Supporting design for activities suited to the situation of organizational learning
- A mechanism to generate Intellectual reputation of organization members -

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Abstract. In the creation/inheritance of organizational intellect, it is important to facilitate better communication between organizational members as well as to grasp and manage the organizational intellect. "Intellectual reputation (IR)" introduced in this paper is reputation for the formative process of organizational intellect. We consider a general mechanism to find and introduce a person expected to contribute to a context by generating IR from past performance record of each member. In this pa-per, we examine the role of IR and the mechanism to generate it.

Keywords: organizational learning, ontology, learning community

1 Introduction

We are learning by participating in various organizations or communities. We continue to create and inherit organizational intellect through various activities carried out in them (Wenger, 1998). For example, we learn through individual activities or collaborative ones, passive activities under directions of organizations or communities or active ones on our own initiative, activities on the purpose of creation or ones on the purpose of inheritance, and so on. This view of "learning" affords many studies in a variety of fields, e.g. the concept of social constructionism in psychology and studies on collaborative learning based on it (Doise, 1984), studies on knowledge management (Davenport, 1998), (Nonaka 1995) and learning organization (Senge, 1990), and so on.

Focusing on organizational learning, one of the great spurs to it is to attain a proper balance between driving power and centripetal power. The driving power is practical activities of organization members and their own intellectual energy; the centripetal power is a direction of the organization. For example, Nonaka proposed the concept of 'Knowledge leadership' to realize relationship between these two powers. In order to harmonize these two powers, it is important for each member to be aware of his/her own and others intellect and to carry out activities in his/her own role.

It follows from what has been said thus far that we make decision on the context of various scenes of activity as an individual or an organization while learning. Typical decision making is, for example, to find a right answer to the questions such as "what should I learn?", "who can contribute to solving this critical problem to the organization?", and so on. In an ideal organization, organization and its members properly make decisions with understanding the organizational vision and the context of activities. Information systems that work as a supportive IT infrastructure in such an organization requires following:
- Having an activity model for sharing the context among users and information systems.
- Providing environments in which the users can carry out a variety of activities.
- Recording progress of each member's activity and providing information to help the members to remember intellects required for making decision according to a context.

Most studies on knowledge management support system have focused on management of documents as the result of creation/inheritance of organizational intellect, as a first step to fill the requirement. This study aims at advancing one more step toward building an information infrastructure, focusing on activities, vehicles, person and awareness of intellect in consideration of the three points mentioned above. In this study we have built "Dual loop model (DLM)" based on SECI model, which is well-known model in studies on knowledge management (Nonaka, 1995), as a model to enable a sharing of context of organizational activities among users and a supportive IT infrastructure. Moreover, we have developed *Kfarm*, which is an information system to

develop users' profound social intellectual awareness in organization, based on DLM (Hayashi, 2001; Hayashi, 2002a).

This paper discusses a framework to support making decision about organizational activities from the viewpoint of "learning" in the wide sense with central focus on the function of providing information regarding organizational intellect for organization members. Herein after, section 2 discusses a classification of organizational activity. Section 3 describes a framework of information systems to perceive intellect by focusing on the activity and to provide the information. Section 4 describes support function for making decision about collaborative learning that is a class of activity in the classification mentioned in section 2. Finally, section 5 concludes this paper.

2 Model for Organizational Learning

We will begin our discussion by considering a classification of activities in order to clarify the requirements for the environments in which the users can carry out a variety of activities. This research considers the following three aspects of knowledge creation and inheritance activities.
- Individual activities or Group activities
- Top-down or Bottom-up
- Practical or Educational

The first aspect distinguishes between personal and group activities. The second distinguishes activities whose purposes are established based on the organization's vision or strategy and activities at the organization members' own initiative. The third distinguishes practical and educational activities. The goal of practical activities includes to eventually produce novel and significant intellect for an organization. The educational goal is to properly transmit significant intellect from past to future members of an organization. Educational activities mean those which are simplified and separated from the practical context with educational goal.

Each aspect does not always mean exclusive distinction among activities. For example, OJT (On the Job Training) is carried out with both practical and educational goals. Fig. 1(i) shows the classification of activities in an organization by projecting these aspects to axes of three dimensions.

One main purposes of this study is to support "Learning" in an organization. Generally the term "Learning" indicates the typical concept of learning that is established as part of the social system of education. On the other hand, researchers, who are interested in the integration of various forms of learning, for example, workplace learning, life-long learning, organizational learning, collaborative learning and so on, refer to the term "Learning" in a wider sense (Eleuterio, 2000), (Ayala, 2000). In Fig. 1, the former corresponds to educational activities shown as the shadowed part of Fig. 1(ii); the latter corresponds to the entire cube.

Most studies on computer supported learning aim at the former interpretation of "Learning". For example, Watanabe and Kojiri arranged various kinds of educational support systems, CAI, CAL, ITS, and CSCL, according to the SECI model; they proposed a learning environment architecture in which learners are able to freely change their learning style (Watanabe, 2001), (Kojiri, 2001). This study addresses that educational viewpoint, but ignores other aspects. Fischer's Life-long Learning (Fischer, 2000) aims at reforming learning space by information technology, approaching learning in a wide sense as learning activities at a practical workspace over a long period. Along a similar line of thought, the final purpose of our study is to build a framework to support learning intelligently in a wide sense.

3 Intellectual Reputation

It is important for members to make decision on the context of various scenes of activity as an individual or an organization while learning. In the previous section, we discuss the scenes of activity and then this section describes a framework of information systems that interpret the formative process of organizational intellect by structuring members' activities from organizational viewpoint and that provide information to help the members to think of useful intellects for making decision according to a context.

As Hood pointed out (Hood, 1980), we mutually realize others' roles in a community from activities they have engaged in. This study introduces "Intellectual Role", which is a conceptualization of actors who carry out significant activities in the formative process of organizational intellect. When we search for a person who can contribute to a certain context in the process, we need to identify intellectual roles required at the context and find a person who can fill the intellectual role. Consider the case of finding a candidate to review an intellect as organizational intellect. Assuming that a person who has successfully done an activity is a candidate

who can properly do a related or similar activity, a person who has played a 'reviewer' of similar intellect is certainly a candidate. Furthermore, we can say that a person who has proposed novel intellect in a similar context is one who can appreciate the novelty of other intellects. The idea of IR is to provide supportive evidence to identify a person who can play a suitable role to the current context.

An individual's IR is extracted from past records of that person's performance based on DLM. In this study, the performance in the formative process of organizational intellect can be viewed as having two aspects: contents and activities (Hayashi, 2002b). Contents imply which field of the work that person has contributed to and activities imply how one has contributed to the formative process of the intellect. Regarding content, it may be inferred that organization has its own ontology that is a basis to place each intellect in the organization. On the other hand, regarding process, the process model of DLM can be a basis to assess a person's competence to achieve activities in the process. Based on these two viewpoints on content and process, performance is interpreted into IR. We will roughly sketch out an overall framework to generate IR in this section.

3.1 Mechanism to Generate Intellectual Reputation

The purpose of this study is to build a mechanism of introducing a person of good reputation when a person wants to communicate with others for creative activity. Fig. 2 shows an outline of that mechanism.

An individual's IR comprises more than a mere record of a person's past activities. The significance of a personal activity is not always clear immediately after the activity has finished. If the activity is a part of a collaborative activity, it is particularly desirable that its significance is clarified based on the role of the person in the collaborative activity and the contribution of that performance to the organization. Putting up good performances for the organization engenders a good personal reputation. A personal reputation is only realized when the person's activity is interpreted according to the formative process of organizational intellect; its performance is then established in the organizational intellect.

The IGG generator in Fig. 2 makes an interpretation by reconstructing the formative process of organizational intellect as IGG from observed activities (Hayashi, 2002b). If the IR generator is given a context as a query, it searches IGGs for a person of high IR in the view of each member's roles for the organizational intellect and significance of the performance. The context represents a situation in the ideal formative process of organizational intellect defined by DLM. Resultant IR of that search consists of the following two types of information:

- *Performance record* comprises the past observed activities as evidence that one can contribute to the current context.
- *Interpretation* represents the significance of one's past activities.

The following section presents IGG, which is the basis for IR generation.

3.2 Intellectual genealogy graph

An IGG represents chronological correlation among persons, activities, and intellect in an organization as an interpretation of observed activities of organization members based on DLM.

Fig. 3 shows an example of an IGG. Hard data for modelling an IGG is a time series of vehicle-level activities observed in the workplace, for example, vehicle handling operations in an IT tool. Typical observable activities are to write, distribute, and review a document. Firstly, the IGG generator builds a vehicle-level model from the data. Then, it abstracts a formative process of intellect from the vehicle level based on DLM.

IGG offers the following three types of interpretation for generating IR:

Interpretation of content of intellect

The ontology in Fig. 2 is a representation of an organization's own conceptual system which the organization possesses either implicitly or explicitly. Significance of an intellect in the organization is made clear in terms of the ontology. An aggregation of the significance of intellects that a person has shows one's special field of work in the organization.

Hierarchical interpretation of activity

According to DLM, the organizational intellect memory interprets members' vehicle-level activities at three intellect-levels of activities: personal, interactive, and organizational levels. As a result, interpretation represents roles that the actor played in the formative process of the organizational intellect.

Chronological interpretation

It is important to note that significance of an activity is determined not only by the activity itself, but also by performance of the actor through the whole of the formative process. The IGG records progress of each member's activity and transitions of intellects caused by the activity in chronological order.

4 An Example of Provision of Intellectual Reputation

In this study, we have been developing an environment, $\mathcal{K}farm$, which embodies our conceptualization thus far. $\mathcal{K}farm$ provides users with environments in which they can carry out a variety class of activities we have discussed in section 2. In this section we will describe an overview of $\mathcal{K}farm$ and then give an example to show a scene of user's decision making in organizational learning.

4.1 An Overview of $\mathcal{K}farm$

$\mathcal{K}farm$ is a distributed system consisting of a K-granary, at least one K-ranch house and some K-fields. In $\mathcal{K}farm$, it is assumed two types of users: K-practitioner and a K-producer. Those come from "Middle up-down management", which is a form of an organization to activate the process of creation/inheritance of organizational intellect (Nonaka, 1995). In Middle up-down management, a "Knowledge practitioner (K-practitioner)" plays the role of generating the creative power mentioned above, while a "Knowledge producer (K-producer)" plays the role of coordinating the top's visions and K-practitioners' practical activities. The K-field and the K-ranch house are environments for a K-practitioner and a K-producer respectively. Those two play dual roles of sensors which watch a user's activities in a knowledge-oriented task and a display which shows information about the organizational intellect according to their roles. The K-granary is a server. It interprets K-producers' and K-practitioners' activities observed in the K-field and the K-ranch house and then aggregates and stores them as an organizational intellect.

4.2 An Example of a Provision of Intellectual Reputation

Fig. 4(A) shows an editor window screenshot of a scene of designing collaborative learning that is a class of activity classification. At this scene, setting participants and their roles for the collaborative learning is K-producer's decision making for designing collaborative learning. Fig. 4(C) is a window assigning roles to participants. Fig. 4(B) displays a visualized IGG which indicates a history of intellect generation. Fig. 4(B-1) is a person who has an intellect related to collaborative learning subjects. The IGG provides a good foundation for choosing participants since it helps the K-producer to grasp who is appropriate for the subject of collaborative learning. In the assignment window, the K-ranch house recommends participants based on the intellectual role in the IGG and the property "role" in the structure pattern. In the example, for the role of "generating new ideas", the K-ranch house recommends the person (Fig. 4(B-2)) who created a seed document of the intellect related to the subject (Fig. 4(B-1)). Thus, it helps the K-producer to decide participants and their roles by providing information about the history of intellect generation and candidates for participation. Further details of designing support function of collaborative learning are shown in (Tsumoto, 2002).

5 Conclusion

In this paper we have discussed integration of various activities in an organization as "learning" in a wider sense; we proposed $\mathcal{K}farm$ as a framework of an information system to support "learning". DLM plays the role of the basis for design and development of a supportive information infrastructure as an activity model for sharing the context among users and information systems. $\mathcal{K}farm$ provides users with environments in which the users can carry out a variety of activities as mentioned in section 2, and with information to help them to remember intellects required for decision making according to a context based on the records of each member's activity, that is IGG and IR described in section 3. By way of conclusion, we should emphasize that it is important to clarify models for designing and developing a framework to support making decision about organizational activities from the viewpoint of "learning" in the wide sense.

Future direction of this study will be to place learning contents under the management of $\mathcal{K}farm$. from the viewpoint of creation/inheritance of organizational intellect. Learning contents is mainly considered as vehicles to facilitate inheritance of organizational intellect, particularly systemic intellect that has been authorized as a significant one by the organization. By placing learning contents under the management of

Kfarm, we aim at managing learning contents connected with management of organizational intellect. In addition, it is also important to consider management of learning contents that is compliant with standard specifications, e.g. SCORM (ADLNet, 2002), from the standpoint of practical employment of learning contents.

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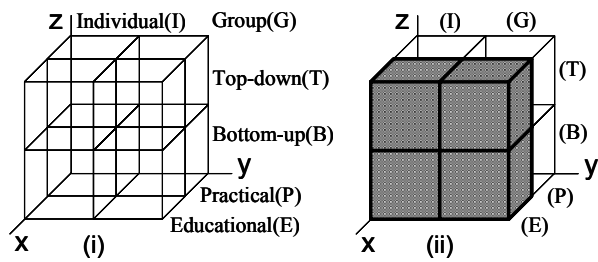Wenger, E. (1998). *Communities of Practice: Learning, Meaning and Identity*, Cambridge University Press, New York.

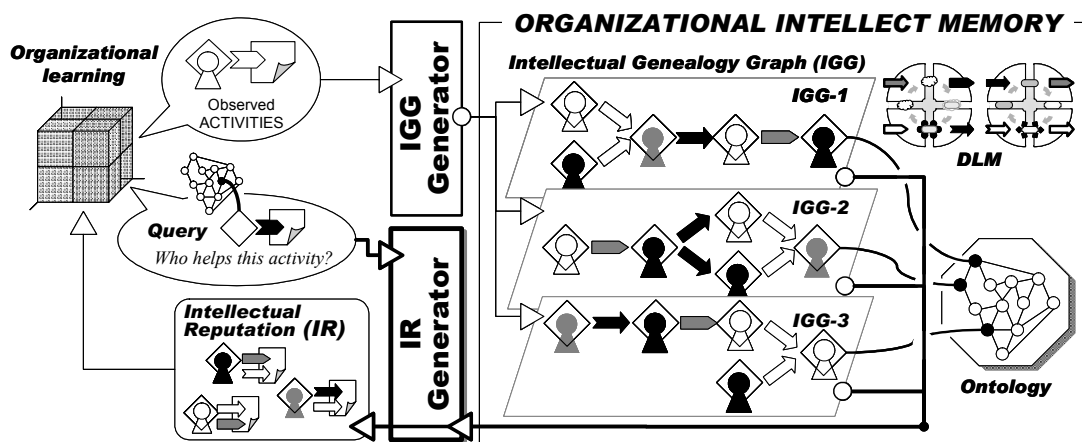**Figure 1.** A classification of learning

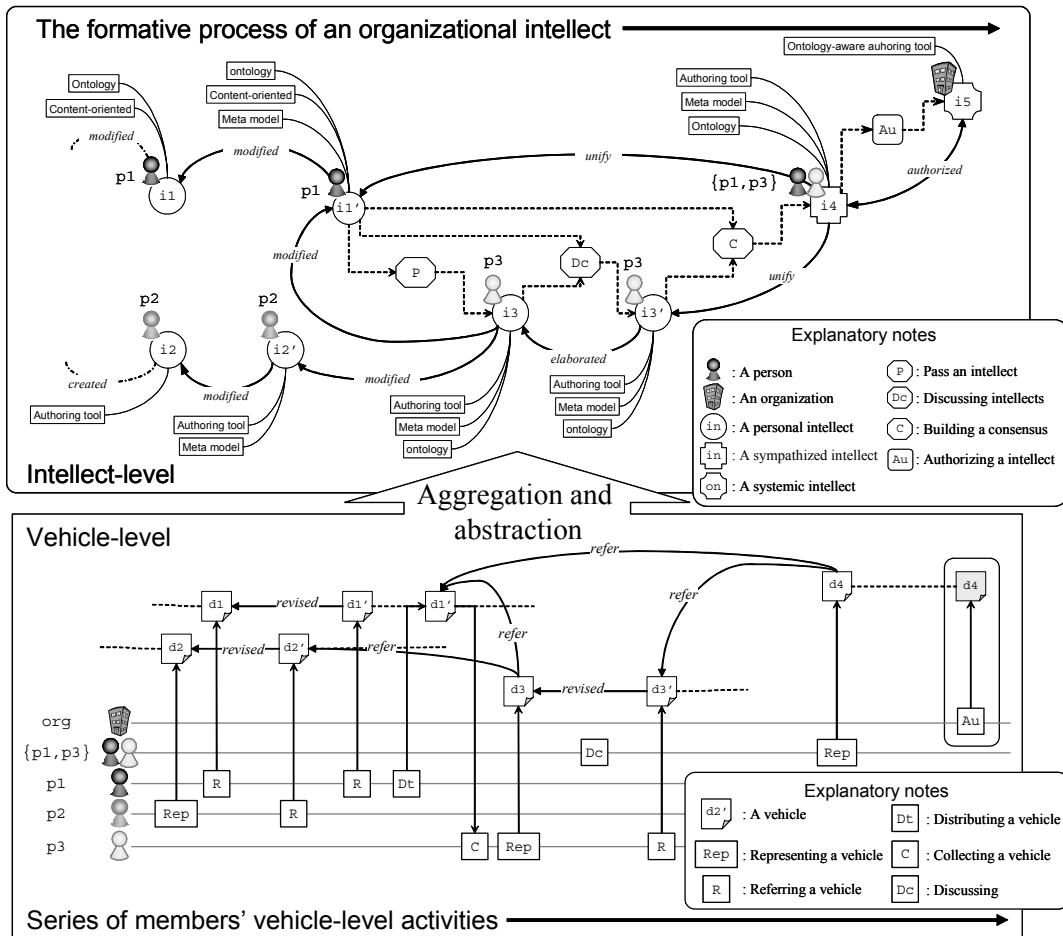**Figure 2.** Overvew of the mechanism to generate Intellectual Reputation
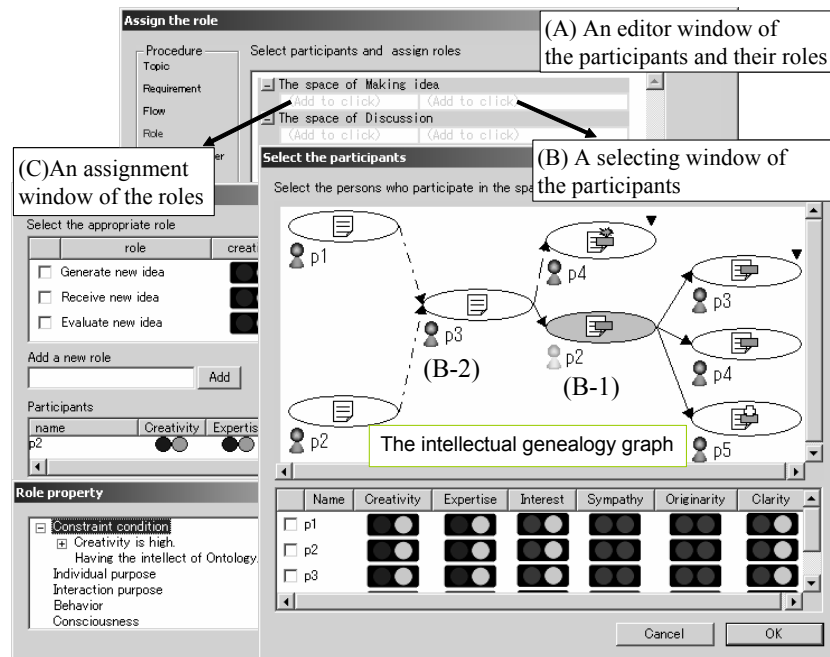
Figure 3. Intellectual Genealogy Graph

Figure 4. A scene of designing collaborative learning