PRACE NAUKOWE AKADEMII EKONOMICZNEJ WE WROCŁAWIU
Nr 1064 2005
Pozyskiwanie wiedzy i zarządzanie wiedzą

Eunika Mercier-Laurent
Lyon 3 University CNRS, France

IMPROVING THE EFFICIENCY OF THE GLOBAL KM FLOW WITH NEW GENERATION OF AI

1. Introduction

Among all domains contributing to the development of the Knowledge Management movement, Artificial Intelligence was the first to provide specific methods and tools for knowledge acquisition, modeling, processing and effective sharing. New generation of AI blends symbolic and digital approaches for more efficient solutions.

Experience in applying the Artificial Intelligence approaches and techniques such as KADS, expert systems, case-based reasoning, constraint programming, multiagent systems to solve complex problems, shows that AI helps to preserve and explore knowledge, as well as to build collective knowledge and intelligent decision support systems. These experience shows that taking into account the human and organizational aspects such as competency, mentality, confidence, motivation, strategy and top-management involvement are vital for the success of the above applications, users and organizations. This paper explains how the AI methods and tools could be helpful in building an efficient Corporate Knowledge Flow for the Knowledge Innovation Process. As the components of the global flow computers have to be conceived as intelligent assistants of humans.

2. Global Knowledge Management®

According to our definition[1], Knowledge Management is

[1] Debra M. Amidon, Eunika Mercier-Laurent Entovation Intl

*An integrated system of **initiatives**, **methods** and **tools** designed to create an **optimal flow of knowledge** within and throughout an extended enterprise to ensure stakeholders **success**.* [24; 20].

The global KM flow takes into account the whole knowledge creation, transforming and transfert process. Three knowledge sources such as humans, documents, and computers are considered. The same knowledge can be used on different ways such as for training, decision support systems, improving manuals, innovating with clients. The KM deal is to organize, optimize and manage the whole flow with the global, systemic and holistic approach.

3. Computer as Intelligent Assistant

In my vision, *human knowledge processors* work in perfect synergy with artificial knowledge processors – computers, robots or new generation devices as PKA[2]. They learn from each other. Computers and robots help people by performing the tasks that are difficult or impossible for human to do.

Classic Information Processing approach allow to explore less then 10% of computer capability. *Knowledge thinking* [27; 28] and blendes AI helps to do better. Among all contributions to the development of the global Knowledge Management movement Computational Intelligence[3] approaches and techniques play a major role in transforming computers into intelligent assistants of humans. This kind of cyber-assistant has to be conceived and programmed to help its user in the tasks for which the computer does better than humans.

The computer (with AI) is able to manage better than human, the tasks such as: record and effectively find data, documents and information, collect and process many parameters in a very short time, build and manage collective experience, find a solution to combinatory problems such as planning, scheduling, resource allocation with constraint programming tools, provide verified information for Business Intelligence, discover knowledge from huge amounts of data and text, connect many brains and build collective intelligence.

While users are able to learn from a computer off- and on-line, computers may be programmed to learn from users and improve the program to help them better.

According to R.S. Michalski, [31] humans learn from observation, from teachers, by doing (together or by trial and error), from other's experience. It could be the same for computers using Multistrategy Machine Learning methods [32].

The process of learning requires the **knowledge transfer**, which can be:

---

[2] Personal Knowledge Assistant

[3] More accurate name for Artificial Intelligence proposed by Ryszard S. Michalski from GMU, Washington.

- From human to human (storytelling, coaching, action learning).
- From document to human (understanding, learning, appropriation).
- From human to computer (through knowledge modeling).
- From computer to human (reasoning, appropriation).

The quality of transfered knowledge depends on a capacity of humans to communicate in a given context and on the choice of relevant knowledge models. At this stage the worldwide experience in bulding expert systems and other knowledge-based systems is useful to understand what was wrong in knowledge transfer methods [8; 19; 20].

3.1. Knowledge thinking approach

Many KM practioners work still in *tool push* mode. The use of knowledge is limited by the tool fonctionalities.

Thinking before doing and understanding a given problem in its large context before choosing a tool is vital[4].

Some questions to ask :

- What kind of knowledge the extended enterprise needs to share and for what?
- Who needs knowledge ?
- Who knows (individual and collective) ?
- What is already done ?
- How to organize this knowledge (what kind of applications) ?
- What are the best knowledge models for efficient share and reuse ?

This approach helps to derive the best from computers capacity.

The Figure 1. shows our knowledge-oriented approach applied to applications design.

The given problem is analyzed taking into account the environment including users, existing applications, knowledge, competency and strategy. The main goal is to discover the real needs and validate the new fonctions that technology can bring.

This approach, that we call *needs engineering*, takes into account the years of experience worldwide in knowledge acquisition, modeling and complex problem solving [2; 8; 9; 12; 14; 17; 20; 23; 24; 30].

A given solution is a part of the global knowledge flow and it is always accepted because we involve the users in the solution defining and designing.

To define and develop an effective knowledge flow, the user's needs have to be considered within a *holistic* approach [16] : the needs of an individual who is a part of an organization and of society.

---

[4] *Understanding the problem is the 80% of a solution* Eunika Mercier-Laurent

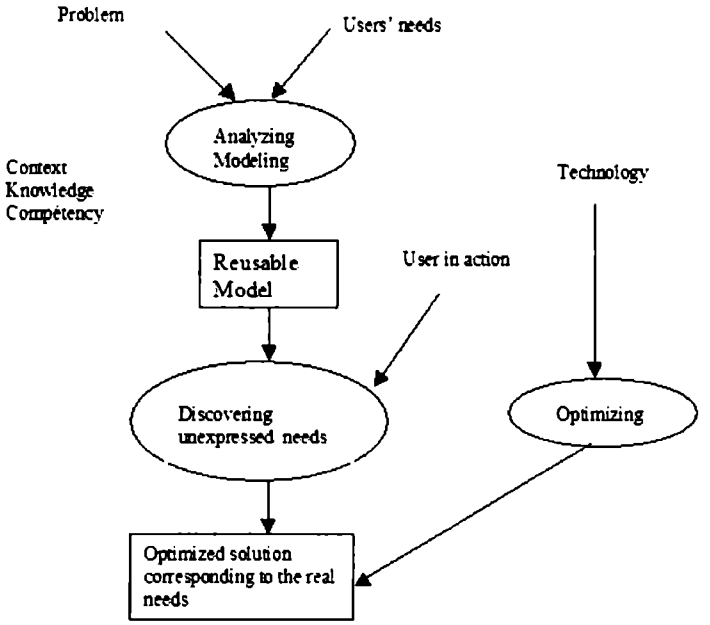
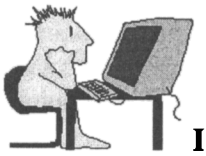


Fig. 1.



Individual Assistant

Personal computer have to be easy to use for everyone and provide services to the user. It could be able to verify the coherence of multiple sources of information, to "read and understand" the emails and documents, answer the easy emails, check my agenda, make un abstract in function of my interest. It could also inform me about the new books, articles, events interesting for me. It should learn by discovery, by analogy, by observation (tacit knowledge), be able to solve complex problems, to help me in diagnostic of equipements or in medical diagnostic, to organize and find documents, to make translation in real time, to help me in the designing of documents and products, to provide an access to collective experience, but also to tell me jokes. It could help me to innovate by verifying if my new idea is already known somewhere in the world. It could be also an

automower, cleaner, storytelling machine..or embedded car navigation system including real time information on the weather, hotels, restaurants...

Some important functionalities are:

- intelligent and intuitive interface with intelligent graphic objects, voice (signal processing), handwriting (forms recognition), tool for easy drawing..
- user-to-external world communication – easy navigation using knowledge models (KADS, ontologies, concept/relation..),
- activity manager (ex. travel or meeting organization),
- knowledge model based document design and retrieval (ontologies, conceptual models, multiagent systems,...)
- easy notes taking (ex. Ideliance a french software based on hierarchicaly organized entity relation model provides graphic representation of notes and natural languge inquiry. It can be used as individual or shared tool)
- decision support systems (CBR[5], expert systems, ANN[6], cause-to-effect...)

Individual user is a part of enterprise and society.

Computer in The Enterprise/Organization System

As a holon [16] being a part of a larger system, individual computers are a part of an extended enterprise [1; 2; 28] or organization knowledge flow. In this context all involved computers (individual and servers) have to help all participants of the knowledge flow internal and external [24].

Enterprise invents, produces or transforms and sales products or/and services to the clients. All enterprise activities such as R&D, management, marketing, design, sales, after sales services, maintenance, finances, human resources management, training, logistics are knowledge-intensive.

The large international enterprises have also the departments such as: Quality, Communication, Industrial Property, Business Intelligence in function of managerial method applied. Several activities are transversal, as for example Information Systems, Document Management, Project Management, Ideas Management, Training, Innovation with Customers and Partners.

The global innovation[7] process goal is to manage all enterprise activities in an innovative way.

---

[5] Case-based Reasoning

[6] Artificial Neural Nets

[7] *from idea to success* for all contributors (E. Mercier-Laurent definition of sustainable global innovation)

All knowledge processors as well human as computers or other devices are involved in the global innovation process which efficiency strongly depends on how the flow of knowledge is organized, optimized and managed. Main approches are from problem solving to whole flow, middle-up-down and stategic [24; 28].

Today enterprises have a lot of separate IT applications for each professional such as CAD, CAM, e-training, supply management. Usually the enterprise data are in the Data Warehouse, organized using *data approach*. The ERP software helps to store data, the same as CRM does. CRM is useful for sales engineer, but is not able to replace the real H2H[8] relation with customers. We learn a lot and discover needs listening to the customers and knowing them. All this software is made for IT specialist and remain difficult to use by an end-user. The same or similar data appear several times in the different enterprise data bases. Face to difficulty in filing the large data bases, the users build their owns, better adapted to their activity.

In the large enterprises there are a lot of websites built for the specific needs. This way of working on individual base is time, energy and money wasting.

Global Knowledge flow for the extended enterprise

The Figure 2 shows our first experience-based architecture of the global knowledge flow.

This approach was born from several years of worldwide experience in solving enterprise problems using AI. It was applied to MNEMOS system, to organize the flow of technical knowledge and competency in the domains such as electronics, data processing, physics, and satellites. One of the goals was to help commercial engineer in the elaboration of tenders' offers.

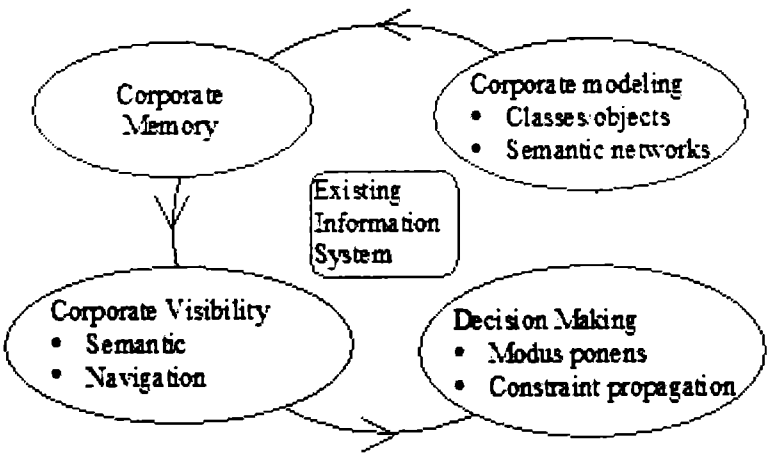


Fig. 2. Corporate Knowledge (CEDIAG 1991)

[8] Human to human

New generation of AI provide now more possibilities for knowledge modeling and reasoning, such as hierarchically organized concepts, cases, multiagents systems, graphs, ontologies, genetic algorithms, reasoning models and blended solutions including several techniques.

Computers designed and programmed using knowledge approach could offer following services for the participants of the global knowledge flow:

Knowledge model-based portals and websites [41].

Intelligent support for effective navigation and finding of information and knowledge based on conceptual knowledge modeling. It can use blended electronic and software solutions as for example TREFLE natural language processing microprocessor for intelligent information retrieval [40] or website architecture based on KADS[9] knowledge models [41], semantic web [38, 42] blending semantic nets, ontology and natural language processing).

Knowledge discovery in data bases and texts (with multistrategy machine learning, ANN, genetic algorithms...) useful for Business Intelligence, Marketing, expert finding from text..

Automated indexing and retrieval of multimedia documents (Mediaworks) using the hybrid indexing and retrieval engine blending the multiagent systems, ontologies, natural language processing and machine learning techniques.

Problem solving and decision support systems based on collective knowledge and experiences for

- diagnostic and maintenance of computers, planes engines, networks, automation, cars, robots, nuclear plant, blast furnace...(experts systems, CBR, cause to effect graphs)
- help desk (CBR)
- collective experience management (CBR)
- configuration of complex products as trucks, planes, lifts (expert systems)
- process control for blast furnaces [8] and Formule 1 racing car with Corelation Studio http://costudio.inway.fr/

Intellectual capital management: resources allocation and management (expert systems + constraint programming, CBR),

Logistics (constraint programming),

Document (patents) analysis (natural language programming, machine learning, text mining techniques)

E-training (intelligent advisors, virtual reality),

Image processing (forms recognition with neural nets), **simulation**

Design and codesign of documents and products (knowledge modeling, CBR, Natural language processing, ontologies),

Innovation management (CBR),

---

[9] Knowledge Acquisition Design System

Sales amplifier (intelligent e-business with fuzzy matching of offer and demand, configurator, catalogue, capture of visitors' knowledge),

Intelligent FAQ[10] processing with CBR and natural language processing for direct finding the right answer.

Computer for Society

One of the first roles of computer was game box, accounting assistant and writing machine.

Internet and technological progress offer now a lot of services and access to the world knowledge. Thanks to computers we can still play, but also to see a movie, listen to the music, find information, learn, buy on line, find a job, visit a museum, exposition, travel to the space (simulation), ask an administrative document, pay taxes on-line, discuss, ask advice to an interest group, give a citizen opinion...

The image processing techniques are used for games, movies and virtual reality. The large possibilities of AI are not really included to the image processing yet.

Terminal computers, cellular telephones and PDAs allow the large public to be informed, to buy a train ticket, register for plane, visit an exposition, got the information about a museum. They could be also more "intelligent"

KM for society

The above picture represents the Estonian government at work. Citizens can give their opinion in the real time, suggest a changes, laws, services.

Two years ago the Entovation Intl[11] launched the concept of the Knowledge Cities and Knowledge Regions. We suggest to organize city and region knowledge to the knowledge flow. This flow brings together the citizens, enterprises, authorities, gouvernment...The main goal is to make work all involved together and share knowledge and experience for the sustainability of the towns, regions, countries and world. In this context AI approaches and techniques helps to organize the city, region or a country knowledge.

Some exemples of services could be improved with AI:

- **Fuzzy matching of offer and demand** (CBR) for e-business, job, flat, service, travel finding,

---

[10] Frequent Asked Questions

[11] www.entovation.com

- **Intelligent travel booking** system able to find the best offer (itinerary, time, price) and take into account the client constraints (CBR, constraint programming, reasoning models),
- **Help desk** service on-line (NLP[12] + CBR),
- **Education on-line** and educational games using strategy, reasoning, learning by doing, problem solving. Collective games, decision taking based on knowledge learnt during the game,
- **Effective search engines** (semantic web),
- **Intelligent bank services** with alarm generation by email, optimized placement (with prediction), services adapted to the client needs,
- Chat and forum **knowledge capitalization** with automatic answer if the question was already asked...,
- **Security management** (image procesing, voice recognition...).

Perspectives

Introducing the above intelligent services included to the global knowledge flow for individuals, enterprises and society has an influence on behaviours, economic and social conditions. The ethics is also important. Instead of sending a cookie to someone's computer before serving him/her it is certainly better to uderstand what he/she is looking for and how to help him/her. To discover the knowledge on consumers and the consumers knowledge it is possible to use classic inquiry or ask the open questions and analyze the answers using natural language processing and machine learning techniques. What future for professionals of traditional paper agenda, alarm clock, calculators? How to influence them through the global knowledge flow to evolve before to be unemployed? How to create the world collective experiences and use them to solve health, ecologic or society problems? How to valuate the know-how? How to find a competence, an expert ? Computer technology evolve very quickly, how to reuse the old computers components? How to avoid every kind of pollution, intellectual pollution included?

How computers can help to fight with unemployment, delinquency or terrorism?

To avoid the waste of energy, time and money when using the classic data oriented approach, it is certainly better to switch from the classic mental schemas to the knowledge oriented thinking. The best way to improve the AI approches and techniques is to apply them and learn from experience. New methods and tools will be invented quicker by the problem-driven research.

If you wish to know more about our experience and ideas for applied research please contact eml@wanadoo.fr

---

[12] Natural Language Processing

References

[1] Amidon D.M. (1997), *Innovation Strategy for The Knowledge Economy*, Butterworth Heinemann.

[2] Amidon D.M., Formica P., Mercier-Laurent E. (2004), *Knowledge Economics: Principles, Practice and Policy*, Tartu University Press.

[3] Auriol E. (1995), *Intégration d'approches symboliques pour le raisonnement à partir d'exemples. Induction et raisonnement par cas dans le diagnostic technique*, PhD Paris IX Dauphine.

[4] Auriol E., Manago M. (1996), *Mining for OR*, ERMS today, February, pp. 28-32.

[5] Benoit M. (1991), *RAMSES – Le Système de Sécurité de Jeux Olympiques d'Albertville*, rapport de stage IMAC.

[6] Chandrasekeran B. (1983), *Towards a Taxonomy of Problem Solving Types, AI Magazine* IV–1.

[7] Clancey W.J. (1985), *Heuristic Classification*, Artificial Intelligence, 27.

[8] Dolenc N., Libralesso J.M., Thirion C., Gobrecht A., Lesaffre F.M., Hellelsen M., Lalhier M., Lenuet D., Steller J.M. (1996), *The SACHEM Project: Blast Furnace Operating Support System; Ambition and Stakes, Development and First Results*, 3rd European Ironmaking Congress, 16-18 September Gent, Belgium.

[9] Dourgnon-Hanoune A., Porcheron M.R. (1996), *Méthodes d'intelligence Artificielle pour le diagnostic*, Revue Française de Mécanique, No 4.

[10] Ferber J., *Multi-agents systems*, [http://www.multiagent.com/].

[11] Fischer P., Layter F., *Decision Adviser La propagation de contraintes au service des décideurs.*

[12] Flores J.C. (2002)m *La Administración del Conocimiento e Innovación*, La Administración de las PYMES para América Latina Barragán *et al*, (Ed.) Trillas Mexico.

[13] Funnemark E. (2001), *Guidance Document for Design*, operation and use of safety, health and environment databases. *ESReDA Series.*

[14] Geraud N., Rincel P., Vandois N. (1990), *ARAMIS-GM Un système intelligent d'aide à la décision pour la gestion des effectifs de Gendarmerie Mobile*, Systèmes Experts et leurs Applications, Avignon.

[15] INRECA [http://www.cordis.lu/esprit/src/22196.htm].

[16] Koestler A. (1967). *Ghost in the Machine.*

[17] Lancini A., Mercier-Laurent E. (1999), *Traffic Road Accidents Return on Experience. Discovering, Organizing and Sharing Knowledge to Minimize Risks and Costs in a Mutual Insurance Company.* ISMICK.

[18] Marshall J., Jones J. (2000), *Reliability enhancement methodology and modelling*, The reliability review. *The R&M Engineering Journal*, ASQ.

[19] Mercier-Laurent E., *Méthodologie de développement de systèmes à base de connaissance*, Expersys 93, Paris.

[20] Mercier-Laurent E. (1995), *Methodology for Problem Solving using AI*, Expersys, San Francisco.

[21] Mercier-Laurent E. (1992), *EDEN diagnosis Expert System Environment*, Expersys, Paris.

[22] Mercier-Laurent E. (1993), *Open KADS Methodology and Workbench for Knowledge Based Systems*, Expersys.

[23] Mercier-Laurent E. (1996), *Knowledge Management – Some Industrial Examples*, Expersys, Paris.

[24] Mercier-Laurent E. (1997), *Global Knowledge Management Beginning from Website – How to Organize the Flow of Knowledge in an International Company -Theories and Practice*, ISMICK 97, Compiegne.

[25] Mercier-Laurent E. (1998), *Web and Knowledge Management process*, Knowledge Discovery from Data Bases, Wroclaw, Poland.

[26] Jakubczyc J., Mercier-Laurent E., Owoc M., *What is Knowledge Management?* Knowledge Discovery from Data Bases 1999, Akademia Ekonomiczna, Wroclaw, Poland.

[27] Mercier-Laurent E., L'approche *connaissance* appliquée au retour d'expérience, EGC 2003
[28] Mercier-Laurent E. (2003a), *Organization and Processing of "best practice". Knowledge Approach to Database Creating and Exploring*, KAM'2003, Turawa, Poland.
[29] Mercier-Laurent E. (2003b), *Innovation à partir de connaissances*, Technology International [http://www.adit.fr].
[30] Mercier-Laurent E., Baudin M. (1995), *Maintenance of Plane's Engines using CBR*, Expersys, San Francisco.
[31] Michalski R.S. (1988), *Machine learning*, vol. 1, Morgan & Kaufmann.
[32] Michalski R.S. (1994), *"Inferential Theory of Learning: Developing Foundations for Multistrategy Learning"*, in Michalski, R.S. and Tecuci, G. (eds.), Machine Learning: A Multistrategy Approach, vol. IV, Morgan Kaufmann, San Mateo, CA, 1994.
[33] MNEMOS Eureka project 1993
[34] Mondeca [http://www.mondeca.com].
[35] Newel A. (1982), *The Knowledge Level*, Artificial Intelligence, 18.
[36] Newell A., Simon H.A. (1972), *Human Problem Solving*, Prentice Hall.
[37] Roche C. (2002), *Ontologies – Mythe ou Réalité*, EGC.
[38] Rohmer J. (2003), *Comment faire coopérer le Web Sémantique avec les systèmes traditionnels de l'entreprise*, Journée Industrielle sur le Web Sémantique, Plate-forme AFIA 2003, Laval.
[39] Schreiber G., Wielinga B., Breuker J. (1993), *KADS, A Principled Approach to Knowledge-Based System Developpment*, Academic Press.
[40] Supik E. (1980), *Réalisation de communications dans un processeur de consultation de données textuelles* PhD, INRIA.
[41] Verbeck F., Gaye R., *Open Kads & Hypertext*, Bull 1996.
[42] *Web sémantique*, Dossier Bulletin AFIA n° 54, 2004.
[43] Wiener N., *Men, Machines, and the World About*, box 13, folder 750, Norbert Wiener Papers, Collection MC-22, Institute Archives and Special Collections, Massachusetts Institute of Technology Archives.
[44] Wiig K. (2004), *People-Focused Knowledge Mangement*, Elsevier.
[45] Xerox [http://www.xrce.xerox.com/competencies/content-analysis/past-projects/dmhead/home.en.html].

POPRAWA WYDAJNOŚCI GLOBALNYCH SYSTEMÓW ZARZĄDZANIA WIEDZĄ Z WYKORZYSTANIEM SYSTEMÓW SZTUCZNEJ INTELIGENCJI NOWEJ GENERACJI

Streszczenie

Artykuł oparty jest na prawie 20 latach doświadczeń w rozwiązywaniu trudnych problemów przemysłowych przy pomocy metod i technik sztucznej inteligencji symbolicznej i cyfrowej. Przedstawia on przepis na budowę inteligentnych komputerów do wspomagania globalnego procesu zarządzania wiedzą. W artykule przedstawione zostały trzy punkty widzenia: indywidualny, organizacji i społeczeństwa, zgodnie z naszą metodą holistyczną. Podajemy kilka przykładów zastosowań. W naszej przyszłościowej wizji uwzględniamy problem symbiozy komputera z użytkownikiem. W części końcowej podajemy kilka perspektyw i pomysłów wykorzystanych w badaniach naukowych.