From teaching to assistance for project

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ABSTRACT: The knowledge management takes an increasingly important place in the organizations, also in teaching process. It takes part to all the processes that allow to capitalize, to share and to make evolve the patrimony of knowledge. In particular, the transfer of knowledge, as teaching, is an important process which has induced by the CETU and UCLouvain for a few years to explore this way of research through two great projects which are: DIDACTU and RAMCESH. DIDACTU is the first tool for transmission of knowledge in the geotechnics field. It makes it possible to its users (geotechnicians) to find the knowledge easily as in a computer learning system. The RAMCESH project tries to automatize the transfer of knowledge from written documents suppressing redundancies.

1 INTRODUCTION

This paper describes the different developments done by the CETU and by the Université catholique de Louvain in the topic of knowledge management. In a first step, the authors define the idea of knowledge management because it's essential to understand the problem of knowledge transmission encountered each day in teaching. After, they present two projects for their needs of transmission, diffusion and knowledge sharing.

2 KNOWLEDGE MANAGEMENT

2.1 *Definitions*

The knowledge management is all the methods and techniques allowed to detect, to identify, to memorize, and to share knowledge between members of organizations

The actors of the organization must not confine to consumption of raw information. They must take care to the use of information, what means interpretation, structuring, capitalization, and sharing of knowledge.

2.2 *The capitalization and sharing of knowledge*

Nonaka & Takeuchi (1995) divide knowledge in two broad categories: explicit knowledge and tacit knowledge.

Tacit knowledge is defined as knowledge rooted in processes, routines, specific context. It is notably constituted of know-how and knowledge born from experience (professional skills, for example).

Explicit knowledge is structured and codified knowledge, generally expressed thanks to various formal languages or models, and generally designed to be transferred between agents (people or software).

According to Nonaka & Takeuchi (1995), there is four ways to go from tacit to explicit knowledge or the reverse:

1) Socialization, from tacit to tacit knowledge (between an agent and an organization; it can be sharing of know-how by teamwork or plain apprenticeship)
2) Externalization, from tacit to explicit knowledge (metaphors, conceptualization, models, hypothesis)
3) Combination, of explicit knowledge
4) Internalization, from explicit to tacit, which is the way people generally reverts back concepts and rational knowledge in know-how; this is mainly understood in an organization-to-agent way.

Ermine (2000) describes the whole process, which is sometimes called "the virtuous circle of knowledge", according to the following schema (Figure 1):

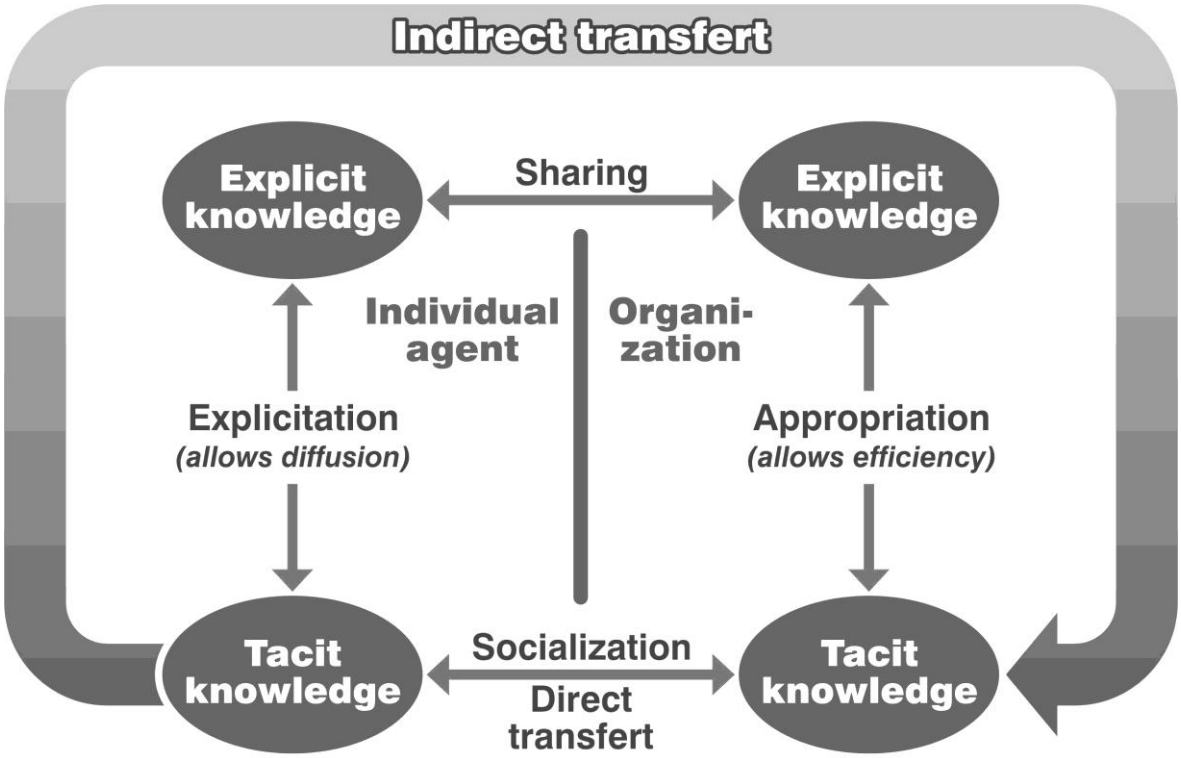

Figure 1. The process of knowledge capitalization and sharing

The process of knowledge sharing can be done one of two ways:

Direct transfer by socialization: this is typically a sharing by example (as in old-fashioned apprenticeship), where knowledge is built by observation of an expert. This is arguably the best solution for knowledge sharing, but quite hard to set up in a modern organization, for cost and time reasons (experts are seldom available for this kind of time-consuming operation).

Indirect transfer can be a partial alternative to direct transfer. This global transfer process is in fact subdivided in three subprocesses.

The first one is explicitation (i.e., making knowledge explicit). It consists in representing tacit knowledge as comprehensible information. This is typically the formal teaching process, as practiced in school, for example: lectures belong to this subprocess. It is an asymptotic subprocess, however, as some part of tacit knowledge always "resists" being explicated. On the other hand, numerous methods and tools are currently available to better perform explication – from simple knowledge transcription to knowledge modelization. Current challenges consist in adapting these tools and methods to help "remote explication", that is, e-learning.

The second subprocess is sharing, putting knowledge in common with other people to build a vast body of knowledge from which building its own, individual, knowledge. Modern ways of communication (networks and notably among them Internet) allow easy sharing of knowledge, but must be used with care as it could prevent clarity, or even distort knowledge. Communication policies must go along knowledge sharing.

The third subprocess is appropriation, which is rather an individual process; agents building their own know-how from what knowledge have been shared with them. Appropriation can be empirical (by experimentation for example) or just a mental process, but is the key for all the indirect process to make sense: explication and sharing are useless without appropriation.

Nonaka's model is quite well-known, but it is interesting to remind it here, for it allows us to picture the two aspects of teaching tunnelling represented by the DIDACTU and RAMCESH projects:

- The DIDACTU project clearly belongs to explication and, mainly, sharing. It features declarative knowledge, classified along clear - and explicitly defined - lines, accessible at any point, without any prerequisite about the readers' own previous domain knowledge, which allows any public to access it, but requires further appropriation.

- The RAMCESH project aims to be complementary to the direct transfer by allowing each user to find and reuse knowledge informally expressed (hence, tacit for a large part) in domain documents. The main difficulty in such an endeavour is to combine the necessary indirect (formal) way of transferring knowledge (as needed in a computer-based system to represent knowledge in a computational, declarative, environment) with the implicit nature of knowledge in these documents…

3 REALIZATIONS

3.1 *DIDACTU Project*

DIDACTU is a step to a management of knowledge on the tunnels. It's a tool to share the knowledge, an e-learning on line. It may contain a tool to control also the knowledge and is dedicated to the tunnel actors. This tool isn't an expert but a kindly friend helping to understand the different steps of conception, sale by auction, work realization in the best conditions.

The tree of DIDACTU introduces in fact the notion of knowledge and meta-knowledge. This last notion consists in the knowledge of the knowledge. For example, to know that such knowledge exists at such place is the meta-knowledge. DIDACTU appears as a technique of storage and to find the knowledge following some pedagogical principles in the proposed exploration (Faure & Thimus, 2004).

At the present time, DIDACTU is a tool in French language and the existing chapters are given in figure 2.

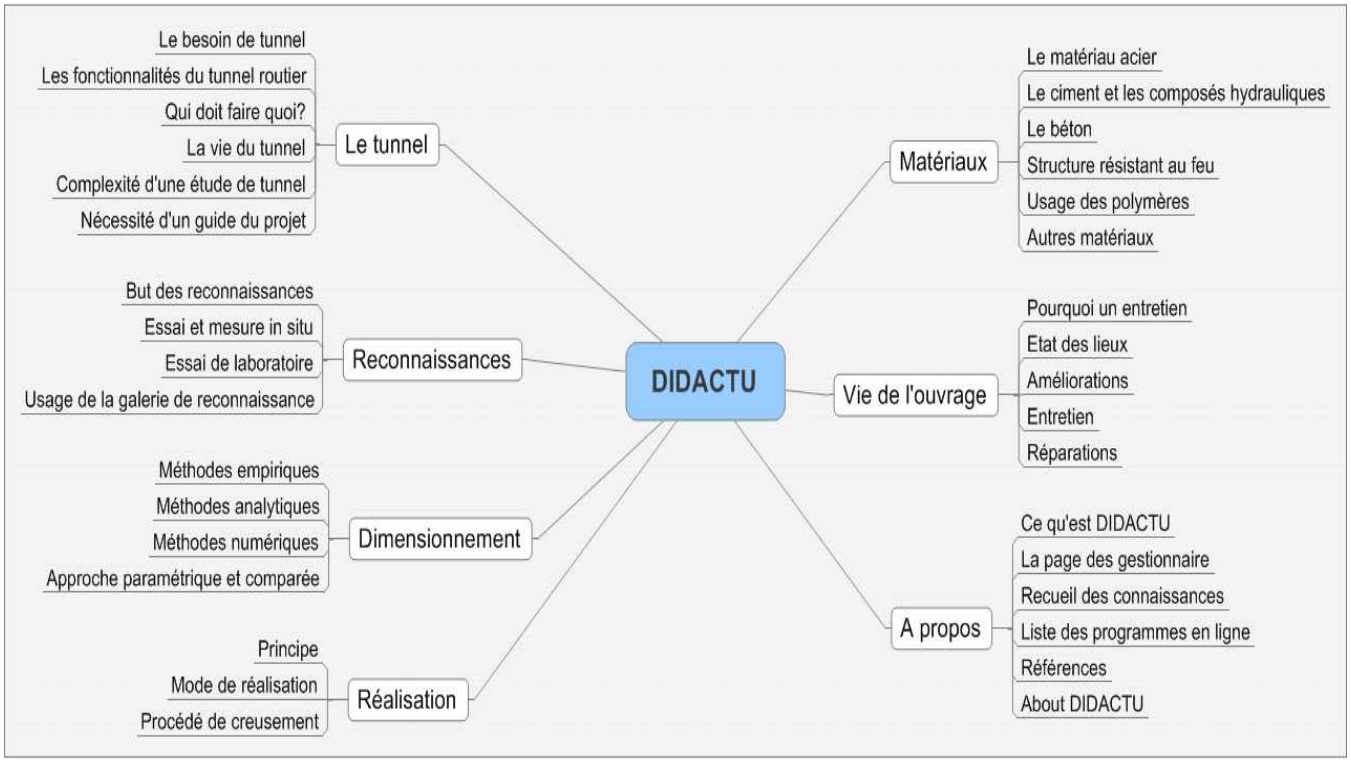

Figure 2. Chapters of DIDACTU

The approach used to build DIDACTU is similar to that one used by the professor which the most completes teaching for the students. To do that, the professor looks after the different sources of information able to answer to the needs. Some may be redundant or more adapted to his wish. His approach consists to identify the most pertinent documents and to assembly to build up a course including all the notions needed for the student to well understand and to assimilate lessons.

The realization of DIDACTU follows this approach, seen also in the process of knowledge sharing describes by Ermine (2000) in his book. Indeed, DIDACTU search to do emerge a part of knowledge by the use of e-learning on line on Internet, to share the retained knowledge, and to take over this knowledge to create his own knowledge.

DIDACTU is a tool dedicated to continue teaching, able to help the projector by knowledge recall and by the possibility to consult on line different calculation and design tools. Nevertheless it exist an important disadvantage: it remains static and hasn't strength formalism allowing a reaction between the different useful information.

3.2 *RAMCESH Project*

In the geotechnical community, hence in the underground works domain, the documents are very numerous: books, papers, working papers, etc…

This huge amount of documents is furthermore partially redundant, making knowledge access a day-to-day (or rather, project-to-project) problem.

For this particular use, a tutorial such as DIDACTU is not sufficient; a knowledge representation approach must be used.

What challenge the RAMCESH (which stands – in French – for Assisted Knowledge Management and Extraction for Artificial Underground Spaces) project faces is to represent terminological knowledge as extracted from documents and to offer a contextualization of this knowledge which allows the user to obtain what knowledge he needs for his specific project and point of view. Furthermore, one of the goals of the project is to check the conformity of

a tunnel project with a set of norms and rules (Faure et al. 2006].

RAMCESH key elements are:

1) Showing domain knowledge as elements to be aggregated according to needs
2) Corollary, building a convenient computer-based formalism for knowledge representation
3) Querying easily knowledge as needed according to a context description

Knowledge transfer is made in RAMCESH by a direct transfer (socialization), or rather an equivalent: the aggregation of knowledge needs no explication and allows an elimination of textual redundancy.

Knowledge is subdivided in static knowledge (terminological knowledge in a hierarchy) and dynamic knowledge (conceptual knowledge and relations between those concepts, described in a knowledge component named Knowledge Grain). Terminological knowledge is extracted by automatic text mining on a statistical basis, and then classified by domain experts along a specialisation-generalisation relationship, in order to obtain terminological trees (generic concepts for the roots, specific concepts for the leaves).

Aside from this terminological hierarchy (taxonomy), the formalism used to express conceptual and contextual knowledge is the knowledge grain, which defines further semantic relations between terminological elements, according to a specific situation.

The corresponding research work, made in collaboration with the SOLEM France Society, has produced an ontology-based information system which allows various possibilities of querying a knowledge base with limited terminological constraints (thanks to an informal environment) and maximal contextual-based information.

Experimental software has been designed for stocking and accessing knowledge online with a knowledge grain visualization and building tool, along with local tools used for building terminological and conceptual bases.

As for now, the RAMCESH terminological base contains more than 5000 terms for tunnelling and geotechnics, as well as their synonyms and morphological variations (Faure et al. 2007); under completion is the implementation of the conceptual knowledge base, with more than 1000 knowledge grains identified from various texts.

Full operationalization will follow. It will be undertaken by domain experts (more than by "knowledge engineers") and will be a major work, as it is iterative:

1) Choosing and assembling texts
2) Looking for text parts which can be « translated » into knowledge grains
3) Building and stocking knowledge grains
4) Broadening use of the system

4 CONCLUSION

Knowledge management is an important and global phenomenon. Some projects have been developed to answer to the question of sharing of knowledge. The authors have shown in this paper two ways of researches: first DIDACTU, e-learning on-line on Internet and RAMCESH, project more ambitious, for an efficient sharing of knowledge allowing the reactivity of these when inconsistency alert of conception risk.

The questioning of the base by the context, during the project, allows retrieving all the needed knowledge over the context and by this way allows to avoid forgetting. It's thus a efficient help to the project moving around by automatism of helping.

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