Development of a knowledge market based on reputation, and absorption of uncertainty in electronic commerce

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Abstract

We explore the basic model of a virtual marketplace for information goods and knowledge. We propose the 3-R model—reputations, relationships, and recommendations—as a framework for understanding the future network society. We assert that the mechanism that governs a knowledge market is the explicit circulation of reputation. Next, we analyze the differences between a knowledge market and other knowledge acquisition processes, and examine the range over which a knowledge market forms. We find that, in a knowledge market, the "know who" and "know where" information circulates.

With the development of the network society, we can now obtain a lot of information. However, it is difficult to evaluate and judge what is important among this mass of information and where the relevant information is. Moreover, information sharing systems in many enterprises have failed. We searched for a structure that could overcome this limit and found that the knowledge market has this potential. This paper discusses the feasibility of a knowledge market and its mechanism. We analyze the requirements for a knowledge market to develop and the domain of objects that it can treat.

1. Introduction

The impact of the Internet and information technology (IT) on management and the economic system is still unknown. The development of a network society is fundamentally changing the way information circulates in society. A new information sharing space is emerging on computer networks as a result of the exchange of information and knowledge, namely a cyber commons. This phenomenon is being studied in various interdisciplinary domains. In sociology, Kaneko (1999) has discussed the problem-solving model of an online. In management science, Kokuryo (1999) developed a management strategy by using an open architecture strategy. In social informatics, Yamamoto (1999) developed a model of a cyber commons and simulated its behavior. We need to understand the mechanism of a cyber commons in order to achieve effective circulation of knowledge and information in society.

It is said that knowledge in becoming the center of an economic system [3]. Some scholars insist that the most important property of an organization is knowledge [1] [10]. Davenport (1998) insisted that the driving force of knowledge circulation in an organization is the same as in an ordinary market. And he concluded that three factors are needed in a knowledge market: reciprocity, repute, and altruism. What is the role of "reputation" in a knowledge market? No one has yet studied the mechanism and no rules that work in a knowledge market have been made yet. In order to clarify these subjects, we consider cases and develop a framework for analyzing a knowledge market. We provide an indicator of

knowledge market management.

We argue that a future network society will develop based on the network, not as a technology-driven network system but as a social system embedded in human relationships. This is one goal of the framework of a cyber commons. It is realized by development of knowledge market and is the possibility of cyber commons. We express this concept in table 1.

Table 1: Key words of net society

Net-society in 20 century	Net-society in 21 century
Automatization	Reputation
Contents	Relation
Search Engine	Recommendation

2. 3-R: Reputation, Relation, and Recommendation

We propose the 3-R model (reputations, relationships, and recommendations) as a framework for understanding the future network society.

2.1. Reputations

It is difficult to form trust on network society. It is existence of the problem of the free rider in a community and the non-cooperating action in transactions etc. The method of conquering these problems is that explicitly reputation circulation which we argue in this paper.

The e-bay [17] is the enterprise that provides the place of the auction among consumers. In this site, the transactions history of a seller and a buyer and the degree of satisfaction are exhibited for every transaction. A reputation of participant is clearly shown by this mechanism. This system has given the incentive which provides a participant with the inducement to cooperation, and contribution to quality of goods. The k-square is the exchange market of knowledge. The transactions history of a seller and a buyer and the degree of satisfaction are exhibited, and it has secured informational reliability by the reputation. In section 7, we describe this mechanism in detail. The PTP [18] is a community between which consumers exhibit and share evaluation of goods. A participant not only exhibits evaluation, but also can do mutual evaluation to evaluation by other participants. This structure has realized the reliability and the fairness of evaluation.

2.2. Relationships

In recent years, the creation of value by a community has attracted attention. A typical example is the success of the Linux community [13]. In Japan, one example is the note PC (a notebook-sized laptop), which was developed in response to demands from the user community. The importance of a community is increased by the success of such a community. In management science, efforts have been made to analyze relationships among members in a community for utilizing a network community [6]. In studying a community, it is important to understand the relationships among members.

2.3. Recommendations

A portal site that offers recommendations from experts (e.g., The About.com [21]) has been developed as a competitor to conventional portal sites. In each field, an expert introduces sites that he/she recommends to users, and the site functions like a portal site.

3. The limit of information sharing

The amount of information that an individual can receive has increased with the evolution of information technology and changes that have occurred in the communication structure of society. An individual now needs to process much more information than before. However, the extra quantity does not necessarily raise the quality of the information being available, according to Simon's hypothesis of bounded rationality. Even when information technology evolves, one's attention does not. Moreover, the distribution of attention is a zero sum game [2]. Thus the domains that one is interested in and the domains that one can pay attention to continuously are restricted. Technology can provide the means to access a lot of information, but it cannot help process and evaluate it.

In various knowledge management projects, enterprises have tried to share and utilize the human capability of filtering information. However, such

trials were not successful. Many bulletin board services (BBSs) for sharing information, Know Who Database, and individual home pages on the Web in an enterprise fail since information is not supplied even when it is built. There are two causes of this: 1) it is difficult to give participants an incentive and 2) it is difficult to maintain the quality of the supplied information. We need to develop and understand a new knowledge circulation system.

A knowledge market may overcome these problems. In a knowledge market, an individual supplies "replies" and "questions". The problem of incentive is solved by reputation, which circulates clearly in a market. Moreover, reputation also may solve the problem of the uncertainty of information. There is no need to clarify reputation in an enterprise so it can be measured quantitatively. In a larger community, reputation needs to be evaluated more clearly.

We need to understand the different mechanisms operating in markets of knowledge and tangible goods. Therefore, in the next section we discuss the characteristics of information and knowledge goods in comparison with those of tangible goods.

4. Cyber commons for knowledge creation

Although there is a limit of information sharing, network society also enabled creation of new information values. We call it a cyber commons [11]. It is new information creation and circulation space in a computer network. This subject is interdisciplinary. In management science, Kokuryo (1998) studied customer-to-customer community are prosperous. In sociological stage, Kaneko (1999) studied a case of voluntary community for social problem. Recently, the case of Linux community has attracted attention internationally.

The changes in social systems that made these phenomena possible can be summarized as follows.

1. Development of interactive information chain
   This has expanded the range of people who have access to the means of sending and displaying information from broadcasters to ordinary people.

2. Overcoming of the asymmetry of information
   The business model in which a manufacturer and seller have much more information than consumers has disappeared because consumers can now access such information via the Internet.

3. Development of community business
   A spontaneous community emerges and carries out the management value

4. Overcoming of geographical and time restrictions
   The network overcomes restrictions on communication based on geography, time, and opportunity.

We need to understand the mechanism of a cyber commons in order to harness the potential of these network society conflicts and to achieve effective knowledge creation and circulation. There is prior research about the mechanism of the commons from various angles. Ostrom (1990) defined requirements for the commons. Kollock (1996) pointed out social dilemmas that might arise in the commons. Yamamoto (1999) examined the information space in which information circulation is produced by participants gathering "questions" and "replies".

5. Rules of knowledge market

In this section, we analyze the characteristics of knowledge goods in comparison with those of tangible and information goods.

5.1. Tangible goods and information goods

We define tangible, information, and knowledge goods by extending the definitions of Whinston (1997).

Tangible goods:

Tangible goods are goods whose quality can be judged before purchase and compared against advertisements, product specifications, and uncertain nature with a common judgment standard. Transactions in the market are completed by the change of ownership and payment of consideration is by the exchange principle.

Information goods:

> Information goods are goods whose quality cannot be judged before purchase. Neither advertisements nor product specifications provide sufficient judgment standards. Experience in using such goods is necessary to assess their quality. However, since consumption of goods is completed after the consumer sees the goods and understands them, transactions do not function effectively. We characterize these information goods by the impossibility of prior evaluation.

Knowledge goods:

> Knowledge goods are kinds of information goods. We define, for example, the method of solving a problem and specific know-how as being knowledge goods. In addition to the characteristics of information goods, knowledge goods have the following features.

They have time dependency. The value of knowledge depends on the delay between when it is needed and when it is provided. And the value of knowledge depends on how much it shortens the time taken to solve a problem. They also have consumer dependency. Consumers differ greatly in how much they value particular information goods [14]. We characterize these knowledge goods by context dependency.

The feature of information goods that we mentioned here affects the mechanism of their marketplace. There is a difference is in a participant's inducement and contribution between the marketplace of tangible goods where the goods circulate by the exchange principle and the marketplace of information goods where the goods circulate by the diffusion principle. For example, the existence of free riders is unavoidable in an information goods market. The transaction procedure for tangible goods is based on product injection from the supply side (seller), while that for information goods is based on demand injection from the demand side (buyer).

5.2. Absorption of uncertainty in information goods

From the characteristics of information goods, we can understand that uncertainty about quality is inherent in information goods. Whinston (1997) pointed out three possibilities for absorbing the uncertainty: a group of suppliers creates a standard, a middleman intervenes, and a supplier provides a consumer with information that he has.

Providing consumers with information is not a perfect solution because of the impossibility of prior evaluation. Although the existence of a standard set by the supplier is effective in the case of information goods, which can be dealt with as commodities, it is not appropriate for information goods customized for each consumer, i.e., knowledge goods. The existence of a middleman is effective in the information goods market. A business model has recently been developed that selects information to be sent to a customer and selects a suitable supplier and suitable service from among a large number of supplier groups. This is called an Infomediary [4]. This is a good example of a middleman playing an important role in the information goods market.

However, in the knowledge market, it is difficult for transactions to be efficiently conducted by an Infomediary because of the impossibility of prior evaluation and the context dependability of knowledge. Thus, the matching capability of a market and cooperation incentive between participants becomes an important solution. To reach this solution, in section 7, we argue in detail that explicit circulation of reputation is important.

6. Knowledge community and knowledge market

Even before the Internet was developed, there were systems for circulating knowledge and information, such as mailing lists and bulletin board services. However, the knowledge market that has developed in recent years has different characteristics from the conventional information sharing system. Here, we analyze the differences between the knowledge community and the knowledge market. We define the fundamental difference as “Whether there is a payment of explicit currency in exchange for knowledge”. In this section, we analyze the features of each mechanism in order to explore the requirements for developing a knowledge market.

6.1. Features of a communication process

In a knowledge community, communication takes the form of discussion, so it is developed as a comment tree. The topic in a community is continuous. Although a participant can argue about something from various angles, it is not necessarily a subject that is important to all participants. On the other hand, in a knowledge market, communication derives from the demand of a buyer and the response of a seller. Information in the market is ad hoc and there are various demands and replies. A participant can get a relevant reply on demand. Therefore, there is a trade-off in the diversity and specificity of information that a participant can get.

6.2. Difference of diversity of information

A participant does not need to use a market if his demand is in his domain of expertise, since he generally knows where to find it. He wants to go the market when he does not know such information. Thus, a knowledge market has a tendency to be injected with information from various fields as demand and reply. This increases the diversity of information and decreases its specificity. In a knowledge community, the boundary as a member is explicit and common rules exist. Information sharing is made by argument in the limited genre. Therefore, to obtain the information that he/she is seeking, a participant must participate continuously to some extent.

We can understand the feature of a community and a market with the axis of time to commit and diversity in market. Although a knowledge market can treat a broad genre, it seldom treats a specific argument. A knowledge market is suitable for the circulation of "know-who" and "know-where" information.

6.3. Difference of explicitness of reputation

In a knowledge community, it is rare that a reputation circulates explicitly in the market. In many cases, core members of a community are voluntary. The rewards that a participant can get for participation are respect from other members and better information by sending information in a community. These do not circulate explicitly within a community. In a knowledge market, we consider circulation of explicit reputation as an inducement for participants, and also as a price system.

7. Reputation in knowledge market

In the field of economics of information, economists have argued about the role of reputation. They have regarded a reputation as a quality guarantee function in the market where imperfect information exists. Reputation is not only a quality guarantee function but also a driving force for an efficient knowledge market and the currency in the pricing mechanism of the knowledge market. Davenport (1997) suggested that being a good knowledge seller makes one a more effective knowledge buyer. It is necessary to make a participant recognize that supplying questions and replies to a market is useful to oneself. Furthermore, Chienowa.com [20] and K-square [19] built the knowledge market which introduced an explicit market principle on the Internet. Although there is a difference in grade, one trades knowledge at actual currency value in these marketplaces. What function has reputation achieved in the knowledge market which takes such an explicit market mechanism? In order to understand the pricing mechanism of knowledge, we compare the knowledge market with the knowledge circulation community (mailing list, BBS) and market for tangible goods (Table 2).

Table 2: Price system by reputation in knowledge market

market of tangible goods	knowledge circulation community	knowledge marekt
$P = h(V)$	$R = i(V)$	$P = f(R)$ $R = g(V)$
Price is decided by Value of goods.	Reputation is decided by Value of goods.	Price is decided by the Reputation. Reputation is decided by Value of goods.

The transaction procedure in a knowledge market is as follows (Fig.1). Transactions are started

by a question or demand.

1: Post question or demand
2: Post offer to reply
3: Select company of transaction
4: Exchange knowledge and rewards
5: Update the replier's reputation

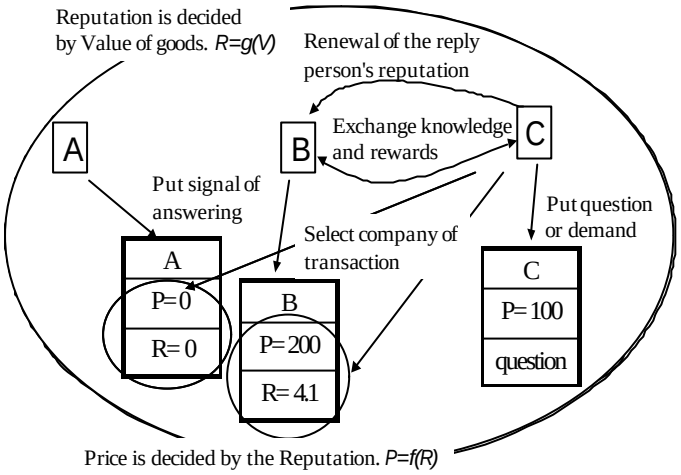

Figure 1: Transaction procedure in knowledge market

By this procedure, the actions in the market of sellers and buyers are open, and one's reputation in the market also circulates openly and explicitly.

8. Conclusion

We explored the possibility of a knowledge market as an efficient knowledge exchange system in an information society. According to our analysis, the important requirement for market conditions is explicit circulation of reputation. A knowledge market offers new possibilities for retrieving information in a network society, which is burdened with an excess of information. Comparing the features of a knowledge market with those of a knowledge community, we showed the domains in which a knowledge market can function effectively. A knowledge market is suitable for the circulation of Know-Who and Know-Where information.

References

[1] Davenport, T. and Prusak, L., "Working Knowledge", Harvard Business School Press, 1998.

[2] Davenport, T. and Beck, J., "Getting the Attention You Need", Harvard Business Review, September-October 2000,Harvard Business School Publishing, 2000.

[3] Drucker, P.,"Post-capitalist Society", Butterworth-Heinemann, 1992.

[4] Hagel III, J., "Net Worth", Harvard Business School Press, 1999.

[5] Kaneko, I., "Community Solution", Iwanami Shoten, 1999 (in Japanese).

[6] Kim, A., "Community Building on the Web", Peachpit Press,2000

[7] Kokuryo, J., The Role of 'Customer-to-Customer' Interaction on Computer Networks, Journal of the Japan Society for Management Information, Vol.7, No.3, pp19-34, 1998.

[8] Kokuryo, J., "Open Architecture Strategy", Diamond Corp., 1999.

[9] Kollock, P. and Smith, M.,"Managing the VirtualCommons: Cooperation and Conflict in ComputerCommunities", in Herring (ed.), Computer-Mediated Communication, John Benjamins Pub. Co., 1996, pp.109-128.

[10] Nonaka, I., "Knowledge Creating Company", Oxford Univ Press, 1995.

[11] Ohta, I. and Ishida, K., "A Cyber Commons in a Virtual Society", Proc. of the 42nd Annual Conference of the International Society for the Systems Sciences (CD-ROM), 1998.

[12] Ostrom, E., "Governing the Commons", Cambridge University Press., 1990.

[13] Raymond, E., "The Cathedral and the Bazaar : Musings on Linux and Open Source by an Accidental Revolutionary", O'Reilly & Associates, 1999.

[14] Shapiro, K. and Varian, H., "Information Rules", Harvard Business School Press, 1998.

[15] Whinston, A. et., "The Economics of Electronic Commerce", Macmillan Computer Pubishing, 1997.

[16] Yamamoto, H. and Ohta, T., "A Study of Social Dilemma in an Information Space and Emergence of Cyber Commons", Journal of the Japan Society for Management Information, Vol.8, No.1, pp67-87, 1999 (in Japanese).

[17] The eBay as http://www.ebay.com/

[18] PTP as http://www.ptp.co.jp/

[19] K-square as http://www.ksquare.co.jp/

[20] Chienowa.com as http://www.chienowa.com/

[21] About.com as http://www.about.com/