origins and Early Development of Possessive Behavior," *Political psychology*), pp. 30-42.

Gharib, R. K., Philpott, E., and Duan, Y. 2017. "Factors Affecting Active Participation in B2b Online Communities: An Empirical Investigation," *Information Management* (54:4), pp. 516-530.

Guan, T., Wang, L., Jin, J., and Song, X. 2018. "Knowledge Contribution Behavior in Online Q&a Communities: An Empirical Investigation," *Computers in Human Behavior* (81), pp. 137-147.

Hsieh, Y.-Y., and Vergne, J.-P. 2018. "Bitcoin and the Rise of Decentralized Autonomous Organizations," *Journal of Organization Design* (7:1), p. 14.

Jahn-Eimermacher, A. 2008. "Comparison of the Andersen–Gill Model with Poisson and Negative Binomial Regression on Recurrent Event Data," *Computational Statistics Data Analysis* (52:11), pp. 4989-4997.

Kang, L., Jiang, Q., and Tan, C.-H. 2017. "Remarkable Advocates: An Investigation of Geographic Distance and Social Capital for Crowdfunding," *Information Management* (54:3), pp. 336-348.

Khansa, L., Ma, X., Liginlal, D., and Kim, S. S. 2015. "Understanding Members' Active Participation in Online Question-and-Answer Communities: A Theory and Empirical Analysis," *Journal of Management Information Systems* (32:2), pp. 162-203.

Nahapiet, J., and Ghoshal, S. 1998. "Social Capital, Intellectual Capital, and the Organizational Advantage," *Academy of management review* (23:2), pp. 242-266.

Nambisan, S., and Baron, R. A. 2009. "Virtual Customer Environments: Testing a Model of Voluntary Participation in Value Co‐Creation Activities," *Journal of product innovation management* (26:4), pp. 388-406.

Organ, D. W. 1990. "The Motivational Basis of Organizational Citizenship Behavior," *Research in organizational behavior* (12:1), pp. 43-72.

Pierce, J. L., Rubenfeld, S. A., and Morgan, S. 1991. "Employee Ownership: A Conceptual Model of Process and Effects," *Academy of Management review* (16:1), pp. 121-144.

Rishika, R., Kumar, A., Janakiraman, R., and Bezawada, R. 2013. "The Effect of Customers' Social Media Participation on Customer Visit Frequency and Profitability: An Empirical Investigation," *Information systems research* (24:1), pp. 108-127.

Thompson, S. A., and Sinha, R. K. 2008. "Brand Communities and New Product Adoption: The Influence and Limits of Oppositional Loyalty," *Journal of marketing* (72:6), pp. 65-80.

Wang, G., Gill, K., Mohanlal, M., Zheng, H., and Zhao, B. Y. 2013. "Wisdom in the Social Crowd: An Analysis of Quora," *Proceedings of the 22nd international conference on World Wide Web*: ACM, pp. 1341-1352.

Wang, Y., and Fesenmaier, D. R. 2004. "Towards Understanding Members' General Participation in and Active Contribution to an Online Travel Community," *Tourism management* (25:6), pp. 709-722.

Wasko, M. M., and Faraj, S. 2005. "Why Should I Share? Examining Social Capital and Knowledge Contribution in Electronic Networks of Practice," *MIS quarterly*), pp. 35-57.

Yang, S. J., and Chen, I. Y. 2008. "A Social Network-Based System for Supporting Interactive Collaboration in Knowledge Sharing over Peer-to-Peer Network," *International Journal of Human-Computer Studies* (66:1), pp. 36-50.