

Knowledge Trading Environment using Virtual Money for Lively e-Community

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Abstract: - This paper describes the knowledge trading environment where e-community members can receive recognition and reward by producing their knowledge. This environment, which we call "KNOWTE", aims at motivating the members to share (produce) their knowledge for lively e-community. In KNOWTE, the members can sell (produce) their knowledge to and buy (consume) knowledge from other members by using virtual money. In other words, the produced knowledge is regarded as commodities and is traded in the e-community. Recognition is shown as the financial status (i.e., the amount of virtual money). Reward is given as virtual money that can be exchanged for real commodities.

Key-Words: - Knowledge sharing, knowledge trading, motivation, recognition, reward, virtual money, e-community

1 Introduction

The wide spread of the Internet dramatically changed human intellectual activities. Nowadays people are making maximum use of the web to collect information and collaborating with other people all over the world to solve complicated problems. These situations indicate that world wide knowledge sharing and e-community have become indispensable in the modern society.

There have been many researches on knowledge sharing and e-community (e.g., [1] and [2]). One of the recent hot topics of knowledge sharing and e-community is social networking site/service (SNS for short). SNS is said to be knowledge sharing environment based on explicit social relations. In other words, SNS is the knowledge sharing environment where knowledge is shared by acquaintances having common characteristics (e.g., interest, expertise, skill, goal, and task). It would be understandable that knowledge shared by such acquaintances is more reliable than that by the general public. However, SNS-like knowledge sharing often fails. For example, there are few members who share knowledge actively and the members are divided into knowledge producers and knowledge consumers. In an e-community, knowledge sharing failure may be

largely a result of members who are not motivated to share knowledge. If composed of many non-motivated members, the e-community is getting not lively. In particular, companies having e-communities must prevent the knowledge sharing failure, which may lead to unproductive situations.

How to motivate e-community members to share knowledge has been actively discussed. The reason why they are not motivated would be found in explicit social relations inside the e-community. In knowledge sharing by the general public, the members would not be nervous about social relations (e.g., occupations and personalities of knowledge producers and knowledge consumers). While, SNS-like knowledge sharing is based on explicit social relations and the members know each other. Therefore, some of the members may hesitate to share (produce) knowledge, being too nervous about other members.

From this background, we think that e-community should work on the knowledge sharing environment where the members are motivated to share knowledge beyond being nervous about other members. In this study, we focus on recognition and reward for knowledge production and propose knowledge trading environment. In this environment, knowledge is regarded as commodities and the members can sell

their knowledge to and buy knowledge from other members by using virtual money. This can be expected as a new approach to motivating e-community members to share knowledge.

The remainder of this paper is organized as follows. Section 2 discusses how to motivate knowledge sharing, focusing on human relations inside an e-community. Section 3 outlines the design of the knowledge trading environment and shows considerations about the knowledge trading environment. Section 4 introduces the related works. The final section summarizes this study and shows our future works.

2 Knowledge Sharing Failure

Knowledge sharing is a fundamental activity in the cyclic process of knowledge management (KM for short), which deals with transformation of tacit knowledge into explicit knowledge in highly organized community (e.g., company). How to realize successful knowledge sharing has been an important issue in KM [3]. One of approaches to successful knowledge sharing is to facilitate the positive factors for knowledge sharing. Another is to eliminate the negative factors [4][5]. According to experiential reports of KM (e.g., [6]), knowledge sharing failure is largely a result of members who are not motivated to share knowledge. In many cases, there are few knowledge producers and then the shared knowledge becomes insufficient and partial. Therefore, it is important to motivate all the members to be active knowledge producers.

The reason why they are not motivated would be found in explicit social relations (human relations) inside the community. One of the relations is between members. Another is between a member and a community.

2.1 Failure Caused by Member-Member Relation

In a community, a member knows other members' positions and roles inside the community and their personalities. To preserve the good human relations and protect his/her identity, therefore, he/she may often be too nervous about other members and hesitate to produce his/her knowledge. For example, there may be members who do not produce their knowledge from the following reasons.

- I have no confidence in my knowledge (its value in the community). If incorrect or redundant, my knowledge might cause other members troubles.
- I do not have a method for seeing whom my knowledge is used by. My knowledge might be abused for other members' personal gain.
- I do not know the need to share my knowledge. My knowledge is my intellectual property.

The most essential approach to motivating such members to produce their knowledge is to change culture in the community. For example, there have been the following efforts to change it.

- Explain the need, value, and benefit of knowledge sharing to the members at a seminar.
- Develop trust (friendship) between the members by preparing opportunities and spaces where they can talk frankly.
- Accustom the members to knowledge sharing by getting them in on a team where knowledge sharing is done on a daily basis.

2.2 Failure Caused by Member-Community Relation

Knowledge production involves transformation of tacit knowledge into explicit knowledge, which is a highly intellectual activity and requires much time. Therefore, knowledge producers should receive recognition and reward from the community.

If members who have produced a large amount of their knowledge cannot receive recognition and reward, they may raise distrust of the community. This would decrease their motivation for knowledge sharing. Therefore, it is also important to establish a program of recognition and/or reward in the community. For example, there have been the following programs [7].

- Show recognitions publicly to all the members. For example, at the company of Harris Government Communications Systems, plaques with the names and pictures of active knowledge producers (and knowledge consumers who have contributed to the company by using the produced knowledge) are displayed on the wall near the building entrance. Furthermore, the active knowledge producers receive the certificates of recognition and are listed on the company newsletter.
- Give rewards to active knowledge producers. Typical rewards are bonus payment, position advancement, and extra vacation. For example, at the company of Cap Gemini Ernst & Young,

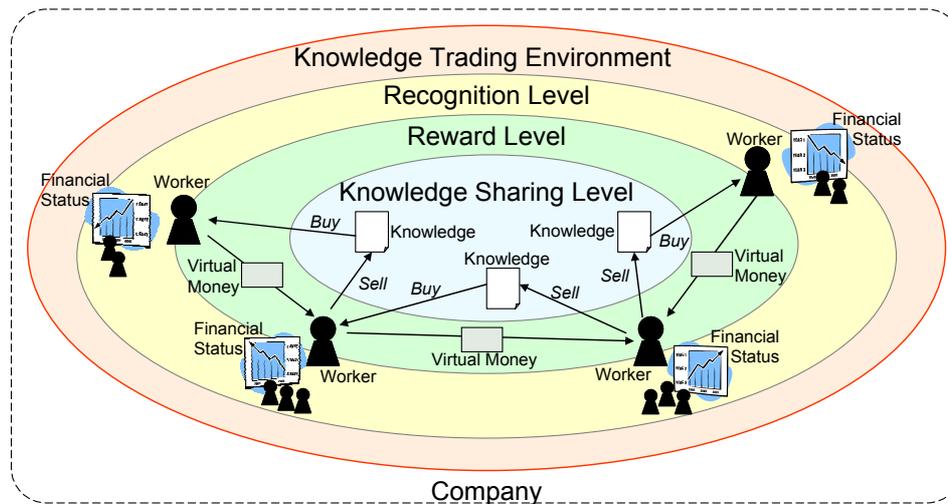


Fig. 1 Overview of knowledge trading environment, KNOWTE

active knowledge producers receive royalty points according to a number of times that their produced knowledge is used. They can exchange the points for extra vacation.

If a program of recognition and/or reward can be introduced into knowledge sharing in an e-community, the members may be motivated to produce their knowledge and the e-community may be getting lively.

3 Knowledge Trading Environment

In this study, we propose the knowledge trading environment where e-community members can receive recognition and reward by producing their knowledge. This environment, which we call "KNOWTE", aims at motivating the members to produce their knowledge for lively e-community.

KNOWTE is developed based on the conventional knowledge sharing environment where the members can upload knowledge to and download/see knowledge from the shared space on a web server. Therefore, the members can access to KNOWTE using a standard web browser.

3.1 Overview

In KNOWTE, the members can sell (produce) their knowledge to and buy (consume) knowledge from other members by using virtual money called "Yan". In other words, the produced knowledge is regarded as commodities and is traded in the e-community. Our fundamental idea is that the members can receive

recognition and reward as a result of their effort in knowledge production.

- Recognition is shown as the financial status (i.e., the amount of virtual money) publicly to other members. The members can always see active knowledge producers from the statistical data about all members' financial statuses.
- Reward is given as virtual money that can be exchanged for real commodities.

When knowledge is bought by a knowledge consumer (a member), the knowledge producer gets virtual money from the knowledge consumer. At this time, the knowledge producer can know who bought his/her produced knowledge. KNOWTE differs from the conventional knowledge sharing environment in that the members are restricted to share (consume) knowledge according to their financial statuses. Figure 1 shows the overview of KNOWTE.

3.2 Community Members

In KNOWTE, the members are both knowledge producers (sellers) and knowledge consumers (buyers). At the first login, they are given the predefined amount of virtual money.

One of the members is assigned to a knowledge organizer who has to normalize and promote knowledge sharing in the e-community. In other words, the knowledge organizer is a supervisor of the e-community.

3.2.1 Knowledge Producers

A knowledge producer behaves through the following process.

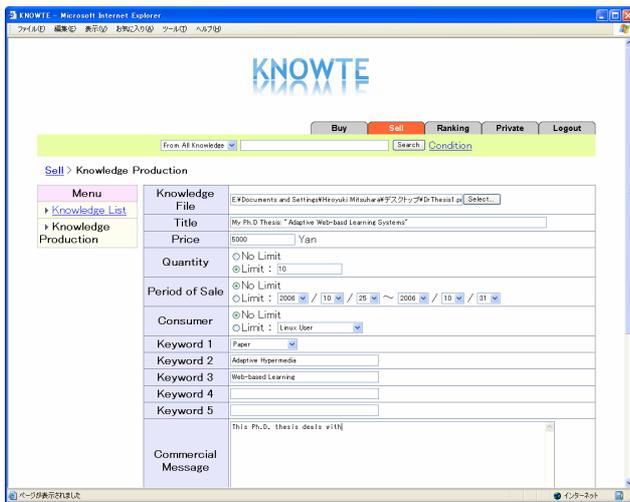


Fig. 2 User interface for selling knowledge

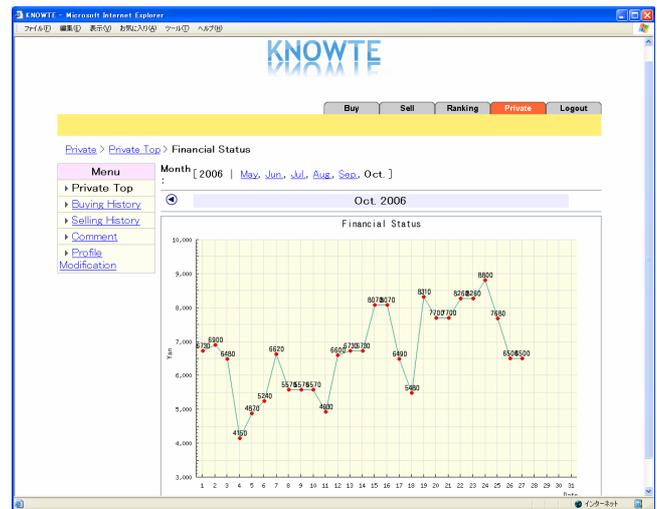


Fig. 3 User interface for seeing financial status

- (1) Produces knowledge— creates knowledge by transforming tacit knowledge into explicit knowledge. The produced knowledge is represented (visualized) as multimedia data file such as text, image, audio, and/or video.
- (2) Prices the knowledge and defines a selling strategy for it. The items of the strategy are shown in Table 1. Figure 2 shows the user interface for selling knowledge (defining the strategy).
- (3) Uploads the knowledge (file) and the selling strategy to the shared space. When the knowledge is uploaded, its metadata (e.g., knowledge producer name) is automatically uploaded.
- (4) Receives virtual money (same amount as the defined price) from the knowledge consumers who bought the knowledge.
- (5) Modifies the selling strategy, watching the sale situation and his/her financial status. Figure 3 shows the user interface for seeing the financial status. For example, a knowledge producer may drop the price when the knowledge does not sell at all.
- (6) Creates an extensive advertisement to promote his/her knowledge and upload it to the shared

space. This is not an obligatory activity. To upload it, therefore, the knowledge producer has to pay his/her virtual money to the knowledge organizer. For example, a knowledge producer may create a commercial film (streaming video in several tens of seconds) to make himself/herself better known in the e-community.

3.2.2 Knowledge Consumers

A knowledge consumer behaves through the following process.

- (1) Selects knowledge he/she wants to buy from the list of knowledge uploaded to the shared space. Also, he/she can search for knowledge by formulating a search query (e.g., knowledge title, keyword, and knowledge producer name). Figure 4 shows the user interface for buying knowledge.
- (2) Buys knowledge (multimedia data file). The price of the knowledge is deducted from the amount of his/her virtual money.
- (3) Downloads (sees) the knowledge. He/she can always download the knowledge from his/her private space in KNOWTE.

Table 1 Strategy items for selling knowledge

Item	Brief Explanation	Example
Title	Define the title of knowledge	You're Professor!
Price	Define the price of knowledge in the virtual money.	100 Yan
Keyword	Define keywords of knowledge.	Art of living well
Period of Sale	Restrict the period of sale of knowledge	2006/10/18-2007/05/12
Quantity	Restrict the quantity of knowledge for sale.	20
Consumer	Restrict knowledge consumers who buy knowledge.	Only for women
Commercial Message	Make a commercial message to promote knowledge.	Valuable for students!

3.2.3 Knowledge Organizer

The important work of the knowledge organizer, who can always see all members' financial statuses in detail, is to watch knowledge sharing in the e-community and cope with disparity in their financial statuses. This disparity indicates that the knowledge sharing is not lively. In order to motivate all the members to be active knowledge producers, the knowledge organizer has to solve this disparity in natural ways. For example, there are the following financial solutions (supports) for the members who have eaten up their virtual money.

- Lends virtual money to such members. This is the knowledge organizer's privilege.
- Buys knowledge produced by such members. The knowledge organizer can buy and sell knowledge like other members.

The knowledge organizer is not given the right to delete and modify the produced knowledge, because inappropriate knowledge would not sell at all and then would be deleted or modified by the knowledge producers themselves.

3.3 Advantages

From the viewpoint of knowledge sharing failure caused by member-community relation, the following advantages would motivate the members to produce their knowledge.

- Recognition for knowledge production is always shown to the e-community (i.e., other members). This provides mental satisfaction.
- Reward for knowledge production is given as virtual money that can be exchanged for real commodities. This provides material satisfaction.

From the viewpoint of knowledge sharing failure caused by member-member relation, the following advantages would motivate the members to produce their knowledge.

- If knowledge is bought by many knowledge consumers, the knowledge producer may have confidence.
- It is difficult for the members to abuse knowledge, because knowledge producers can know who bought their knowledge.
- They may not assert their intellectual property, because they can receive reward for their knowledge production.

If the members are motivated like this, they would not only produce (sell) their knowledge but also consume (buy) other members' knowledge in order to produce new knowledge from various kinds of knowledge.

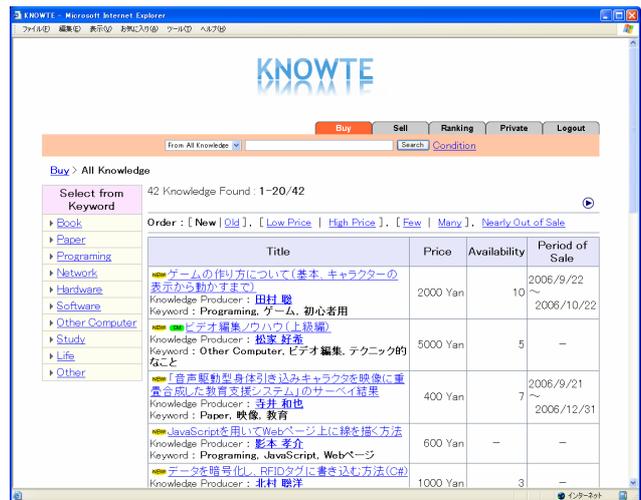


Fig. 4 User interface for buying knowledge

This is the ideal circulation of knowledge production and knowledge consumption. And then disparity of their financial statuses would be getting solved by the ideal circulation (i.e., continuous knowledge trading). As a result, a large amount of high-quality knowledge would become sharable in the e-community. Such e-community can be said to be lively.

3.4 Consideration

If having a large amount of virtual money, the members can be regarded as those who have sold a large amount of their knowledge and have contributed to the e-community. While, if having a small amount of virtual money, the members can be regarded as those who did more knowledge consumption than knowledge production and have been ready for producing their knowledge. Therefore, they are expected to contribute to the e-community afterward.

In conventional knowledge sharing, recognition for knowledge production would depend on the practical value of the produced knowledge and be often derived from the rating scores by knowledge consumers. This is reasonable recognition that focuses on the produced knowledge itself. In KNOWTE, the recognition depends on the financial status. This might be unreasonable recognition. When buying knowledge, knowledge consumers cannot see the main body of the knowledge. Therefore, the knowledge consumers must select knowledge, seeing its superficial data (e.g., title, price, keywords, and commercial message). The knowledge producers who are good at defining the selling strategy may have a large amount of their virtual money, even if they have not produced high-quality knowledge. Here the following question

emerges: "Can the financial status be the appropriate measure of the recognition?"

We define the high quality knowledge as follows: *"The high-quality knowledge is used by many e-community members and becomes the origin of new knowledge."* In KNOWTE, this definition can be rephrased as follows: *"The high quality knowledge is bought by many knowledge consumers and becomes the origin of new knowledge produced by the knowledge consumers."*

At the initial stage in KNOWTE, recognition for knowledge production is not directed to the produced knowledge. Therefore, the financial status may not be the appropriate measure of the recognition at the initial stage. However, we think that the recognition is gradually directed to the produced knowledge. The knowledge producers who sell high quality knowledge can increase their virtual money from the high quality knowledge. On the contrary, the knowledge producers who sell low quality knowledge cannot increase their virtual money from the low quality knowledge. We expect that the following process will appear.

- (1) Knowledge consumers will eventually refrain from buying knowledge produced by a knowledge producer who sells low quality knowledge.
- (2) Then, the financial status of the knowledge producer is getting worse. This indicates that the knowledge producer cannot receive recognition and reward.
- (3) The knowledge producer reflects on his/her own knowledge production and reforms himself/herself.
- (4) The knowledge producer makes effort to produce high quality knowledge in order to improve his/her financial status.

Given this situation, we think that the financial status can be the appropriate measure of recognition for knowledge production from medium- and long-term standpoint.

There are many experiences and arguments that the use of reward in creative work has a detrimental effect on performance [8][9]. Amabile et al. argued that for high creativity, intrinsic motivation should arise from the individual's positive reaction (interest, involvement, curiosity, satisfaction, or positive challenge) to qualities of the task itself [10]. Robinson and Stern found out that reliance on extrinsic motivation (reward) inactivates employees' participation in a task [11]. Like these, reward is generally regarded as a negative factor for creativity. On the other hand, it is said that that reward is necessary for sustained collaborative work practice

[12]. We think that reward can be used to motivate e-community members to share knowledge. The important point is how to realize the knowledge sharing environment where reward is cyclically used for knowledge production. We think that the knowledge trading environment is just such an environment.

4 Related Works

There have been some kinds of knowledge sharing environment similar to KNOWTE. One of them is collaborative Q&A environment where members upload their questions to the shared space on a web server and other members answer the questions. The Expert Exchange is a collaborative Q&A environment that has introduced local points available only in the e-community (the environment). In the Expert Exchange, a member has to pay his/her local points when uploading his/her questions and downloading the answers. If having many questions, the member has to get the local points by answering other members' questions in advance. This environment would prevent the members from being divided into knowledge producers and knowledge consumers and would motivate them to produce their knowledge. The concept of local points can be identified with virtual money in KNOWTE. However, KNOWTE is not a collaborative Q&A environment. In KNOWTE, the members can produce their knowledge unilaterally. Therefore, various kinds of knowledge that are not limited to answers to questions can be shared—knowledge that is seemingly trivial might generate novel ideas in the future.

Focusing on virtual money in an e-community, we found some e-community systems similar to KNOWTE. Mojo Nation is one of the P2P systems for file exchange and introduces virtual money in order to solve the problem of free ride in file exchange*. In this system, the members can get the virtual money by offering their computer resources (e.g., files, disk space, and processor power) to other members. The members can use the computer resources after paying their virtual money. This system is used for file exchange rather than knowledge sharing and does not aim at the ideal circulation of knowledge production and knowledge consumption. Hayashi et al. developed a web-based e-community system that introduces virtual money into human everyday file in the real world [13]. In this system, the members can receive

*Mojo Nation has been closed.

the virtual money as reward for volunteer activities (e.g., activity as peer learners in e-learning) from those who asked for help (the volunteer activities). The members can exchange their virtual money for coupons available at a shopping center in the real world. This system is based on a typical give-and-take approach. In this approach, the consensus building between a giver and a taker is explicitly done. While, KNOWTE is based on an unconscious give-and-take approach and does not need the explicit consensus building.

I-HELP system is a virtual learning environment for university classes and introduces virtual money to learning material trade [14]. This system has recognition and reward programs that are very similar to KNOWTE. In this system, recognition for knowledge (learning material) production is shown as the contribution ranking of the produced knowledge and reward for knowledge production can be exchanged for reward in the real world. This system is different from KNOWTE in that the reward (the price of knowledge) depends on rating scores from knowledge consumers. In other words, I-HELP system does not have the framework where the members can define the value of their produced knowledge by themselves.

5 Conclusion

This paper described the knowledge trading environment where e-community members can receive recognition and reward by producing their knowledge. This environment, which we call "KNOWTE", aims at motivating the members to produce their knowledge for lively e-community. In KNOWTE, the members can sell (produce) their knowledge to and buy (consume) knowledge from other members by using virtual money. In other words, the produced knowledge is regarded as commodities and is traded in the e-community. Recognition is shown as the financial status publicly to other members. Reward is given as virtual money that can be exchanged for real commodities.

We are developing a prototype system of KNOWTE. This prototype system works in conjunction with the pervasive information system we developed. In general, pervasive information systems (e.g., [15] and [16]) display information on the pervasive displays that are attached to public spaces. Therefore, KNOWTE is compatible with pervasive

information systems in that many people can see information.

The first priority in our future works is to complete the development of KNOWTE. And then we have to consider the proper settings of KNOWTE for making knowledge sharing work well (e.g., how much the predefined amount of virtual money is.) Also, it is very important to analyze the process of knowledge sharing in practical use of KNOWTE and clarify the effectiveness. Regarding the practical use, we are interested in whether trading behaviors in the real world emerge in KNOWTE (e.g., how obligors try to repay the virtual money borrowed from the knowledge organizer).

In addition, we regard learning material as knowledge produced by teachers and are planning to use KNOWTE to motivate teachers to create learning material for e-Learning.

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