

Chapter XXVI

Technology Trends in Knowledge Management Tools

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ABSTRACT

A large number of tools are available in the software industry to support different aspects of knowledge management (KM). Some comprehensive applications and vendors try to offer global solutions to KM needs; other tools are highly specialized. In this paper, state-of-the-art KM tools grouped by specific classification areas and functionalities are described. Trends and integration efforts are detailed with a focus on identifying current and future software and market evolution.

BACKGROUND AND DEFINITIONS: A FOCUS ON PEOPLE AND CONTEXT

This paper focuses on presenting the variety of tools currently available to support KM initiatives and discusses trends in the vendors' arena. However, there are many definitions of knowledge (financial, human resources, information systems, organizational behavior, and strategic management-based definitions) (Alavi & Leidner, 1999) that have resulted in equally many definitions of KM (Davenport & Prusak, 1998; Jennex, 2005). There are many definitions of knowledge (financial, human resources, information systems,

Table 1. Knowledge and context relationships

Relationships	Definitions	Examples
$K = I \times U$ where K = Knowledge I = Information U = Use	Knowledge <i>(Interiorized information put to action)</i> ↑	I am in Paris today (<i>user context</i>) ↓ I am going to wear a coat.
$I = D \times C$ where I = Information D = Data C = Context	Information <i>(Data in context)</i> ↑	The temperature is 10 ^o Celsius today in Paris
	Data <i>(Raw facts)</i>	10 ^o Celsius

organizational behavior, and strategic management-based definitions) (Alavi and Leidner, 1999) that have resulted in equally many definitions of knowledge management (KM) (Davenport and Prusak, 1998; Jennex, 2005). This paper focuses on presenting the variety of tools currently available to support KM initiatives and discusses trends in the vendors’ arena. To place the discussion and classification of the tools within the specific framework and organizational view embraced by the authors, an operational definition of knowledge as *information accumulated and assimilated to implement a specific action* is used. Information is *data within a specific context* and data is the *raw facts, without context* (Binney, 2001; Cohen, 1998; Davenport & Harris, 2001). Table 1 summarizes the relationships among the definitions and provides a practical example to illustrate the link between data, information, and knowledge.

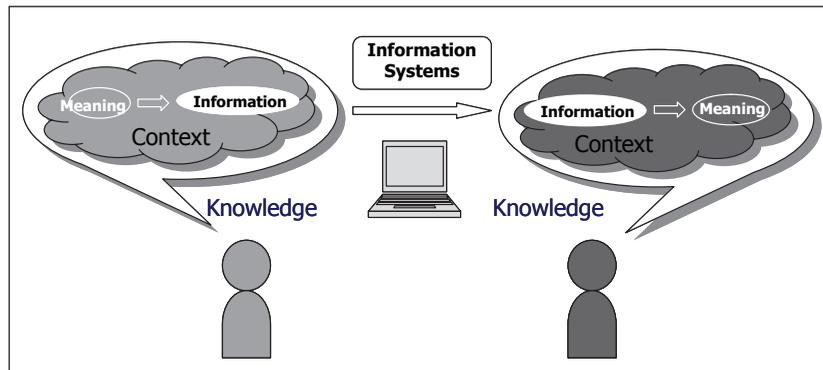
The example in Table 1 embeds a clear distinction: information is not transformed into knowledge unless it is accumulated, learned, and internalized by individuals. In addition, it needs to be translated into specific actions. The transformation of information into knowledge is

mediated by the “individual actor,” who adds value to information by creating knowledge (Davenport & De Long, 1998; Kwan & Cheung, 2006). Thus, knowledge is strictly linked and connected to the individual (or group) who creates it, which may cast doubts on the ability of information systems tools to effectively support KM and perhaps explain some of the failures of the early tools (Biloslavo, 2005; Chua & Lam, 2005).

It follows that the “visible” part of knowledge—what the literature calls explicit as opposed to the tacit dimension of knowledge (Polanyi, 1966)—is only information regardless of the amount of other individual or project knowledge embedded into it. Therefore, the tools to collect, catalogue, organize, and share knowledge can only transfer information (the explicit knowledge) embedded in various forms and types of documents and media. When the transferred information is put back in the context of the individual recipient, its re-transformation occurs when the object of the transfer is put into action.

Figure 1 diagrams this distinction, giving to information systems a specific transfer or transportation role, rather than a substantial knowledge creation capability. Based on the definitions presented in Table 1, the roles of information management and KM are clearly distinct, even if

Figure 1. Information systems and knowledge transfer



interconnected. The tools for information management are focused on data and information transfer; the tools for KM are focused on assimilation, comprehension, and learning of the information by individuals who will, then, transform data and information into knowledge.

The key difference between information and KM is the role played by the individual actors (Adamides & Karacapilidis, 2006; Davenport & Jarvenpaa, 1996; Frank & Gardoni, 2005). KM places people at the center, while information management focuses on the information infrastructure (Janev & Vranes, 2005; Ruiz-Mercader & Merono-Cerdan, 2006); KM focuses on people and their role in the organization. The first failed attempts at KM focused too heavily on tools (and the IT function often led the implementation of KM in organizations) (Davenport & Prusak, 1998). Finally, we have better understood the role played by people and brought back KM into human resources and strategic/leadership management realms (Biloslavo, 2005; Lyons, 2005).

Knowledge Management Tools Characteristics

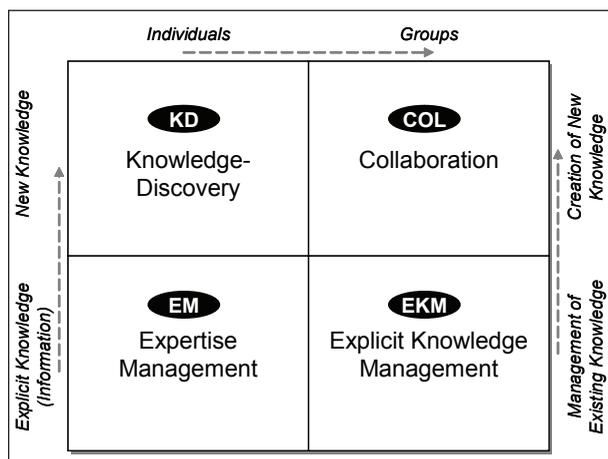
Within the aforementioned premises, a KM tool will focus on facilitating individual continuous learning, use, and contextualization of organiza-

tional knowledge embedded in people and documents (Alavi & Leidner, 2001). This leads to at least four key functional requirements for KM tools: (1) facilitate information contextualization; (2) intelligently transfer information; (3) facilitate social interactions and networking; and (4) present a customized human-computer interface that meets user needs.

1. **Facilitate information contextualization.** Nonaka and Konno (1998) discuss the concept of “ba” or shared understanding and shared context. Individuals assimilate information much faster when presented in a familiar context. To facilitate *information contextualization*, metadata on its characteristics and integration within a specific environment must be attached to it before storing. This facilitates easier retrieval and management for the knowledge seeker. Past approaches to full text-based searches on documents yielded limited success, specifically when multiple media formats are stored. In addition, they yielded limited results as they decoupled the document from the context and taxonomy it belonged to. Better results are more often associated with access to the conceptual representa-

- tion, structure, and links associated with the retrieved documents (Jarvenpaa & Staples, 2000; Turnbow & Kasianovitz, 2005). Sophisticated clustering and indexing search engines, like Vivisimo (www.vivisimo.com), are representative examples in this category.
2. **Intelligently transfer information.** The transfer of information needs to be aligned with its intended use (Bhatt & Gupta, 2005). Especially in liability issues that may emerge when the information is decoupled from the context where it is accumulated and transferred (Zhao & Bi, 2006), it is important to implement what we call “*intelligent transfer*” (Junghagen & Linderoth, 2003) Information transfer must occur by taking into account the user, the content, and the time of transfer. A tool that can optimize these three aspects can truly provide information according to the needs of the users, respecting one of the key functional foundations of KM (Argote & Ingram, 2000; Kwan & Cheung, 2006). More development is needed in this area, although upcoming location-aware applications are emerging.
 3. **Facilitate social interactions and networking.** Direct communication and verbal knowledge transfer through *social interactions* among individuals is the most natural aspect of knowledge sharing (Huysman & Wulf, 2006). A KM tool must support this social aspect and facilitate exchanges. However, traditional group support tools designed to accomplish a specific objective or task (such as a project) may be ill suited to recreate the spontaneous milieu for the information and knowledge exchanges, which are important to knowledge creation. Digital socialization tools need to encourage spontaneous as well as casual meetings with multiple views and interactions. Research on ubiquitous social computing (Snowdon & Churchill, 2004) is trying to address these specific needs by creating ad hoc, location-aware, social interaction systems within university campuses. A KM tool that can informally and formally support social interactions needs to accommodate both individual and community synchronous and asynchronous discussions; enable peer reviewing and responses; discussions rankings; and support the management of social

Figure 2. KM tools framework



network representations and interactions (Van Der Aalst, Reijers et al., 2005).

4. **Present a customized human-computer interface.** The tools must also support *interface customization* and ease of use. The human-computer interface ease of use and usability will drive intention to use and reuse the tools (Jarvenpaa & Staples, 2000; Turnbow & Kasianovitz, 2005). The establishment of swift trust (Hiltz & Goldman, 2005), the error-free interface; the coherent structure and organization will also impact reuse. In addition, the application interface should also be supportive of ergonomics principles and be sociable. Finally, for the tools to support learning and utilization, they must also be geared to providing visual representations and maps linking taxonomies and documents.

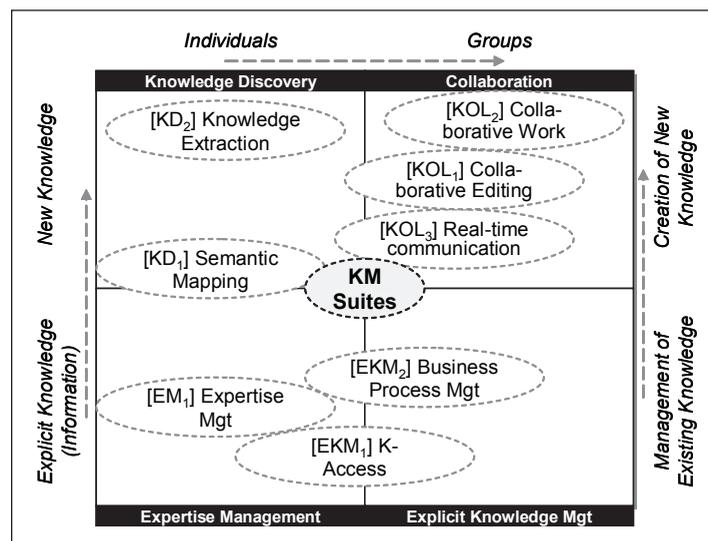
Parallel to the aforementioned roles, which are meant to support individual use, a KM application needs to be designed to sustain KM implementations within the organization. This includes managing existing knowledge and sup-

porting the creation of new knowledge. This process is embedded and thrives on information that is transferred from individuals to groups with a continuous transformation of information into knowledge through contextualization and knowledge discovery.

Figure 2 presents roles and actors linked to KM tools in enterprises and highlights their functions. As described earlier, information is converted into knowledge by individuals and groups, who are the core of the information-to-knowledge transformation process (Rollett, 2003). These tools support KM and new knowledge creation by focusing on:

- *Management of explicit knowledge (EKM)*, with specific focus on the compilation, organization, replenishment, and use of the knowledge base. Compilation and capture of knowledge includes facilitating the creation and publication of information in shared areas. Organization requires structuring information based on taxonomies and ontologies that facilitate document mapping. Replenishment and use (and re-use) can be

Figure 3. KM tools clusters



Technology Trends in Knowledge Management Tools

- supported by providing users with tools to add comments on how the information was used and contribute to future uses. Case-based reasoning can be also implemented in repositories to support the resolution of future problems.
- *Knowledge discovery (KD)* through the uncovering of unexploited information stored in large databases. This includes text analysis and mining; knowledge extraction and automatic classification and visualization of patterns; and use of semantic mapping to link documents.
 - *Expertise mapping (EM)* tools that link and facilitate knowledge exchanges within the enterprise. These tools go well beyond facilitating finding the right resources (as in employees' directories) because they dynamically ease contacts, follow ups, and communication.
 - *Collaboration tools (COL)* for the production of knowledge, coordination, and communication. The production activities provide a static view of the results of team interactions and lessons learned after the exchange. The collaboration activities are more dynamic and support the definition of actors and roles, activities, and tasks throughout the duration of a project. Lastly, communication spaces facilitate direct exchanges among users and, therefore, are important new knowledge creation areas.

Table 1.

Tools for knowledge access		
Vendors	Applications	Web Link
Fast	Fast ESP	www.fastsearch.com
Convera	RetrievalWare 8	www.convera.com
Entopia	K-Bus	www.entopia.com
Exaled	Exaled Corporate	www.exalead.fr
Autonomy Verity	Idol K2	www.autonomy.com

Table 2.

Tools for semantic mapping		
Vendors	Applications	Web Link
Anacubis	Anacubis Connect	www.anacubis.com
Inxight	VizServer	www.inxight.com
Kartoo	KartooKM	www.kartoo.net
MapStan –Amowebea	mapStan	www.amowebea.com
Ontologies		
Cerebra	Cerebra suite	www.cerebra.com
Mondeca	ITM	www.mondeca.com
Ontopia	Knowledge suite (OKS 3.0)	www.entopia.com
SchemaLogic	Enterprise suite	www.schemalogic.com

An Overview of KM Tools

A number of tools are currently available to support the functionalities and processes described. Some tools are highly specialized while others try to offer comprehensive solutions to the enterprise. This section briefly lists and describes the tools; the next section provides a brief synthesis of key market trends. Figure 3 presents a summary of the key categories of KM tools and functionalities. The tools are clustered based on the framework presented in Figure 2.

Tools to Access Knowledge [EKM₁]

These tools provide access to explicit knowledge that can be shared and transferred through the enterprise information systems. They rely on powerful indexing systems, including systems to classify expertise based on both content and collaboration dynamics and networks within the enterprise (e.g., Entopia K-Bus). Please see Table 1.

Tools for Semantic Mapping [KD₁]

Semantic mapping is emerging as a fundamental instrument to make sense out of the vast amount of data and information available in increasingly large repositories (Davies & Duke, 2005). Semantic mapping tools are meant to quickly support presentation of information, analysis, and decision making. The extent of interaction with the knowledge map varies by tools, with some tools being mostly static visualizations and others allowing continuous and dynamic interactivity by changing the data views. For example, KartooKM provides many different views from centric mapping; to clustering; topographical maps; interactive trees; closeness and social networks maps; circular maps; and animated charts. Ontology tools are also part of this category as they enable users to organize information and knowledge by groups and schemata that represent the organizational

knowledge base (e.g., Ontopia Knowledge Suite, OKS 3.0) (Parpola, 2005). Please see Table 2.

Tools for Knowledge Extraction [KD₂]

Tools for knowledge extraction support structured queries and replies. They help mining text by interpreting relationships among different elements and documents. Therefore, they help the knowledge seeker in identifying the exact document and the other documents related to his/her queries (e.g., vivísimo.com clustering), resulting in structured and more articulated answers. Some sophisticated data and text analysis tools also support the identification of relationships among concepts, using sound and rigorous statistical association rules (e.g., SPSS). Please see Table 3.

Tools for Expertise Localization [EM₁]

These tools enable quickly locating the knowledge holders in the enterprise and facilitating collaboration and knowledge exchanges (Huysman & Wulf, 2006). Therefore, they are focused on going beyond simple directories by enabling users to easily capture and organize the results of their project interactions (Coakes & Bradburn, 2005) by quickly locating project expertise and enabling re-use and innovation (e.g., Kankoon Skol). Please see Table 4.

Tools for Collaborative Editing and Publishing [COL₁]

Tools like Vignette and DocuShare enable collaborative editing of documents and the management of the entire document publication cycle. They include systems for document management within the enterprise, as well as more flexible systems such as Wikis and Blog creation tools (like the Movable Type software that enables users to share public spaces within company servers for discussion, comments, and knowledge exchanges) (Frumkin, 2005). Please see Table 5.

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Table 3.

Tools for knowledge extraction		
Vendors	Applications	Web Link
ClearForest	ClearForest Text Analysis Suite	www.clearforest.com
Intelliseek	Enterprise Mining Suite	www.intellisik.com
Insight	InsightSmartDiscovery	www.inxight.com
Lingway	Lingway KM	www.lingway.com
Temis	Inxight Discovery Extractor	www.temis-group.com
Relationship discovery		
Grimmersoft	WordMapper	www.grimmersoft.com
SPSS	LexiQuest Mine	www.spss.com

Table 4.

Tools for expertise localization		
Vendors	Applications	Web Link
Agilence	Expertise Finder	www.agilence.com
Kankoon	Kankoon Skol	www.kankoon.com
Tacit	ActiveNet	www.tacit.com

Table 5.

Tools for collaborative editing		
Vendors	Applications	Web Link
Interwoven	TeamSite6	www.interwoven.com
Open Source	Drupal	www.drupal.org
Six Apart	Movable Type	www.movabletype.org
Vignette	Vignette V7 Content Services	www.vignette.com/fit/
Xerox	DocuShare4	http://docushare.xerox.com/

Table 6.

Tools for collaborative work		
Vendors	Applications	Web Link
EMC – Documentum	eRoom	www.documentum.com/erom
IBM / Lotus	QuickPlace	www.lotus.com
Affinitiz	Affinitiz	www.affinitiz.com
Microsoft	SharePoint Services	www.microsoft.com
One2Team	One2Team Pro	www.one2team.com
Tomoye	Simplify 4.0	www.tomoye.com

Table 7.

Tools for real time collaboration		
Vendors	Applications	Web Link
Marratech	Marratech e-Meeting Portal	www.marratech.com
Microsoft	Live Communication 2003	www.microsoft.com
Microsoft	Windows Messenger	www.microsoft.com
WebEx	Meeting Center	www.webex.com
Yahoo	Yahoo Messenger	www.yahoo.com

Table 8.

Tools for business process management		
Vendors	Applications	Web Link
Boc	Adonis	www.boc-eu.com
IDS Sheer	Aris Process Platform	www.ids-scheer.com
Mega	Mega Process	www.mega.com
Workflows		
FileNet	Business Process Manager	www.filenet.com
TIBCO	Staffware Process Suite	www.tibco.com
W4	W4	www.w4.fr

Table 9.

Global Solutions and Suites		
Vendors	Applications	Web Link
Ardans	Knowledge Maker	www.ardans.fr
Thalès-Arisem	KM Server	www.arisem.com
Knowesis	Athanor	www.knowesis.fr
Knowings	Knowledge Manager	www.knowings.com
Sharing Knowledge	SK2	www.sharing.com
Portals		
Autonomy	Portal in a Box	www.autonomy.com
HummingBird	Humming Enterprise	www.hummingbird.com
IBM	Suite Lotus	www.ibm.fr
OpenText	LiveLink	www.opentext.com
Oracle	Enterprise Manager, Collaboration Suite, Data Hub	www.oracle.com
Plumtree	Enterprise Web Suite	www.plumtree.com
Vignette	Vignette V7	www.vignette.com

Tools for Collaborative Work [COL₂]

These tools enable teams to globally share dedicated spaces for managing the project lifecycle; editing and publishing materials; conducting live discussions and interactions; and maintaining a repository of materials associated with every step of the process (Frank & Gardoni, 2005). For example, using MS SharePoint servers, teams can quickly create password-managed and secure project areas and follow the lifecycle of document creation and exchanges. Other tools (e.g., Tomoye Simplify) are focused on bringing together and facilitating the work of communities of practice (Coulson-Thomas, 2005). Please see Table 6.

Tools for Real Time Communication [COL₃]

These tools overlap with some of the functionalities of the previous category. However, they are specifically focused on live communication exchanges, whiteboarding, and file sharing (e.g., Meeting Center, Yahoo Messenger). Please see Table 7.

Tools for Business Process Management [EKM₂]

These tools can be split into applications for process modeling and tools for workflow management. Process modeling tools focus on designing and optimizing processes (Gronau & Muller, 2005). They formalize and define the elements of the process, assign actors to roles, and identify data sources and flows within the processes (Hlupic, 2003). For example, the Aris Process Platform provides modules for the strategic, tactical, operational, and measurement tasks related to process management. Workflow specific tools, such as Staffware Process suite, are focused on the management of the rules and execution of enterprise processes. They also automate specific

operational and analytical steps around the process deployment. Please see Table 8.

Global Knowledge Management Solutions

Applications in this category are divided in software suites dedicated to KM, such as Knowledge Manager and SK2, and enterprise portal solutions that provide modular applications. For example, portal packages provide collaboration modules; content management; access to repositories and information; process management; text mining; and business intelligence (e.g., Lotus Suites; Plumtree Enterprise Web Suite). Please see Table 9.

Key Trends and Perspectives in KM Tools

Information systems have continued to evolve and change their role to better respond to the needs of organizations. Until recently, organizations have used information technology to support information management (Ruiz-Mercader & Merono-Cerdan, 2006; Schultze & Leidner, 2002). Therefore, organizational systems have been information bound and information centric. Today, we have a better understanding that for information to be effectively used by individuals, information systems need to be more people centric and support specific individual needs.

To better leverage the knowledge of individuals in organizations, firms need to understand that employees' daily activities are tightly interconnected to other people and processes in the organization. Therefore, firms need a support system for "the group," rather than an information system designed for individual and autonomous work. In few words, the paradigm needs to shift from an individualistic view of information systems to a collective and collaborative view. For this reason, ubiquitous social computing models (Snowdon & Churchill, 2004) are emerging in several organizations. Many KM tools have been traditionally used

in an isolated interaction between the individual and the tool. The new KM logic implies that these tool be seamlessly integrated to manage group discussions, be used by groups, and foster a mix of face-to-face and distant collaboration. The boundaries of collaboration within the enterprise need to evolve. Three key trends are related to this transition.

First, starting from 2002, we have observed a convergence of KM tools (Edwards & Shaw, 2005) through mergers and acquisitions. Market share of pure communication players have become scarce and communication management has been complemented with content management solutions. Or, communication solutions have been integrated with other platforms to support existing tasks (for example, eBay acquisition of Skype to integrate VoIP in the auction transactions). These consolidations have attempted to provide an operational answer to firms faced with capturing the value of current communication interactions by quickly and clearly organizing, storing, and sorting the results of the exchanges through electronic document management solutions. Several vendors of document management solutions have added communication capabilities. Documentum (today part of EMC) bought e-Room; Interwoven acquired i-Manage; and Vignette acquired Intraspect. Following the same trends, actors in the collaboration arena have expanded into the document management realm. IBM/Lotus with Abtrix and Open Text with Ixos.

Second, the concepts of networked enterprises and collaboration have been augmented with the need for exchanges while multitasking. Users will not need to quit the applications they are currently using to augment their work with a synchronous communication component. These components will be easily integrated within the user workspace; will be highly interoperable; and information will be easily transferred across tools and applications. For example, Microsoft offers an integrated SharePoint solution that communi-

cates with office productivity tools (supported by .NET server solutions). IBM/Lotus is also moving quickly in this area with the Lotus Sametime integration of instant messaging, conferencing, and project spaces with Websphere Portal Server. These platforms are tightly integrated with the proprietary systems they interface with. However even if IBM and Microsoft hold a market advantage in this area, recent trends in the open source market are promoting standardization and alternative interoperable solutions that can be integrated across platforms.

Third, most of the emerging communication needs are focused on supporting individuals in managing communications and collaboration schedules, needs, and requirements. Tools need to integrate with personal information management systems (PIMs) and multiple hardware platforms (PDAs and Smartphone) in order to provide ubiquitous connectivity to an increasingly mobile workforce.

SUMMARY AND CONCLUSION

In this paper, we provided a summary overview of the types, functionalities, and clustering of KM solutions. Technical, organizational, and individual factors contribute to knowledge creation. From the technical standpoint, the KM tools need to demonstrate that they are beneficial to the organization, at least based on usage statistics. From the organizational standpoint, the tools must be supplemented with workplace changes that promote knowledge sharing and dissemination through the new platforms, for example, rewarding peer ranking and documents use as practiced by Infosys (Chatterjee & Watson, 2005; Kochikar & Suresh, 2004; Mehta & Mehta, 2005). Lastly, individuals must feel secure that participation and utilization of the tools is not targeted at personnel reduction; rather at personnel enhancement and long-term leadership and growth.

It is the mix of the aforementioned factors, coupled with a clear understanding of the market, the tools, and the drivers for a savvy selection of applications aligned with business needs, which may ultimately support successful KM initiatives.

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ENDNOTE

- ¹ Please note all hyperlinks are valid as of January 2007

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