A Knowledge Management Support Environment based on Dual Loop Model

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ABSTRACT

It is necessary that the relations between individuals and organizations be properly understood and support learning for knowledge inheritance, and encourage the creation, the spreading and inheriting of new knowledge. This paper presents an framework of information systems for knowledge management focused on a learning system in organization. Major characteristics of this framework are derived from "Dual loop model" which represents the flow of knowledge in an organization. Since these two things enable the framework to grasp the meaning of knowledge and the progress of organizational learning, it can provides appropriate support for knowledge management Then we will introduce two systems as concrete examples, namely a knowledge management support environment: *Kfarm*.

1. INTRODUCTION

With the recent development of an information infrastructure such as the Internet, the quantity of knowledge that individuals and organizations come across daily is increasing markedly, and requires a major upgrading of knowledge management abilities. In such circumstances, the development of a basis of knowledge management that supports knowledge creation, operation, and inheritance under the slogan 'knowledge management' [1, 2] has drawn attention.

In this study, we aim to develop an information system for knowledge management that takes 'learning' as its principal axis. We call such a knowledge management 'Learning oriented knowledge management'. It is considered:

It is necessary that the relations between individuals and organizations be properly understood and support learning for knowledge inheritance, and encourage the creation, the spreading and inheriting of new knowledge.

To realize this idea, harmonization between individual learning, which include acquisition and use of knowledge and externalization of its product, and organizational learning, which is aggregation of individual learning, is required. We mainly focus on

- A Computer-aided model which supports knowledge creation activities in an organization

To clearly express the design principles of the system in this paper, we propose 'dual loop model' as a reference model for system design. This model reflects the key idea of our approach inspired by the theories of Senge's 'Learning Organization' [3] and Nonaka's 'Organizational Knowledge Creation' [2].

In this paper, we introduce the dual loop model and describe the role of ontology[6] in knowledge management. We also introduce a knowledge management environment *Kfarm* as an implementation of our idea.

2. Correlation between organizations and individuals in the knowledge creation process

In this chapter, we propose a model based on which computers support the knowledge-creating activities in With the recent development of an information infrastructure such as the Internet, the quantity of knowledge that individuals and organizations come across daily is increasing markedly, and requires a major upgrading of knowledge management abilities. In such circumstances, the development of a basis of knowledge management that supports knowledge creation, operation, and inheritance under the slogan 'knowledge management' [1, 2] has drawn attention.

2.1 Dual loop model

Our goal is to present a framework that supports all the activities from the practical ones in an organization to the knowledge creation ones. In this research, based on the two ideas set out in previous section, some activities related to the formation of organizational knowledge are explained from both viewpoints of the 'individual' as the substantial actor in an organization and the 'organization' as the aggregation of the individuals. The two viewpoints are modeled as two separated loops of activities with explicit interactions between them. The whole model called "Dual Loop Model" is illustrated in Fig. 1. It works as the reference model for designing a knowledge management support environment, *Kfarm*, we will see in the next chapter. The dual loop model is constructed from an individual's knowledge conversion process (Fig.1 (A), personal loop) and organizational knowledge conversion process (Fig.1 (B), Organizational loop), and it represents the flow of knowledge between them. The flow of knowledge in this dual loop model is explained herein and functions supporting each activity are detailed in the next chapter.

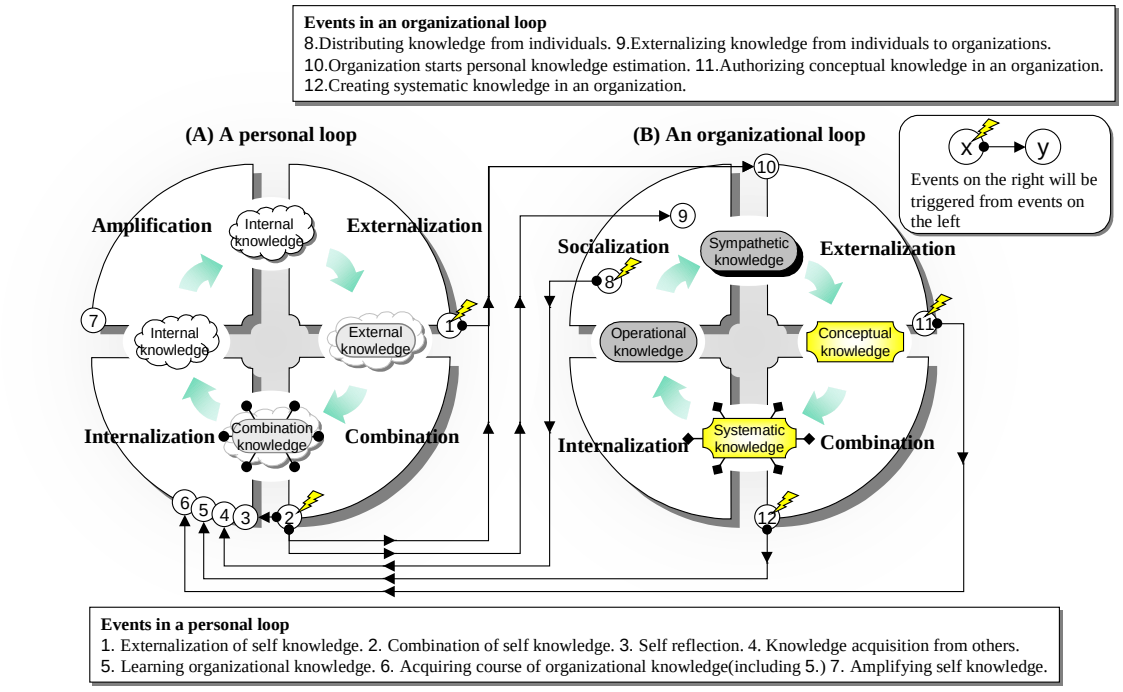

Fig.1 Dual loop model (partly simplified)

2.1.1 Personal loop

The personal loop is a loop of individual activities of knowledge acquisition and creation. As shown in Fig.1 (A), it consists of four processes: internalization, amplification, externalization and combination. This loop has a learning mode, in which an individual acquires knowledge from his/her surroundings, and a creative mode, in which he/she creates new knowledge. A typical activity in the learning mode is one in which the members acquire knowledge of which the significance is approved in an organization. Systems supporting the leaning and the creation modes can be considered the learning support and creative thinking support systems, respectively. A possible common basic requirement for supporting these two modes is:

- Easy access to useful knowledge for knowledge acquisition and creation activities.

This is closely equivalent to the considerations in the study of Ogata et al's knowledge awareness support [4] and in Takeda et al's kMedia [5]. We develop this idea in a framework that promotes the 'appropriate creation/distribution' of knowledge in an organization based on knowledge management theory. In the learning mode:

- Create a rational learning process for an organization.

In the creative mode, a basic requirement is:

- Support acquiring knowledge and sending it to others as the basis of individual amplifying process.

In Fig. 1, (1)-(7) represent the events of the K-practitioner's activities. Typical starting events for the learning and creative modes assumed in the dual loop model are (5) and (7), respectively in Fig. 1. (5) represents an event in which 'significant knowledge in an organization' should be acquired, and (7) is an externally-triggered event that represents a start of the creation of new knowledge. These are defined in connection with a user's activity conditions and an organization's loop events.

2.1.2 Organizational loop

An Organizational loop is an abstract model, reflecting members' activities in personal loops in an organization as knowledge inheriting and creating activities from an organizational viewpoint. The typical activities include acquisition and creation of knowledge inside and outside an organization. The loop consists of internalization, socialization, externalization and combination. In the organizational structure of the middle up-down management, the processes of internalization and socialization (on the left), and the processes of externalization and combination (on the right) are the activities for K-practitioners and K-engineers, respectively. In Fig. 1, (8), (11) and (12) represent the events that trigger off a K-practitioner's activities performed in the personal loop process. For example, (8) represents such an event as 'knowledge distributed by individuals', (4) represents 'obtaining knowledge from others'. The arrow from (8) to (4) shows a causal link between the two events.

Furthermore, this dual loop model can explain learning conditions in an organization. For example, an organization that frequently has events in the socialization process (at the top left) and rarely has events in the combination process (at the bottom right) mean that even though a K-practitioner actively carries out knowledge acquiring and creating activities, they are not likely to be recognized as 'organizational knowledge'. Lack of activities of K-practitioners and K-engineers can be identified as the

causes. Further, when an organization have events only in the internalization process in the Organizational loop (at the bottom left), it can be seen that a tendency of the organization leans to practice acquisitional activity . Thus, the dual loop model is also useful as a reference for analyzing the proper process of knowledge acquisition, passing down and creation in an organization.

3. *Kfarm*

Kfarm is a system referencing the organization structure of the *middle up-down management*. Nonaka and Takeuchi suggested 'middle up-down' management as an example of an organizational model that promotes a knowledge creation process. Knowledge officers (K-officers), knowledge engineers (K-engineers), knowledge practitioners (K-practitioners), from a knowledge creating viewpoint layers, correspond to with top (executives), middle (middle management), and lower (employees) from organizational viewpoint layers, respectively. The K-engineers in the knowledge creation viewpoint layer are expected to coordinate between the top's visions and the employees' practical activities, and to promote innovative knowledge creation within a particular order of the organization. In the following, K-practitioners and K-engineers are related to the dual loop model in the middle up-down management, and necessary support in *Kfarm* is discussed. Fig. 2 shows the interfaces of each environment. Although five buttons correspond to functions 5 and 6 in Fig.2 are provided only to K-engineers, K-practitioners will be provided similar interfaces except for those five.

3.1.1 K-practitioner environment

K-practitioners participate in organizational learning through either their own documents or documents obtained from outside. K-practitioners' basic tasks and their support functions are as follows:

Sorting: select a term from the terminology trees (Fig. 2 (c)) and put a term index on a folder. Store documents in the indexed folder. The documents have the same indexes as the folder and are converted to conceptual indexes in *Kfarm* (e.g. function 1).

Support: providing terms based on ontology, making clear term descriptions

Distribution: distribute one's documents with term indexes to interested people (e.g. function 3-2).

Support: knowledge awareness support

Reference: search and reference documents and bulletins of others and organizations based on terms (e.g. function 2,3)

Support: visualize know-who/know-what information

Learning: search learning contents that fit one's situation and learn (e.g. function 3)

Support: search based on ontology

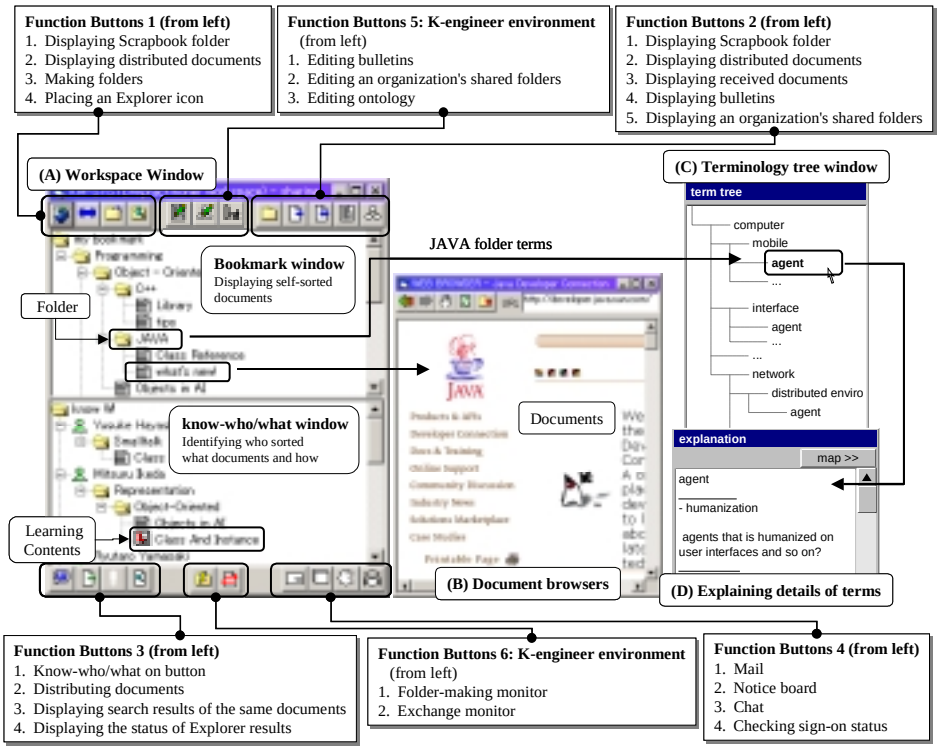

Fig.2 User interfaces in Kfarm (K-practitioner environment)

3.1.2 K-engineers environment

K-engineers lead organizational learning, based on the organization's visions, by adopting created knowledge and concepts in an organization. Therefore, all behavior/events in a K-practitioner environment will be informed to K-engineers. This information will give K-engineers more opportunities to collect new concepts of K-practitioners. K-engineers' basic tasks are as follows:

Understanding circumstances: make folders for K-practitioners, understand document exchange events (e.g. function 6)

Support: informing distributing events, visualizing knowledge exchange

Editing: make systematic knowledge documents as bulletins in order to make clear the direction of an organization (e.g. function 5-1)

Support: functions for making bulletins

Authorization: authorize the useful documents from sympathized knowledge documents in organizational activities and use them as conceptual knowledge documents (e.g. function 5-2)

Support: inform distributing events, visualizing knowledge exchange

Sorting: sorting of conceptual knowledge documents, set up conceptual indexes as official meanings in an organization, and use as systematic knowledge documents (e.g. function 5-2)

Support: organizational shared folders, ontology editing functions

Distributions: distribute K-practitioners systematic knowledge documents according to the situation of an organization (e.g. function 3-2)

Support: visualizing know-who

Searching learning contents: search learning contents and target people that match the situations of an organization, and distribute (e.g. function3)

Support: visualizing organization conditions, searching based on ontology

4. Concluding remarks

Organizational learning can be taken as an aggregation of individual learning, and it is necessary that an individual's knowledge increase for an organization to increase its knowledge. To realize this, it is also necessary to increase an individual's knowledge that matches the value of the idea from organizational viewpoint. By meeting those two requirements, it is thought that beneficial knowledge for an organization will be created and the identity of the organization will be established.

In this paper, where an individual's learning becomes the basis of organizational learning, we have suggested *Kfarm* as an architecture for IT systems, which supports giving direction based on organizational visions by K-engineers and the cooperating of knowledge creation by K-practitioners. *Kfarm* can monitor learning processes in an organization and can provide adequate support based on the correspondence between user operations and events on the dual loop model.

Learning contents authoring tools[7,8,9] we have already developed can be generalized as a general-purpose learning content design support environment, and its deeper cooperation with *Kfarm* can be a future subject. For example, it will be possible to better fulfill learning support in an organization's activities by connecting user models in *Kfarm* with learner models obtained with the use of learning contents. Furthermore, we are considering incorporating it from a point of human resource management, in the framework of learning support in an organization.

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