Modeling Corporate Memories using the ReCaRo Model, Some Experiments

Lotfi Admane

Abstract—This paper presents a model of case based corporate memory named ReCaRo (REsource, CAse, ROle). The approach suggested in ReCaRo decomposes the domain to model through a set of components. These components represent the objects developed by the company during its activity. They are reused, and sometimes, while bringing adaptations. These components are enriched by knowledge after each reuse. ReCaRo builds the corporate memory on the basis of these components. It models two types of knowledge: 1) Business Knowledge, which constitutes the main knowledge capital of the company, refers to its basic skill, thus, directly to the components and 2) the Experience Knowledge which is a specialised knowledge and represents the experience gained during the handling of business knowledge. ReCaRo builds corporate memories which are made up of five communicating ones.

Keywords—Corporate memories, meta-model, reuse, ReCaRo.

I. INTRODUCTION

THIS work comes within the field of modelling of corporate memories. Progressively, the company constitutes a capital of knowledge. However, this capital is very volatile because it is often scattered on the experts of the company and in documents. The objective of ReCaRo is to collect it, organise it and preserve it for reuse purposes. This preservation is done through the concept of corporate memory [1], [2], [3], [4], [5], [6]. This capital is then reused in different situations in order to reduce the costs and the time of development.

In this paper, we propose a generic model of corporate memory called ReCaRo which emphasizes, particularly, on the problem of reuse of the knowledge contained in the corporate memory.

To build the corporate memory, we propose an approach in two steps. First, it is important to define and select the whole concepts necessary to the design of a corporate memory. This step is necessary because the concepts can be different from one model to another. In a second stage, one has to model the selected concepts using the ReCaRo model.

This paper is divided into four main parts. The first one presents the concept of corporate memory and the concept of knowledge and its reuse. The second one presents the model of corporate memory ReCaRo. The third one presents the application of the ReCaRo model in information systems

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design projects and finally, the last one presents the ReCaRo software. This last part resents how the corporate memory is enriched and search methods proposed.

II. KNOWLEDGE, KNOWLEDGE REUSE AND CORPORATE MEMORY

We will not try to define the corporate knowledge, but we will position ourselves directly within a framework of knowledge. Among the characteristics of knowledge, there is the usual distinction between data, information, comprehension and knowledge [7]. The aspects of contextualisation of the knowledge were particularly developed in sociology [8] and in cognitive psychology [9]. [10] introduced the distinction between "knowledge", "information" and "data". [3] introduced the distinction between know-how and the knowledge. [11] evoked the link between knowledge and context. Finally [12] introduced the concept of knowledge system. The definition of the concept of knowledge in the organisation remains very prone to discussion.

An important point in this paper is the reuse of this knowledge. In the most general case, "To reuse" means, to use again existing elements. In the case of knowledge management, the term reuse means to use one or several existing resource components in order to create new components within a minimum search time and with few adaptations. They have to be lower than those necessary to the construction of new components offering the same functionalities [13]. On the theoretical level, [14] has introduced the concept of cycle of the reuse of knowledge. On the practical level, most works on the principle of reuse introduce the concept of reusable component [15]. These works introduce the reusable component as being an object of the organisation described through a set of characteristics, often descriptive. For simplification needs, these reusable components are often gathered in classes.

The concept of corporate memory is the general framework for organising, memorising and reusing knowledge. [10] defines the corporate memory as representing the experience and the knowledge acquired by the company. [6] presents the corporate memory as being an explicit representation, not contextual, and persistent of information in a company. [16] defines the corporate memory as being a persistent and explicit representation of knowledge and information in an organisation in order to facilitate their access, their share and their reuse. It proposes also the concept of project memory.

The concept of corporate memory is developed in various forms. [10] defines the documentary memories, [17] proposes memories as a set of records of elements of knowledge. There is also a form of implementation of this type of memories under the concept of warehouse of documents. This implementation is a preparation for the possible treatments of the documents by text mining tools.

III. THE RECARO MODEL

A. The ReCaRo Model: Why?

Most of the proposed models [18], [19], have an approach centred on element of knowledge. Those elements of knowledge are modelled as independent items (document, emails, technical notes, etc). The model of [19], require a transformation of these elements of knowledge before introducing them into the memory. Others, as [18], integrate additional descriptions of these elements of knowledge.

The ReCaRo model has an approach centred on the resources. As the other models, it capitalises elements of knowledge but with the characteristic to bind them to objects specific to the company. This approach is motivated by the observation of the strong tendency of the company to standardise its processes and its resources. It, often, reuses the entities it controls, handles and adapts to different situations. In the long run, these entities, conceived for a definite need become independent of any context. These entities can be physical objects, rules, processes, etc. While using these entities, the company refines knowledge which is referred to. The approach of ReCaRo is to regard these entities as being a support of knowledge. The objective of ReCaRo is to select these entities, to model them and memorise them so that they constitute the capital of business knowledge of the company. ReCaRo model is also interested in the experiments around these entities as being a capital knowledge developed by the company during its activity. We will call this last the capital of experiment knowledge because it is often thematic and specialised. It constitutes the dynamics of the capital of business knowledge because it explains how this last is used.

B. Key concepts of ReCaRo

The ReCaRo model provides to the designer a general framework for the modelling of corporate memories based on the reuse. It is built around five concepts: the reusable resource, the role, the context, the case and the scenario of cases.

The reusable resource: the definition that we give to the reusable resource (RR) is slightly different from the definitions met in the literature. We regard as reusable resource, any immaterial or material object designed for a specific use and able to be reused or having already been reused in different contexts. Each use of the RR is characterised by its own context of reuse.

The role: the concept of roles was very much used in

engineering of the information systems and the document. The ReCaRo model, gives different semantics to the roles. They are used, at the same time, as connectors and descriptive labels of reusable resources. The objective of the roles is to describe the use of a resource in a given context. It describes the actions made on the resource to reuse it. Very often, a role is a term having a semantic and symbolising an action.

The context: A context is a description of the situation in which the resource has been used. The concept of context is complementary to the role. It is used to replace the reuse within its particular framework.

The case: A case represents the description of the use or the reuse of a RR in a given context. It is defined by the reusable resource to which roles are associated. Each role describes an action (modification, adaptation, etc) made on the reusable resource. It can, therefore, describe states of the reusable resource during its reuse. A case can be documented by a context.

The scenario of cases: A scenario of cases represents the description of the coordinated use of several cases for the realisation of a common and single objective. It represents a set of several cases connected by the means of roles. In this situation, the roles keep exactly their function which is that of connectors carrying a semantic. The scenario of cases is used, primarily, to describe scenarios which are too complex to be described by simple cases.

C. The ReCaRo Model

The ReCaRo model proposes a multi-memory architecture. It builds memories composed of five sub memories: memory of the reusable resources, memory of the roles, memory of the contexts, memory of the cases and memory of the scenarios of cases. These memories communicate according to a logic defined in Fig. 1.

The memory of the reusable resources selects all the reusable resources handled in the organisation. It constitutes the inheritance of business knowledge of the company, since it memorises knowledge relating to the basic resources of the company. It has an evolution proportional to the evolution of the knowledge of the organisation. Its management can be entrusted to Knowledge Manager.

The memory of the roles constitutes the main mechanism of description of the various uses of the reusable resources. It is composed of all the roles handled in the organisation.

The memory of contexts is used in the memory of case and scenarios of cases to describe the context of their creation, reuse or dealing.

The memory of the cases is composed of elements

extracted from the memory of reusable resources and the memory of roles.
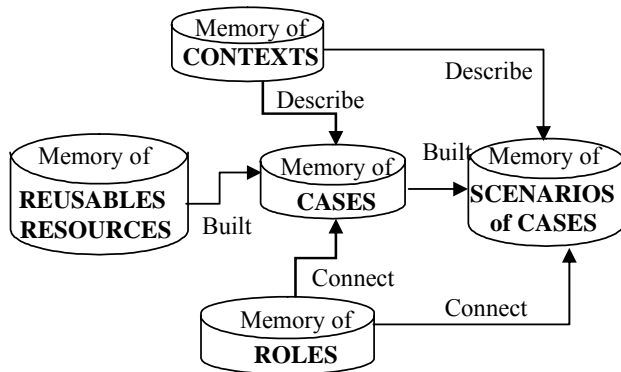

Fig. 1 General architecture of the corporate memory

The memory of the scenarios of cases is composed of elements extracted from the memory of cases. These ones are connected by roles.

The memory of cases and the memory of scenarios of cases memorise the experience acquired by the company related to the reusable resources. These two memories constitute the experience capital knowledge of the company.

IV. EXPERIMENTATION: THE MEM_DOC PROJECT

This project aims to build up a corporate memory to help in the design of solutions of information systems (SSI). This memory is a documentary one [20]. It is built from the design reports of SSI.

The corporate memory offers to the designers of SSI help during the design phase while answering questions of the following type: 1) is there an element of design (diagram of data base, case, technical solution, etc.) meeting my need. 2) I am looking for every diagram of data bases having been developed in the field of medicine. Or, 3) I am looking for a portion of data base managing data relating to an order (invoice). The modeling of the five memories of ReCaRo is as follows.

A. The Memory of Reusable Resources

In this project, the reusable resources (RR) are the components of the information system (diagram of data bases, diagram of case, technical solution, user interface, software component, etc). In the design of information systems, there is many and various RR. Their collection and their modelling would induce an explosion of the memory size of the RR as well as the number of models. To avoid that, we chose a modelling according to their support. The adopted principle is that every RR would be described in a report as a text or a diagram. We, therefore, proposed only one RR which we will call component of information system.

This RR represents any component of the Information System (IS). It is described as a simple structure. However, we propose two types of RR: portions of text and graphs which offer all the knowledge developed around the RR component of information system. Each RR is described by a set of properties. Fig. 2 gives the detail of these RR.
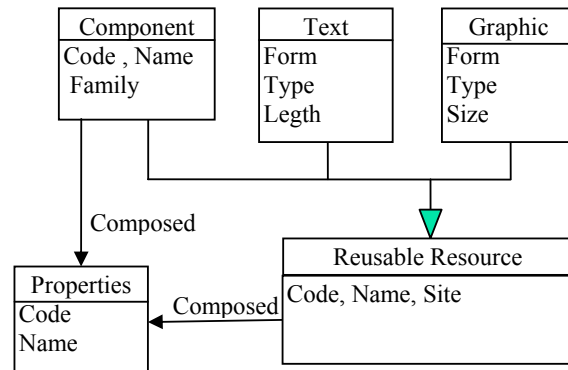

Fig. 2 Description of the reusable resource

The RR, type portion of text, represents all that was written around a component of the solution of an information system. The RR of type graphic represents all that was schematised around this component. The RR of type component of information system, the real RR, will be represented briefly but enriched by all that was written or schematised around them thanks to the RR portion of text and graph. The example of Fig. 3 describes the RR VE1 which represents a portion of data base (it is among other things described by the properties: formalism, number of relations). It describes also the RR T625 which is a short and specialised text describing a view of data bases.

Reusable Resource : COMPONENT	
Code :	VE1
Name :	external view
Family :	Data Bases
Formalism:	Relational
Nbr. of rel.:	7

Fig. 3 Example of reusable resources of type portion of text and graphic

B. The Memory of Roles

For the modeling of the roles, we have used practically the same approach as for project SH_TRC. We chose internal roles and roles of connection. For the internal roles, a classification was introduced. We proposed: 1) the internal roles of field which describe the fields to which the RR belongs. 2) The roles of classification which describe the class of component of an information system to which RR belongs, and 3) the general roles which describe the specific characteristics of the RR. Fig. 4 gives an example of roles.

C. The Memory of Contexts

The modeling of the contexts is identical to that of project SH_TRC. The majority of the contexts defined in project

SH_TRC were reused. Additional contexts were introduced. They characterise the particular specifications of the projects.

Roles of domain : hydraulic, mechanics, electric, finance, education, medicine…
Roles of classification :Data_base component, software, screen component, process component, etc.
General Roles : location, make modification, descriptive text, operating mode, Modify, etc.
Connection's Roles : Adapt-on, compatible-with, used-in, described-by, describe, schematized-by, schematize, Add-component, Obligatory-composition, Optional-Composition, Specialisation-of , Generalisation-of, Reuse-in, Derived-from, Equivalence-to, Obligatory-need, Optional-need, Induction, precede, following, before, after, etc.

Fig. 4 Extraction from the memory of roles

We define for example the contexts cost_constraint which means that the case or network of case was built under a constraint of cost. Context strong_competition means that the case or network of case was built under a constraint of strong competition. These contexts are used to justify characteristics introduced in cases, for example, the use of materiel A instead of the one usually used, because it is too expensive.

D. The Memory of Cases and Scenarios of Cases

The defined cases in this memory describe the various forms of reuse of the RR. They describe situations of the type: such RR was defined in the project, it is inspired by such other resource, has points of connection with such resource, is commented by such person etc.

Creation of a view of data base	
Code :	C001
Name :	Creation of view number C001
Description :	< Text >
Reusable Res. :	VE1
Role :	Data_base component relational, medicine, imaging,
Context :	Creations of view

derivation of a view of data base	
Code :	C002
Name :	Derivation of view C002
Description :	<Text >
Reusable Res. :	VE2
Role :	Delete_relations, modify_relations, Add_relations
Context:	Derivation of view

Fig. 5 Example of CASES a) description of view, b) derivation of view

The example of the Fig. 5a describes the scenario of the creation of the resource VE1. The example of fig. 5b describes the process of derivation of the resource VE.

The example of Fig. 6 described the derivation of RR VE2 from RR VE1 with the use of connection roles.
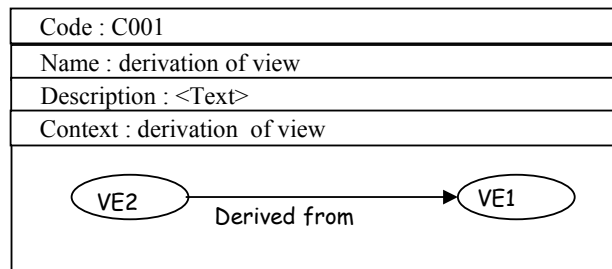

Fig. 6 Example of a scenario of cases

Fig. 7 represents the procedure P1 which calls the external view VE1, it uses the user interface E1 and a portion of the associated code is C1.
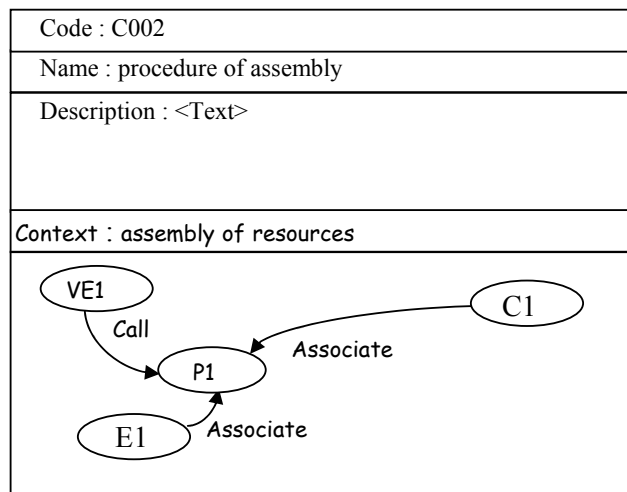

Fig. 7 Example of scenario of cases

V. ENRICHMENT OF THE ReCaRo MEMORY

The implementation of ReCaRo for the design of corporate memories made it possible to learn some lessons. On the methodological level, the stages for the design of corporate memories can be schematised by Fig. 8.

The modeling of the corporate memory is done in three steps. The first step consists in collecting all the RR of the company, the roles and the contexts. A classification of these elements is carried out. This step allows building the memory of the RR, the memory of the roles and the memory of the contexts. In the second step, we build the memory of the cases. The same approach is used: taking an inventory of the cases, classification and modelling. Taking an inventory of a case consists in taking an inventory of the RR and the roles which compose it. In the third step, we build the memory of the scenario of cases. The approach consists of taking an inventory of the cases, and the roles which compose them.
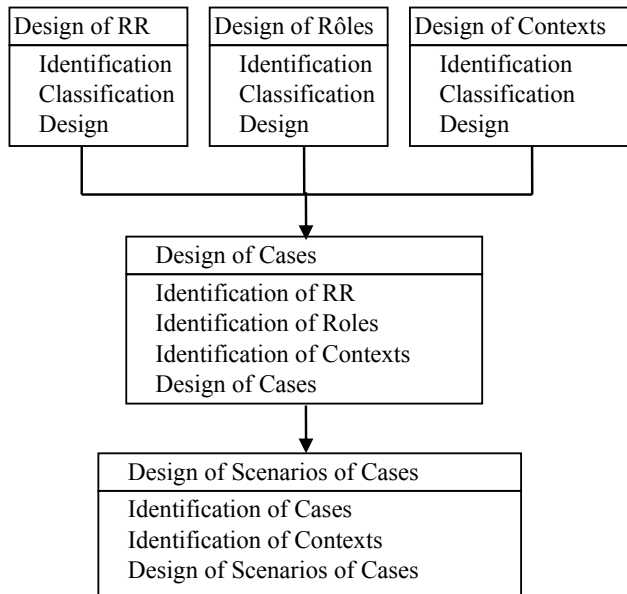
Fig. 8 Global process for the ReCaRo method

Compared to the model, the various implementations made it possible to deduce the following characteristics:

The proposed classification of knowledge (business knowledge and experience knowledge) was applied without difficulties in the two experiments.

The roles used in project SH_TRC were reused without difficulties in the Mem_Doc project. This leads us to propose an additional criterion of classification. We propose four families of roles. The first two families represent the general internal roles and the general roles of connection. The latter have a general independent semantic of the topic knowledge treated. The last two families represent the specific internal roles and the specific roles of connection. The latter have semantics particular to the field of treated knowledge. They are usable for a given field.

The description of the cases does not introduce any constraint since a case is a combination of reusable resources and roles. This combination makes it possible to describe cases of use by specifying the RR as well as the characteristics and modifications made. The scenarios of cases are a good alternative to describe the most complex situations.

VI. EXPLOITATION OF THE RECARO MEMORY

Two modes of exploitation are provided in ReCaRo.

A. The Navigation Mode

This mode makes it possible to sail in the five memories of ReCaRo. An interface (Fig. 9) posts in the shape of a tree the contents of each of the five memories. The user can develop any memory up to the level of the sheets.
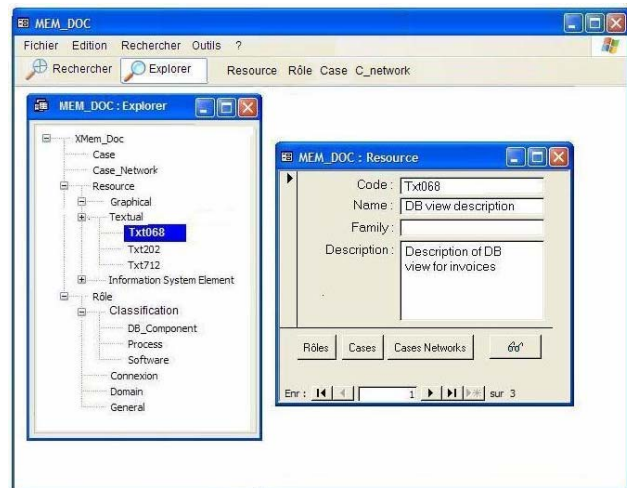

Fig. 9 The navigation mode

The sheets of the tree represent a Reusable Resource, a Role, a Context, a Case or a Network of Case. For each selected sheet, the user can consult all the capital knowledge builds around. For a Reusable Resource, it can consult it. It can consult the cases or networks of case where the reusable resource was implemented. Fig. 9 presents an example of tree of navigation.

B. The Seek Mode

In this mode, the user specifies the required elements (Reusable Resource, Role, Context, Case or Network of Cases).
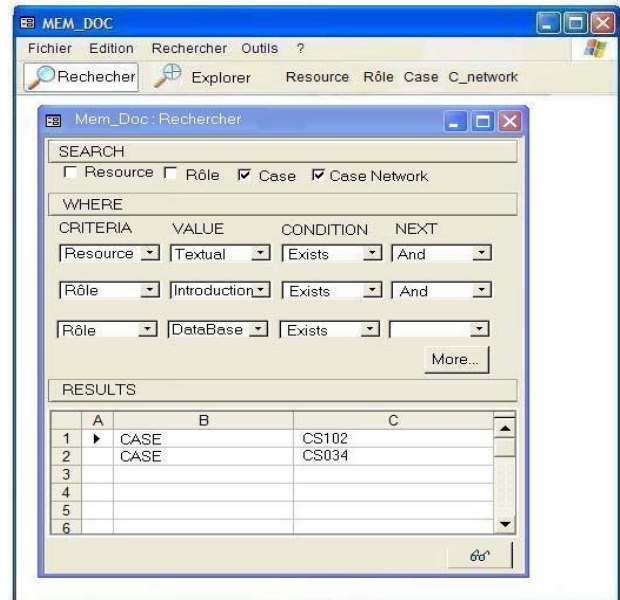

Fig. 10 The seek mode

He specifies then the search criteria. ReCaRo presents in the form of a list the whole of the found results. For example, the

search for a text describing a database view treating of the order taking will be formalized as a CASE. Figure 10 described this research.

It should be specified that research relates to the memory of the cases, and, that the case searched implements a reusable resource of type TEXTUAL. It is necessary to specify the roles which are used in this case. The roles will be used as filters. It can specify the role DATA_BASE_WIEW, to mean that the case must call upon a database view. It specifies, also, the role DESCRIPTION to mean that the case is a description, and specifies the role INVOICE to mean that the case treats order taking.

VII. CONCLUSION

In this paper, we presented a model and a methodological process for designing corporate memories based on the reuse principle. Two ideas were developed.

The first one relates to the architecture of the corporate memory. We proposed multi-memories architecture. This means that every memory developed according to the ReCaRo model will be composed of five communicating memories: the memory of the reusable resources, the memory of the roles, the memory of the cases and the scenarios of cases and the memory of the contexts.

The second idea relates to the implementation of the corporate memory. The main problem was the definition of the concept of reusable resource. For that, we initially propose to identify the key concepts of ReCaRo (RR, Rôle, Contexte) specific to the treated field. The step remains for the moment purely intuitive.

To capitalize, in the long term this work, the idea is to develop mechanisms to collect produced knowledge. In our case, this knowledge is: 1) Generic models of reusable resources: they are collected throughout the dissemination of the suggested method. These models are standardised, and given to the designers of corporate memories as reusable generic models; 2) Generic models of reusable roles: they are collected in the same way as the reusable models of resources. The models of roles are standardised and classified; and 3) Listing of the most usual roles: one could collect the roles themselves because they can be reusable in their state. Their capitalisation becomes selecting those roles, organizing them and proposing them to the users.

REFERENCES

[1] Brooking A. Corporate memory: strategies for knowledge management. London: Thom Business Press; 2000.

[2] Kingston J, Macintosh A. Knowledge Management through multi-perspective modelling: representing and distributing organizational memory. Knowledge-Based Systems 2000; Vol. 13, N 2-3: 121-131.

[3] Ackerman M.S. Augmenting organizational memory: a field study of Answer Garden. ACM Transactions on Information Systems 2000; Vol 16, N 3:203-214.

[4] Abecker A, Bernardi A, Hinkelmann K, Kuhn O,Sintek M. Toward a technology for organizational memories, IEEE Intelligent Systems 1998; May/June : 40-45.

[5] Buckingham-Shum S. Negotiating the Construction and Reconstruction of Organisational Memories. Journal of Universal Computer Science 1997; Vol. 3, No. 8: 899-928.

[6] VanHeijst G, VanDerSpek R, Kruisinga E. Organizing corporate memories. In Proceedings of workshop on Knowledge Acquisition for Knowledge-Based Systems, Alberta, Canada 1996; 87-96).

[7] Boersma J. Stegwee R. Exploring the issues of Knowledge Management. In Proc of the Information Resources Management Association International Conference 1996; 127-135.

[8] Tang-Ho L, Lamontagne L. Structuring Organizational Memories using Multi- Dimensional Knowledge Networks. In Proceedings of the EJCAI'2000.

[9] Poitou JP. La gestion collective des connaissances et la mémoire individuelle. In : J. M. Fouet, Connaissance et savoir faire en entreprise. Paris: Hermes; 1997.

[10] Pomian, J. Mémoire d'entreprise : techniques et outils pour la transmission du savoir. Paris: Sapientia; 1996.

[11] Davenport T, Prusac L. Working knowledge, how organizations manage what they know. Boston: Harvard Business School Press; 2000.

[12] Ermine JL, Barthelme F, Rosenthal-Sabroux C. Architecture for knowledge evolution in organizations. European Jnl of Oper. Research 1998; Vol. 109, No. 2: 414-427.

[13] Zdrahal Z. An Intelligent Brokering Service for Knowledge-Component Reuse on the World-Wide-Web. In Proceedings KAW, 1998.

[14] Nonaka I. Takeuchi H. The Knowledge-creating Company: How Japanese Companies Create the Dynamics of Innovation New York: Hardcover; 2002.

[15] Bushmann F. Meunier R, Ronhert H, Sommerland P, Stal M. Pattern oriented software architecture: a system of pattern. New York: John Willey and Sons; 1998.

[16] Dieng R, & Al. Méthodes et outils pour la gestion des connaissances, une approche pluridisciplinaire du knowledge management. Paris : Dunod ; 2001.

[17] Eichenbaum C, Tamissier S. Gestion des connaissances sur les réacteurs avec le système ACCORE. Document numérique 1997 ; Vol. 2, No.1.

[18] Demian P. CoMem: Design knowledge from a corporate memory. Doctoral Thesis 2004, Stanford University.

[19] Santhanam R, Sharef M. Process for corporate memory retention. Jnl Knowledge management practice 2002.

[20] Motta E, Buckingham S, Domingue J. Ontology-Driven Document Enrichment: Principles, Tools and Applications. International Journal of Human-Computer Studies 2000; Vol. 52, No. 5 : 1071-1109.