Findings from the Florida Artificial Intelligence Research Symposium (FLAIRS) Knowledge Management Track

Dr. Irma Becerra-Fernandez
Florida International University
Decision Sciences and Information Systems
College of Business Administration
University Park Campus, BA 256A
Miami, FL 33199, becferi@fiu.edu
(305) 348-3278, (305) 348-3476 fax

Abstract

This paper presents a summary of the invited presentations at the 1999 Florida Artificial Intelligence Research Symposium (FLAIRS) Knowledge Management (KM) track. This track focuses on the effective design and development of state of the art KM applications. The goal of this track is to continue a long-term effort in integrating works that address important issues and current unsolved problems with regard to research in KM, and publicizing the contribution of AI in KM by maintaining contacts and advertising sharable resources (mailing list, archives, Web site, etc.). Furthermore this track attempts to determine what is common in all Knowledge Management domains so that the KM community can further this work. It has been observed that KM Systems underway at most organizations fall into three categories: Educational KM systems, Knowledge repositories, and Problem solving KM systems. State of the art applications in all three categories were presented in this track. The applications presented included an invited presentation on a research tool to elicit and capture the knowledge of experts, a paper on the development of an application to identify experts in the State of Florida State University System, and a paper on the use of Conversational Case-Based Reasoning for Problem-Solving Knowledge Management Systems. Finally, the track included an invited presentation describing KM initiatives at NASA-Kennedy Space Center.

Introduction to Knowledge Management Systems

Knowledge Management (KM) is an increasingly important new business movement that promotes the creation, sharing, and leveraging of knowledge within an organization to maximize business results. Today's environment renders new skills obsolete in a matter of years or months. Loss of knowledge is a problem that companies must address, even when they are not faced with the threat of downsizing. For example, many information technology-consulting firms currently face a 10% annual turnover, even when revenues are growing by 30% per year (Reimus, 1997). Therefore, assuming constant revenue per professional employee, a growing information technology-consulting firm of 100 would need to add 40 new professionals (10 due to turnover, 30 due to revenue growth) the following year. The percentage of professionals with less than two years tenure in the firm is 30.8%. In other words, at any point in time, 30.8% of the firm's knowledge workers lack sufficient depth in organizational-specific knowledge. Therefore, effective tools for eliciting, capturing and leveraging knowledge are essential for organizations to maintain their competitive edge.

Because of the increasing importance of Knowledge Management as a business movement, it has become increasingly critical to differentiate between three words often confused: Data, Information, and Knowledge. To distinguish between the three, we adhere to Zachman's (1997) definition of Data, Information and Knowledge:

1. Data is comprised of facts.
2. Information is data in context – its meaning depends on the usage.
3. Knowledge is information with direction or intent – thus, it facilitates a decision or action.

Several definitions for Knowledge Management abound in the literature today, among them (Becerra-Fernadez et.al. 1998a):

1. "Getting the knowledge from 'people who have done it' documented and available across the enterprise…as it was done by the team who did it" (Gundry & Metes, 1996).
2. An important new business movement that advocates the creation, sharing, and leveraging of knowledge within an organization to maximize business results (Milagro, 1997).
3. Creating the opportunities for private knowledge to be made public and tacit knowledge to be made explicit (Stewart, 1995).
4. Creation, acquisition and transfer of knowledge and modification of organizational behavior to reflect new knowledge and insights (Garvin, 1994).
5. Process whereby organizational knowledge is elicited and catalogued into a System that facilitates its re-use (Becerra-Fernandez, 1999a)

Knowledge Management in general tries to organize and make available important know-how, wherever and

whenever it is needed (Becerra-Fernandez et. al. 1998b). This includes processes, procedures, patents, reference works, formulas, "best practices", forecasts, and fixes. Technologically, Intranets, GroupWare, data warehouses, networks, bulletin boards, and video-conferencing are key tools for storing and distributing this intelligence (Maglitta, 1996).

It has been observed that KM systems underway at most organizations fall into three categories (Becerra-Fernandez, 1999a):

1. Educational Knowledge Management Systems: To elicit and catalog tacit knowledge, and at the same time serve as an educational tool.
2. Knowledge Repositories: The majority of the KM systems in place. Under the auspices of KM tools historically used for singular unrelated purposes are integrated to address the Corporate Memory problem.
3. Problem-Solving KM Systems: Organizations with significant intellectual capital require eliciting and capturing knowledge for reuse in solving new problems as well as recurring old problems. New problems could be similar to old problems or even consist of a combination of old problems. In order to solve a new problem, users can benefit from identifying and analyzing a previous solution to an old problem, provided one can identify a relativity criteria between the old and the new problem.

All of these Knowledge Management Systems can achieve significant savings in time and capital. During our KM track at the FLAIRS, we discussed examples of the three kinds of KM Systems. A complete description of each of these Knowledge Management Systems can be found in the conference proceedings.

The FLAIRs Knowledge Management Track

This paper presents a summary of the papers introduced at the 1999 Florida Artificial Intelligence Research Symposium (FLAIRS) Knowledge Management (KM) track. The focus of this track is on the effective design and development of state of the art KM applications. This track includes research in related topics including cultural implications in creating a "knowledge sharing" environment versus one of "knowledge-is-power". Topics of interest include all aspects of relevant to KM, including related AI applications based on traditional AI methods such as Case-Based-Reasoning, neural networks, knowledge representation, reasoning, knowledge engineering, cognitive issues, validation of knowledge repositories, etc. Papers discussed the topics of design, development and use of KM.

The goal of this track is to continue a long-term effort in integrating works that address important issues and current unsolved problems with regard to research in KM, publicizing the contribution of AI in KM by maintaining contacts and advertising sharable resources (mailing list, archives, Web site, etc.) and determining what is common in all Knowledge Management domains so that the KM community can further this work

Educational Knowledge Management Systems

Canas and Ford were invited to present talk on the use of a tool that allows eliciting and capturing the knowledge of experts, particularly the knowledge that might be lost during downsizing. The Concept Map-based Browser (Ford et. al., 1996) was developed at the Institute for Human and Machine Cognition (IHMC) at the University of West Florida (UWF). The navigation problem, an important concern in hypermedia systems, is alleviated by the use of concept maps, which serve to guide in the traversal of logical linkages among clusters of related objects. Concept maps are assimilation theory's major methodological tools. Assimilation theory is essentially a cognitive learning theory that has been applied to education. The implementation of knowledge acquisition tools in conjunction with a Concept Map-based Browser and its application, to a specific domain of knowledge allows the elicitation and representation of the domain expert's knowledge in a browsable form. This will allow the user to "navigate" through a multimedia model (digital video, text, audio, pictures, etc.) that represents the expert domain knowledge. The Concept Map-based Browser permits video, animation, text, speech, and other mediating representations to be integrated for presentation. A previous related project at NASA Lewis Research Center (Coffey, Moreman, & Dyer, 1999) was presented, which involved the use of the IHMC Concept Map-based Browser to preserve Senior Engineers' knowledge of launch vehicle systems integration with regard to the Centaur/RL-10 rocket system.

Knowledge Repositories

Becerra-Fernandez (1999b) presented a paper on the development of SAGE: Searchable Answer Generating Environment. In-depth examination of current KM projects revealed the largest percent of KM projects attempting to create some kind of a knowledge repository. Current studies identify three types of knowledge repositories (Davenport et. al., 1997a):

a. In the first type of knowledge repository, organizational knowledge existed in some kind of explicit form, typically highly structured documents,

for example systems to store marketing-oriented documents.

b. The second type of knowledge repository consisted of developing less structured databases of employees' insights and observations. These projects are typically called "discussion databases" or "lessons-learned systems".

c. Finally, the third type of knowledge repository attempts to manage organizational knowledge by storing pointers of those who have specific knowledge within the organization.

In this paper the author discusses the third type of Knowledge Repository. To know who and where are the experts is one of the most challenging activities organizations face. The purpose of the SAGE application is to create a repository of experts in the State of Florida (FL) State University System (SUS). This application creates one single web-enabled repository, which can be searched in a number of ways including research topic, investigator name, funding agency, or university. SAGE is a repository of Intellectual Capital within the state of FL SUS; helping locate FL SUS researchers for collaboration with industry and federal agencies, thus increasing the potential for research funding to the SUS. SAGE also enhances communication and allows more visibility for FL SUS experts, making universities more marketable while combing and unifying existing data from multiple sources into one user web-accessible interface. The SAGE system addresses an important KM problem: giving a user access to distributed knowledge, through a web-based Graphical User Interface. The development of the SAGE application was funded through the NASA/Florida Minority Institution Entrepreneurial Partnership (FMIEP) grant.

Problem Solving KM Systems

Becerra-Fernandez and Aha (1999c) presented a paper on the use of Converstional Case-Based Reasoning for Problem-Solving Knowledge Management Systems. Case Based Reasoning (CBR) is an intelligent systems methodology that enables information managers to increase efficiency and reduce cost by substantially automating processes (i.e., diagnosis, scheduling, or design). This paper discusses the application of the NaCoDAE Conversational CBR (CCBR) system for this process. NaCoDAE is a software package developed at the Navy Center for Applied Research in Artificial Intelligence. It uses CCBR technology to store cases, questions, and actions; and has a built-in method that efficiently searches for the most relevant cases. By identifying and ranking the relevance between a new case and previously encountered cases (i.e., stored in the case base), CCBR systems can capture and share all of an organization's related knowledge capital for future use, and knowledge recycling can optimize resources spent on research and development. Unfamiliar cases are solved and documented by retrieving and adapting solutions from similar stored cases. A sample application based in NaCoDAE CCBR was presented, a proposed Knowledge Management System designed to enhance the NASA-KSC Shuttle Processing Out-of-Family Disposition process. The Shuttle Processing Out-of-Family Disposition process addresses any operation or performance outside expected range or one that has not previously been experienced. CCBR technology can yield productive results by transforming problem report and interim problem report related documentation into explicit knowledge that can be reused to obtain solutions for new anomalies. Applying CCBR technology to the Out-of-Family Disposition process can transform the organization into a *learning organization* that continues to grow in intellectual capital and related applied knowledge.

Knowledge Management at Kennedy Space Center

Freeman was invited to present a talk on the National Aeronautics and Space Administration (NASA) Kennedy Space Center (KSC). KSC plans to explore and deploy Knowledge Management. The imminent plans are the result of the current environment of downsizing and re-definition of work prevalent in most federal agencies today. Freeman discussed the emerging Intelligent Systems Program and its aim to develop methodologies for managing knowledge via a series of pilot projects throughout the Center. One of the pilot projects currently underway is an intelligent advisory system to support operations. Freeman presented some of the many different kinds of models to capture knowledge under development at KSC.

Conclusion

Many organizations depend on decision-makers to create "mission critical" decisions that are grounded on inputs from various areas. The typical decision-maker has a deep understanding of specific domains that affect the decision-making process combined with the experience that permits the individual to react immediately and decisively on the knowledge. A prominent decision-maker has also gained extensive experience and implicit knowledge from years of work in such domains. An advancing trend today is downsizing, many organizations

make a conscious decision to downsize in order to cut back spending and better compete in an increasingly aggressive market. Among the many side effects of downsizing is the dissipation of "Knowledge Resources" within organizations; hence, organizations end up devitalized, that is, there is a decrease in morale, commitment, quality, teamwork, productivity and innovation. Knowledge Management (KM) is an increasingly important new commercial movement that supports the formation, distribution, and leveraging of knowledge and information within an organization to capitalize on business results. Loss of knowledge is a predicament that businesses must address, even when they are not confronted with the threat of downsizing. To conserve the existing knowledge, a practical Knowledge Management System demands that it be obtained/produced, shared, regulated, and leveraged by a steady conglomeration of individuals, process, information technology applications, and organizational culture.

References

Becerra-Fernandez, I., (1997). "Methodology to Harvest Intellectual Capital at KSC". KSC Research & Technology 1997 Annual Report.

Becerra-Fernandez, I., Riedel, J., & Lee, T. (1998a, February). Knowledge Management: Redefining Corporate Assets. In Proceedings of the Seventh International Conference on Management of Technology Conference. Orlando, Florida.

Becerra-Fernandez, I., (1998b, April). Center for Innovation and Knowledge Management. Association for Computer Machinery SIGGROUP Bulletin, special Issue on Knowledge Management "Knowledge Management at Work", 19 (1), 46-51.

Becerra-Fernandez, I., (1999a, March) In Proceedings of the International Knowledge Management Executive Summit (IKMS'99), San Diego, California.

Becerra-Fernandez, I. (1999b, May) Searchable Answer Generating Environment (SAGE): A Knowledge Management System for Searching for Experts in Florida in Proceedings of the 1999 Florida Artificial Intelligence Research Symposium (FLAIRS), Orlando Florida .

Becerra-Fernandez, I. and Aha, D. (1999c, May) Case-Based Problem Solving for Knowledge Management Systems in Proceedings of the 1999 Florida Artificial Intelligence Research Symposium (FLAIRS), Orlando Florida.

Coffey, J., Moreman, d., and Dyer, J. 1999. Institutional memory preservation at NASA Lewis Research Center. In Proceedings of the HBCU/OMU Research Conference.

Ford, K.M., Coffey, J.W., Canas A.J., Andrews, E.J. & Turner, C.W. (1996) Diagnosis and Explanation by a Nuclear Cardiology Expert System, *International Journal of Expert Systems*, 9, pp. 499-506.