

December 2003

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Recommended Citation

Kwok, Sai and Gao, Sheng, "Knowledge Sharing Community in P2P Network and its Application Features: A Study of Motivation Perspective" (2003). *PACIS 2003 Proceedings*. 104.
<http://aisel.aisnet.org/pacis2003/104>

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Knowledge Sharing Community in P2P Network and its Application Features: A Study of Motivation Perspective

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Abstract

How to effectively share knowledge within organizations has been given much more attention in practice as well as in research. However, most of current approaches are based on the centralized network structure, e.g. a central knowledge repository, which has been considered inappropriate and ineffective to facilitate the process of knowledge sharing. On the contrary, in this study, we propose the idea of virtual knowledge sharing community that is based on the decentralized P2P technology. In the community, each member plays equal role of knowledge producing, receiving and coordinating. We believe that the decentralized P2P has many distinct advantages in knowledge sharing. Moreover, referring to relevant psychological studies on human motivation, four application features for the virtual knowledge sharing community are further proposed. After being applied, each of the features is believed to have capability of motivating the members of community to share knowledge with each other.

Keywords

Knowledge sharing, P2P network, motivation, knowledge management.

Introduction

Research as well as application of knowledge sharing has greatly increased over the last few years. Many international firms have invested substantial effort trying to create, transfer and share knowledge within organizations to enhance their profit generation capability [Laurie 2002]. It has been observed that application of knowledge sharing is often performed on a centralized approach, in which a central knowledge server or a common knowledge repository is used. However, the centralized knowledge management systems have been shown to be ineffective to share knowledge [Fahey and Prusak 1998, Markus 2001]). Extensive considerable rework on the centralized knowledge repository is needed, as its content is found to be error prone and inaccurate. It does not attract organization members to use it. One possible reason could be that the tacit part of knowledge crucial to effective knowledge transfer process is missing [Grover and Davenport 2001] and hence knowledge coordinators in the centralized system lack the contextual knowledge to re-purposing repository content.

A potential solution to these problems could be to conduct knowledge sharing in a decentralized network supported by peer-to-peer (P2P) technology, in which interactive usage of both explicit and tacit knowledge between knowledge users can happen. The decentralized environment for knowledge sharing in this setting can be defined as knowledge sharing community. In such virtual community setting, every worker is not only a knowledge

recipient, but also a knowledge producer as well as a knowledge coordinator. It ensures the integrity of the knowledge to be accessed, since the original knowledge owner is directly involved in the knowledge reuse process. Another distinct advantage of decentralized knowledge sharing system is its enhancement of load balancing so that the workload of a dedicated group of knowledge producers can be dramatically reduced. [Parameswaran, et al. 2001]. In such a P2P-based community, interpersonal trust and an organizational culture that values knowledge sharing can be built and established. The motivations to contribute to the knowledge base can also be naturally achieved through P2P supported virtual community. [Ruppel and Harrington 2001]. In this study, we propose a P2P network structure for the knowledge sharing community and identify four application features that are feasibly implemented into such P2P community setting in order to motivate the members of community to share knowledge with each other.

Literature Background

Knowledge Repository

A knowledge repository, also known as the organization memory, is often a source of problems in centralized knowledge sharing system. To build up the repository rapidly, companies only include factual or procedural knowledge, which is mainly explicit in nature. The tacit knowledge in connection between individuals and other artifacts that determine patterned interaction and behavioral regularities are ignored [Lant and Montgomery 1987]. Even after the designated knowledge coordinators included the context meaning in the repository on the base of their judgment, accuracy of interpretation may be questionable. The knowledge may be modified and revised with personal opinions and experiences by the repository coordinator. Under this context, knowledge users may encounter difficulties in interpreting as well as verifying the knowledge. If insufficient contextual details were not included with the knowledge, it may cause ineffective usage as result, especially for risk aversion users [Alavi and Leidner 2001]. This problem becomes more acute when the knowledge practitioners are new comers to the working domain, who has little experience or personal connection with the organization.

Virtual Community

Knowledge management is a social activity requiring voluntary involvement of individuals with a strong commitment [Ichijo, et al. 1998]. Virtual communities can be viewed as socially motivated communities that share common values and interests through electronic media to communicate, independent of time and place within a shared semantic space, where webs of personal relationships are formed [Rheingold 1993] [Schubert and Ginsburg 1999]. By mapping the realm of knowledge management and virtual community together, the preliminary knowledge sharing community is formed. It has been suggested that a person is motivated to contribute to knowledge if one will subsequently receive useful help in return, increasing of reputation and status through contribution [Kanter 1995, Kollock 1999b]. Interpersonal factors, especially liking and affiliation, also play an important role in motivating contribution of knowledge. The voluntary involvement of organizational members can be easily promoted when they share same visions and goals with sense of efficacy and attachment. The setting of the virtual community embraces the necessary motivational factors that creates suitable environment for knowledge sharing community development. People with the same work interest will organize together and form networks to allow flowing of knowledge. Interpersonal trust can be built within such network. They are the key

components to be managed as noted in the knowledge management literature [Brown and Duguid 1991, Heumer, et al. 1998, Krackhardt and Hanson 1996].

Knowledge Market and Free Rider Problem

Although virtual community setting is suitable for the knowledge sharing community, there do exist some predicaments. Knowledge is not solely a piece of information. It can be regarded as a product with value. It provides competitive edge towards peoples' works and achievements. [Krogh 1998]. Because of the value, individuals will recognize knowledge as their own properties. They need to receive something in exchange [Davenport and Prusak 1998, Grover and Davenport 2001]. Knowledge in sharing community, however, can be regarded as public goods. It is to some degree indivisible and one person's consumption does not reduce the amount available to others. It is difficult or impossible to exclude individuals from benefiting from the goods [Kollock 1999b]. Even the producer disagrees on sharing the goods, every member of the community, regardless of whether or not has contributed, benefits. Its content is indivisible that can be replicated limitlessly with basically zero marginal cost. Members of the community have full access to the collective content or resources, that is, free riding is not punished. It is basically the individual's choice whether to contribute to the community or to shirk and free ride on others' contribution. Whether a community should provide public goods and tolerate free riding behavior presents a social dilemma, and may lead to a serious business risk in the knowledge sharing community. Shirking is occurring in the cases of virtual community such as Napster and Gnutella, although in both examples system performance has apparently not deteriorated to a degree that would make the service unattractive despite massive free riding [Adar and Huberman 2002]. The authors of this paper propose imposing the market mechanism with the support of intellectual property rights in the community to improve the free rider problem. It facilitates the trading of knowledge products as well as providing solid foundation for market competition. Proper institutional governance such as guideline to enforce intellectual property rights should also be implemented to boost up market mechanism.

Proposed P2P Network Structure

We propose a P2P network structure supported by enhanced P2P technology to fit our virtual knowledge sharing community. P2P network first appeared in the advanced research projects agency network (ARPANET) architecture in 1969. The APRANET originally connected four universities and enabled scientists to share information and resources across long distance. Typical P2P applications include Napster, Gnutella and ICQ client programs, which focus on file and knowledge sharing. The pure P2P sharing network is basically an information directory while explicit knowledge is maintained on clients' computers. A P2P network user may connect to any user on the network by specifying the Internet protocol (IP) address of his computer or identity (ID) of the user. A direct connection is established. This connection enables file sharing, video conferencing as well as audio communications. Usually, the P2P network is a decentralized network as shown in Figure 1a, in which each client is equipped with a local repository. A central server as shown in Figure 1b, sometimes, is also deployed within the decentralized network so as to arrange high network traffic flow and allow developer to add necessary infrastructure and provide special features for knowledge sharing community to fit the requirement of community members. When the P2P network is utilized to share knowledge, it forms a knowledge-sharing environment with multiple knowledge repositories. The distinct advantages of using multiple knowledge repositories in knowledge sharing include: (1) knowledge can be produced in many different formats for different users

by different knowledge producers at different functional levels; (2) the role of knowledge generation and codification are conducted by the same knowledge worker, contextual information are naturally embedded; and (3) time required for knowledge generation and sharing process is minimized, as the layer of knowledge coordinator is removed. The knowledge is more readily available to users within the network. The proposed system can ensure the knowledge is dynamic and up-to-date rather than static, which is critical to the success of any knowledge management system [Alavi and Leidner 2001]. It can also improve existing IT-based KM, which is currently incapable of keeping pace with dynamic needs of knowledge creation [Malhotra 1999].

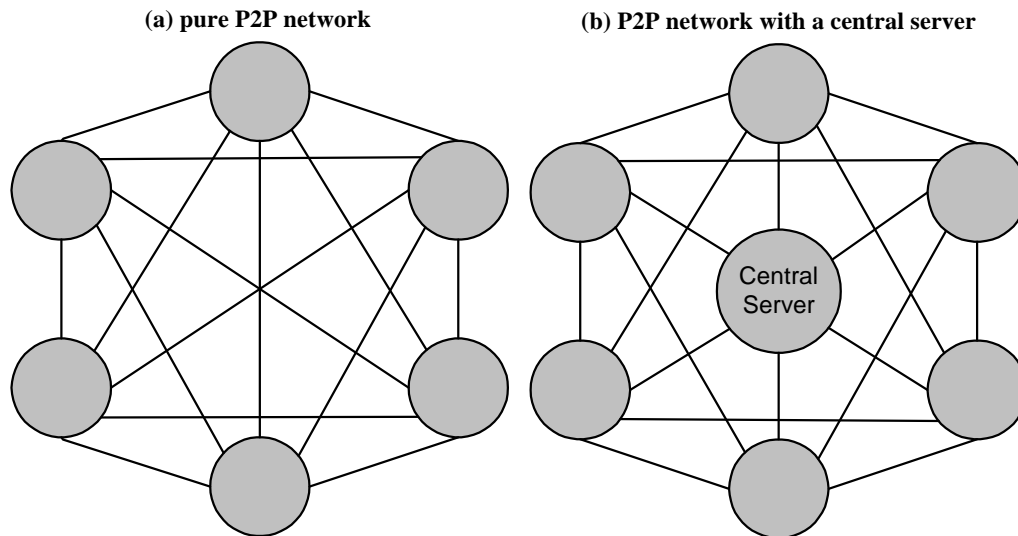


Figure 1: P2P Network Structure: (a) a pure P2P network; and (b) a P2P network with central server).

In a P2P network, a virtual face-to-face communication system can be realized among video- and/or audio-enabled P2P clients. This attribute may refer to the sharing of tacit knowledge, which is conceptually and technically different from tacit knowledge sharing in the centralized approach. It closes the gap between knowledge producers and knowledge recipients, and encourages real-time interactions between them visually and verbally for sharing the knowledge whenever it is necessary. Further elaborations on the manual, advice from past experiences, and suggestions from skillful operators, etc. are obtainable through such interaction process. The exchange process in this decentralized network becomes highly interactive. Alternatively, when a knowledge user wants to explore different views on the same subject, the user has many options to choose from either switching to the other member's repository or interacting directly. This fundamentally changes the sharing of knowledge and makes the P2P approach more useful to workers, especially when they are new to the working domain.

The technology of P2P network also resolves the knowledge authorship problem, which is highly related to the time spent on the verification during knowledge sharing process. The P2P clients usually come with an authorship system. Users are labeled with identities and their contributions are marked with these labels. Knowledge users are free to select their trustful resources when many related knowledge resources are returned from the knowledge sharing system. As a result, members in the community will have substantial information for evaluation before utilizing this piece of knowledge.

Motivational Factors in P2P Knowledge Sharing Community

Motivating users to become involved in a virtual community has been studied in various academic disciplines and can be viewed from a sociological, economic, or technological perspective [Hummel and Lechner 2001]. In the present study, we draw on the psychology literatures to examine what may drive users in a P2P network to share knowledge within their communities. On the basis of psychological theories, we try to summarize and clarify the most salient motivational factors that may influence the willingness or tendency of P2P network users to share knowledge. The purpose of doing so is that we could then add some new application features to P2P community to put particular focus on these motivational factors, in order to facilitate knowledge sharing process from the psychological perspective of users.

In the motivational area, specifically, Deci's work [Deci 1975, Kollock 1999a] emphasized the distinction between internal and external psychological factors to explain human behavior within communal settings, where the former is referring to "intrinsic motivation" and the latter to "external rewards". Intrinsic motivation includes the desire for achieving competence and self-determination. External rewards include factors such as direct or indirect monetary compensation. Moreover, Kollock [Kollock 1999a] suggests that there are four possible reasons why a person is motivated to contribute valuable information or resources to a group. They are (1) the expectation that one will subsequently receive useful help in return, (2) the increasing of one's own reputation and status in the group through contributing, (3) a sense of efficacy, and (4) the feeling of belonging to the group.

Constant et al. [Constant, et al. 1994] discussed information sharing based on social exchange theory. According to them, information sharing is affected by rational self-interest as well as social and organizational contexts. They conclude that organizational culture and policies as well as personal factors can influence people's information sharing attitude and behavior. The more the person believes that information sharing is a social norm, that is, the usual, correct, and a socially expected behavior, the more they will be willing to share. This in fact fits well with grassroots Internet ethics that permeates many virtual communities ranging from Usenet newsgroups to Napster and SETI. Besides social values, sharing behavior also depends on technical factors. That is, the easier P2P-based content sharing systems can be used the more people will actually share. In other words, complicated user interfaces or difficult to use systems may negatively affect user's sharing behavior.

We organize the factors that motivate contribution to P2P communities in Figure 2, which serves us as an explanatory framework for the participatory behavior of peers in P2P networks. The motivational factors that determine the participation level of P2P community members are classified into individual factors and interpersonal factors. Individual factors are divided into extrinsic and intrinsic motivation. Extrinsic motivation can be generated through rewards or derived from personal needs. A reward is a compensation for the contribution to the community. Personal need means that the contribution one provides will benefit or be useful to oneself in some indirect way. For example, making a contribution may increase self-esteem. Intrinsic motivation relates to altruism and reputation. Altruism is the behavior of someone that, although not beneficial or perhaps even harmful to oneself, benefits others [Hoffman 1981]. Reputation refers to the overall quality or character as seen or judged by the community, or the recognition of some specific contribution to the community by other peers. Apart from these individual factors, interpersonal factors, especially liking and affiliation, also play an important role in motivating P2P contribution. Liking is an affection

based on admiration, benevolence, or common interests while affiliation refers to value derived from the connection to the group.

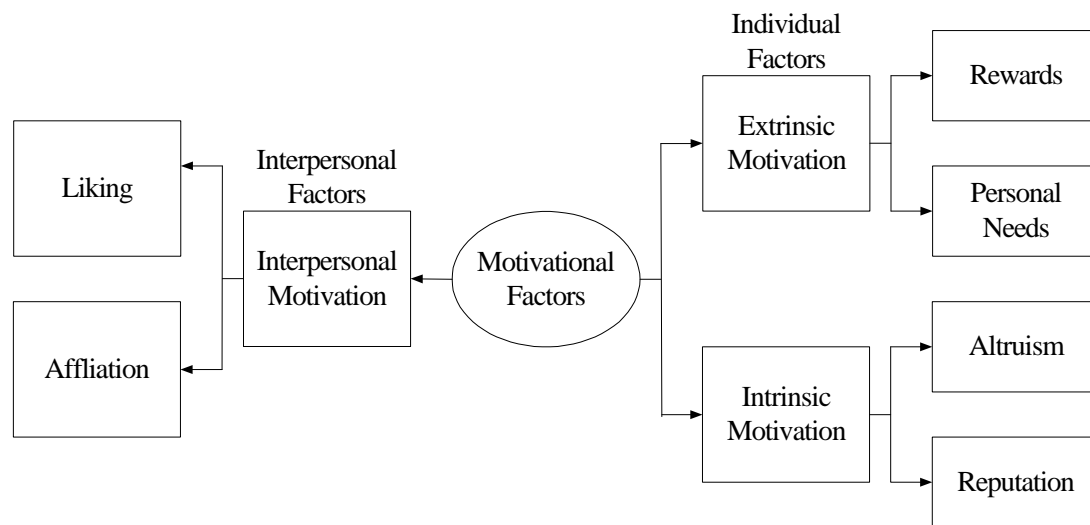


Figure 2. Motivational factors in P2P communities.

Application Features in P2P Knowledge Sharing Community

After laying out a motivational foundation for participatory behavior in electronic communities in the previous section, we now propose a number of software application features that aim to implement incentive mechanisms to stimulate productive knowledge sharing in P2P service environments. Obviously, a wide range of possibilities could be considered, but for our present discussion we have chosen four basic types that best address the motivational factors discussed in our framework above. These application features are (1) *contribution-reward mechanism*, (2) *individual identity and profile generation*, (3) *sub-community organization*, and (4) *reviews and peer recommendation*.

Contribution-Reward Mechanism

Reward is one of the extrinsic motivations to induce contribution. It is very common to use a reward as an incentive to motivate Internet community participants to contribute to the group. Reward can be tangible or intangible. Examples of tangible rewards can be monetary rewards, discount rates for subscription or purchase, bonus points for prize remedy and add-value service. Monetary rewards are common incentives used in Internet community, for example, spedia.com [Janis 2001] who pays users who connect to the Internet and view the Spedia's advertisement bar while surfing the web. Intangible rewards include self-benefit or indirect benefits from the contribution and top contributors ranking. This ranking feature can be important to someone who believes that contributions could get one better reputation from others. An example of this feature can be found at Amazon.com [Anonymous 2003b] that has a top reviewer chat that encourages customers to write reviews for books. The 10 top reviewers in terms of the number of reviews that they have posted will be shown in the chat with small icons to indicate their achievement and contribution to the site.

In order to integrate the reward features into the P2P knowledge sharing community, we propose to add a knowledge-tracking module in the application. Conceptually, the function of the module is to monitor the level of knowledge contribution and retrieval of each member in the P2P community. Rewards are given to the members in proportion to the extent to which they are involved with the community in terms of the amount of knowledge they contribute to or retrieve from their knowledge sharing community. To be more specific, the amount of the reward could be proportional to the number of questions or responses posted in the community, the frequency to communicate with other community members, or the number of useful files uploaded or downloaded.

Individual Identity and Profile Generation

Some file-sharing software, like Gnutella and Freenet [Adar and Huberman 2002, Anonymous 2003a], conduct file transfer or offer downloads in an anonymous way. A user who downloads the digital file from the network cannot identify where the source of the file is hosted and who offers the file. In some cases, the Internet Protocol (IP) addresses of the hosting computers may be identified. However, this IP address can be meaningless if the IP address is dynamically allocated by Internet service provider.

The individual identity feature provides the fundamental element to building trusted relationships among members, and can then induce effective knowledge sharing between them. Thus, an identification system that can identify the individual member who participates knowledge sharing activities is needed when the reward and the participation ranking feature is integrated into the P2P community as well. Any form of members' participation to knowledge sharing within the community, for example, can be identified through their respective ID or the email address.

In combining the identification system with P2P knowledge sharing community, basic personal information including interests about a member can be maintained in the member profile. By referring to the interpersonal psychology of an individual, we know that people tend to form affiliations with others who have similar interests. Therefore, the member profile is not only useful for targeted marketing, but also useful for members within the community to know each other and interact with members who have common interests.

Sub-community Building

The sub-community feature facilitates community members to organize their own sub-communities within the P2P knowledge sharing community. In other words, a community can be composed of many sub communities that are owned by particular members. In the real-world environment, it is common that people form a community made up of people with similar interests, for example, fan clubs of singers, movie stars, football teams, basketball teams, but also professional special interest groups. Information and knowledge exchange are major activities in these communities. Some people seek to increase the welfare of others, which is actually a reflection of altruism, one of our individual intrinsic motivational factors. [Hoffman 1981]. The formation of a sub-community can provide community identity and sense of belonging for an individual, which can also induce another type of altruistic behavior - "kin selection altruism" due to liking and love. They may treat other members of the sub-community as their kin and thus be willing to do something beneficial to others but not necessarily to themselves. Therefore, it is believed that, within a sub community of

knowledge sharing, the member will probably be more willing to contribute knowledge for others or receive it for their own use.

Peer Recommendation

The peer recommendation feature is a useful tool to identify members in P2P community who provide quality services. Peer recommendations can be constructed based on peer evaluations, reviews, and ratings. A member can rate another member based on the experience of previous service. It is also a tool to assist in identifying trustworthy members in the community. An example of a peer recommendation system in use is the user reputation system in Lotus Knowledge Discovery System [Pohs, et al. 2001]. Users can provide feedback and comments to other users. Each user will have her own feedback profile page that shows all feedback and comments from others.

By applying peer recommendations in P2P knowledge sharing community, the community members can rate each other in terms of different criteria. For example, they can rate a member according to the quality or the quantity of knowledge piece this member contributes to the community. This provides not only relevant information to other members but also a self-reference to ones who give out the recommendations. This can be used as records for themselves and used as a decision tool to help decide with which member to interact and to further share knowledge on the basis of the previous experience.

Application Features	Motivational Factors					
	Reward	Personal Needs	Altruism	Reputation	Liking	Affiliation
Contribution Reward Mechanism	+			+		
Individual Identity and Profile Generation	+	+	+	+	+	+
Sub-community Building		+	+	+	+	+
Peer Recommendations	+	+		+		

Table 1: The relationship between application features and motivational factors.

Summary

We propose four feasible application features with which to motivate the members of P2P community to share knowledge with each other. Each of the features enables the motivational function on knowledge sharing behavior of P2P community members by realizing the motivational factors we addressed previously in this study. Every feature may emphasize different range of motivational foundation. The general relationships between the particular features and their underlying motivational foundation are shown in table 1, where a '+' indicates a positive correlation between specific motivational factors and P2P application features. Of course, when applied to a particular domain, these relationships may need to be redefined.

Discussion

In the above section, we proposed four different application features for the P2P network and these features, when implemented, are believed to have the function of motivating individuals to share knowledge with each others. However, such mechanism cannot work well without a suitable organizational environment that may contain participants of knowledge sharing and their working relationships. The P2P network and its application features are physical components that facilitate individuals to behave knowledge sharing in organizations while the individuals are real main force of sharing activities. If the individuals could not behave in an appropriate way with respect of knowledge sharing, or their working relationships could not support such sharing behavior, the whole P2P knowledge sharing system may fail to bring about advantages to organizations. Specifically, individuals should be open to some extent during knowledge sharing process. Such openness may include opening their resources for access from outside, being open for receiving various kinds of knowledge, or being open for different comments and feedback from others. This intention of opening is helpful to build a friendly atmosphere for sharing knowledge. Additionally, individuals should hold earnest and honest attitude toward evaluating the value of knowledge piece. While it has been a serious concern to objectively evaluate the value of knowledge, it is inevitable that the judgement of individuals with a piece of knowledge could be flexible and somewhat subjective. However, such subjectiveness can be attributed to some irrational factors such as people's reputation or personal relationships, instead of the perceived usefulness of knowledge. Therefore, the true value of knowledge could be over-, or under-estimated irrationally, depreciating the value of whole knowledge sharing system.

The trustful relationship is extremely important to the success of knowledge sharing. Since in the P2P network, every individual in a terminal is relatively independent with each other, the behavior of knowledge sharing is one target to another. While sharing knowledge, creators may have the concerns with their copyright or recipients' imitation, and recipients may have the concerns with the accuracy of knowledge contributed. With such concerns in mind, the individuals can hardly conduct knowledge sharing effectively. In order to relieve the concerns and build trustful relationships between individuals, one approach worthy of consideration is to improve the understanding with each other among individuals of sharing. The understanding is mainly working relationship related, such as working experience, knowledge background or position in organization. Specifically, such information could be contained in individual profile that is public and accessible by others through the systems. By checking these profiles, individuals can have some ideas about what source the knowledge comes from and where my knowledge goes. Such understanding may relieve their concerns with trust to some extent. Based on this understanding, individuals can gradually build and improve trustful working relationships. The trustful relationships can make them regard each other as partners rather than competitors during the process of working and then foster their willingness to contribute and receive knowledge from others.

Moreover, organization also plays an important role in facilitating knowledge sharing while implementing P2P network with the motivation features. From the angle of organizational culture, the atmosphere that needs to be fostered to share knowledge with others is the right thing to do and is beneficial to organizational growth as a whole. The leadership support from organizational senior management is very crucial at this stage. The spirit of encouraging knowledge sharing or their actual behavior of sharing can be regarded as a strong message and behavioral pattern to their employees. Besides, the P2P network should not be served as a surveillance system or not be regarded as such a system by individuals in organizations. In knowledge sharing community, each individual possesses the rights to keep his/her privacy or publicize related personal information. The opened actions of individuals in the community

should mainly focus on their knowledge sharing performance. The purpose of P2P network should be claimed clearly to individuals before its implementation so as to extract trust from them. Otherwise, individuals would hold suspicious and hostile attitude toward knowledge sharing through P2P network, and some legal issues may even be raised.

Conclusion

In this study, we first proposed a decentralized P2P network structure for knowledge sharing community as an idea contrary to the traditional central knowledge repository as the sharing media. In this P2P knowledge sharing community, every member is relatively independent and has an individual knowledge repository. Information and knowledge can be communicated and shared through electronic channels, e.g. Internet, within the community. It is believed that this structure is able to keep knowledge of community update and dynamic as well as improve the efficiency of sharing process. Additionally, we organize a framework that contains multiple facets of human motivational issue. By referring to this framework, we then proposed four application features for the P2P knowledge sharing community. These features are technically feasible and believed to be able to motivate community members to participate and involve knowledge sharing activities in terms of knowledge retrieval and contribution. On the basis of present study, future research is promising on (1) explicitly examining the potential of P2P network to improving the effectiveness of knowledge sharing and (2) comparing the effect of four features proposed on motivating members to share knowledge.

Acknowledgment

This research is supported in part by the Hong Kong Research Grants Council through a Teaching Development Grant (HKUST-1-F).

References

- Adar, E. and Huberman, B. A. (2002), "Free Riding on Gnutella," *First Monday*, vol. 10 (2).
- Alavi, M. and Leidner, D. E. (2001), "Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues," *MIS Quarterly*, vol. 25 (1), pp. 107-136.
- Anonymous (2003a), The Freenet Project, <http://freenetproject.org>, accessed on 2 June 2003.
- Anonymous (2003b), Reviewer FAQ, <http://www.amazon.com/exec/obidos/subst/sommunity/reviewer-say.html/107-0207598-3267744#features>, accessed on 15 August 2002.
- Brown, J. S. and Duguid, P. (1991), "Organizational Learning and Communities of Practice: Toward a Unified View of Working, Learning, and Innovation," *Organization Science*, vol. 2 (1), pp. 40-57.
- Constant, D., Kiesler, S., and Sproull, L. (1994), "What's mine is ours, or is it? A study of Attitude about information sharing," *Information Systems Research*, vol. 5 (4), pp. 400-422.
- Davenport, T. H. and Prusak, L. (1998), *Working Knowledge: How Organizations Manage What they Know*. Harvard Business Press, Boston.
- Deci, E. (1975), *Intrinsic motivation*. Plenum Press, New York.
- Fahey, L. and Prusak, L. (1998), "The Eleven Deadliest Sins of Knowledge Management," *California Management Review*, vol. 40 (3), pp. 265-276.

- Grover, V. and Davenport, T. H. (2001), "General Perspectives on Knowledge Management: Fostering a Research Agenda," *Journal of Management Information Systems*, vol. 18 (1), pp. 5-21.
- Heumer, L., Krogh, G., and Roos, J. (1998), "Knowledge and the concept of trust," in *Knowing in Firms: Understanding, Managing and Measuring Knowledge*, G. Krogh, J. Roos, and D. Kleine, Eds. London: SAGE Publication Ltd.
- Hoffman, M. L. (1981), "Is altruism part of human nature," *Journal of Personality and Social Psychology*, vol. 40 (1), pp. 121-137.
- Hummel, J. and Lechner, U. (2001), "The community model of content management: A case study of the music industry," *Journal of Media Management*, vol. 3 (1), pp. 4-14.
- Ichijo, K., Krogh, G., and Nonaka, I. (1998), "Knowledge Enablers," in *Knowing in Firms: Understanding, Managing and Measuring Knowledge*, D. Kleine, Ed. London: SAGE Publications Ltd.
- Janis, M. (2001), "Spedia Unveils Surt+tech," *Adweek*, vol. 42 (9), pp. 55.
- Kanter, R. M. (1995), "Managing the human side of change," in *The Organizational Behavior Reader*, D. A. Kold, J. S. Osland, and I. M. Rubin, Eds. New Jersey: Prentice Hall.
- Kollock, P. (1999a), "The economics of online cooperation: Gifts and public goods in cyberspace," in *Communities in Cyberspace*, A. Smith and P. Kollock, Eds. London: Routledge.
- Kollock, P. (1999b), "The Economics of Online Cooperation: Gifts and Publics Goods in Cyberspace," in *Communities in Cyberspace*, P. Kollock, Ed. London: Routledge.
- Krackhardt, D. and Hanson, J. R. (1996), "Informal networks: the company," in *Knowledge in Organizations*, L. Prusak, Ed. Butterworth-Heinemann, MA: Newton.
- Krogh, G. v. (1998), "Care in knowledge creation," *California Management Review*, vol. 40 (3), pp. 133-153.
- Lant, T. K. and Montgomery, D. B. (1987), "Learning from Strategic Success and Failure," *Journal Of Business Research*, vol. 15 (6), pp. 503-518.
- Laurie, D. L. (2002), "Productivity challenge: Gaining through innovation," *Financial Executive*, vol. 18 (7), pp. 30-35.
- Malhotra, L. (1999), "Beyond Hi-tech Hidebound Knowledge Management: Strategic Information Systems for the New World of Business," BRINT Research Institute.
- Markus, M. L. (2001), "Toward a theory of knowledge reuse: Types of knowledge reuse situations and factors in reuse success," *Journal of Management Information Systems*, vol. 18 (1), pp. 57-93.
- Parameswaran, M., Susarla, A., and Whinston, A. B. (2001), "P2P networking: An information sharing alternative," *Computer*, vol. 34 (7), pp. 31-8.
- Pohs, W., Pinder, G., Dougherty, C., and White, M. (2001), The Lotus Knowledge Discovery System: Tools and experiences, <http://www.research.ibm.com/journal/sj/404/pohs.html>, accessed on 2 June 2003.
- Rheingold, H. (1993), *The Virtual Community: Homesteading on the Electronic Frontier*. Addison-Wesley, New York.
- Ruppel, C. P. and Harrington, S. J. (2001), "Sharing Knowledge through Intranets: a Study of Organizational Culture and Intranet Implementation," *IEEE Transactions on Professional Communication*, vol. 44 (1), pp. 37-52.
- Schubert, P. and Ginsburg, M. (1999), "Virtual Communities of Transaction: the Role of Personalization in Electronic Commerce," *Electronic Markets*, vol. 10 (1), pp. 45-55.