Knowledge Management: Tools and Techniques

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ABSTRACT

Knowledge management is not one single discipline. Rather it is an integration of numerous endeavours and fields of study. This paper provides a framework for characterising the various tools and techniques available to knowledge management practitioners. It provides an overview of a number of key terms and concepts, describes the framework, provides examples of how to use it, and explores a variety of potential application areas. The stress of knowledge management tools and techniques has been manoeuvred to share knowledge through communication and collaboration tools which specify the shift from process to practice.

Keywords: Knowledge management, information management, retrieval-ware, web-based tools.

1. INTRODUCTION

Both knowledge and knowledge management (KM) are difficult to define. Academics in the field of KM typically define knowledge as a derivative of information, which is derived from data. Knowledge is information or data, organised in a way that is useful to the organisation. The central idea is that KM efforts work to create, codify and share knowledge valuable to the organisation. Another idea is that KM shifts the focus from process to practice. It is using communication and collaboration to improve how people do their practice (their job within an overall process). KM is essentially defined by the need to manage knowledge in an organisation like an asset. The impetus for managing knowledge in organisations is the realisation that the new economy is based on knowledge. The most basic idea driving KM is that knowledge is a strategic asset that must be managed. It should be managed as an asset or resource, just like land, capital, and labour. This is a shift away from how to simply obtain knowledge to how to use it productively. Knowledge is to be seen as an activity as well as an object; it is a product and a process. It is something that must be created and shared. KM is essentially about tacit knowledge (TK). It is aimed at making TK explicit and then sharing that for reuse across an organisation. The following can be expressed as KM lifecycle:

Knowledge generation ⟶ Knowledge codification ⟶ Knowledge transfer.

KM initiatives are often expressions of part of this process. Some are concerned with the first part: knowledge creation, innovation or organisational learning. Others are concerned with capturing TK for codification. This means recording videos or feeding data into a database. Knowledge transfer is sharing knowledge. This means a database of information with access methods. It can mean fostering networks of people for sharing knowledge or creating knowledge maps showing who has what expertise. There are different tools for the KM. It can be divided into two parts: Information technologies tools and Web-based (IT) tools. Web, in coming years, will present a set of new tools for managing knowledge by providing an extremely rich common language for representing knowledge.

2. KNOWLEDGE MANAGEMENT

2.1 Definition

Karl Sveiby [1] defined KM as, "The art of creating value from an organisation's intangible assets." Davenport and Prusak [2] defined KM as, "KM is concerned with the exploitation and development of the knowledge assets of an organisation with a view to furthering the knowledge objectives."

Despres, Charles and Chauvel, Daniele [3] defined KM as, "The purpose of knowledge management is to enhance organisational performance by explicitly designing and implementing tools, processes, systems,

structures, and cultures to improve the creation, sharing, and use of different types of knowledge that are critical for decision-making."

According to the World Bank, "KM is the management of knowledge through systematic sharing that can enable one to build on earlier experience and obviate the need for costly reworking of learning by making the same repetitive mistakes."

2.2 Evolution of Knowledge Management

The emergence of the term 'explicit knowledge' and the introduction of KM in the 1980s were new. It was a natural evolution brought about by the confluence of many factors. The developments that have led to present perspective on KM come from many areas. Some are intellectually based, while others are pragmatic and rooted in the need to innovate to secure real-life performance. KM can be described as the most recent phase of an evolution from a managerial focus on data management than information management and finally KM. The three practices that have brought the most contents and energy to KM are information management, the quality movement and the human factors/human capital movement [4].

Information management developed during the seventies and eighties and is usually understood as a subset of the larger information technology and information science world. IT is a body of thought and cases that focus on how information itself is managed independent of the technologies that house and manipulate it. It deals with information issues in terms of valuation, operational techniques, governance, and incentive schemes. "Information," in this context, generally means documents, data, and structured messages. In broad terms, KM shares information management's user perspective, a focus on value as a function of user satisfaction rather than the efficiency of the technology that houses and delivers the information.

3. KNOWLEDGE MANAGEMENT TOOLS

The development of IT for organisations has produced many successful ERP-type systems that manage well-defined processes. But systems to manage ill-defined, knowledge intensive processes have met with less success. KM practitioners use a wide range of IT tools to share, create, codify, and share knowledge. The trend in the development of IT for organisations is toward more communication and collaboration tools.

3.1 Requirement of Knowledge Management Tools

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. Knowledge is strictly linked and connected to the individual (or group) who creates it, which may cast doubts on the availability of information systems tools to effectively support KM. Thus the visible part of knowledge, what the literature calls explicit as opposed to the tacit dimension of knowledge, is only information regardless of the amount of the other individual knowledge embedded into it [5]. Therefore, there is requirement of KM tools, which can collect, catalogue, organise, and share knowledge or transfer information (the explicit knowledge) embedded in various forms and types of documents and media. These reasons are [6]:

(i) *Facilitate information contextualisation*: To facilitate information contextualisation, metadata on its characteristics and integration within a specific environment must be attached to it before storing. This facilitates better retrieval and management for the knowledge seeker.

(ii) *Intelligently transfer information*: Information transfer must occur by taking into account the user, the content, and the time of transfer. A tool that can optimise these three aspects can truly provide information according to the needs of the users, respecting one of the key functional foundations of KM.

(iii) *Facilitate social interactions and networking*: Direct communication and verbal knowledge transfer through social interactions among individuals is the most natural aspect of knowledge sharing. A KM tool supports this social aspect and facilitates searching.

(iv) *Present a customised human-computer interface*: The tools also support interface customisation and ease of use. The human-computer interface, ease of use and usability will drive intention to use and reuse the tools.

3.2 Tools available for Knowledge Management

A number of tools are available to support the functionalities and processes of KM, which are listed below:

(i) Tools to access knowledge:These tools provide access to explicit knowledge that can be shared and transferred through the enterprise information systems. For example, Convera is a tool used for retrieval ware. It works on powerful indexing systems to classify expertise based on both content and collaboration dynamics and networks within the enterprise.

(ii) *Tools for semantic mapping:* These tools are meant to quickly support presentation of information, analysis, and decision making. 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. For example, Anacubis is a ground-breaking visual research and analysis software

for corporate researchers, analysts, and intelligence professionals. It supports the visual discovery and analysis of intelligence in both online and enterprise information. Information is represented in the Anacubis Desktop by icons and links. Users can also import, create, analyse, and distribute visual representations of their research and analysis.

(iii) *Tools for knowledge extraction:* These tools support structured queries and replies. They help mining text by interpreting relationships among different elements and documents. For example, ClearForest Text Analysis Suite is an advanced text driven business intelligence solutions which apply intelligent mark-up to key entities such as person, organization, location, as well as detailed facts or events embedded within free-form text such as news articles, web surveys, and HTML documents.

(iv) *Tools for expertise localisation:* These tools enable quick location of the knowledge holders in the enterprise and facilitate collaboration and knowledge exchange. For example, ActiveNet maintains a continuous, real-time view of organisational activities. ActiveNet continuously discovers each person's work activity and business relationships by processing communications from such sources as documents, discussion databases, e-mail, instant messaging and digital workspaces.

(v) *Tools for collaboration work:* 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. For example, QuickPlace is a Lotus's web-based shared workspace software for real-time collaboration among geographically dispersed participants. Using QuickPlace, coworkers, suppliers, partners, and customers can communicate online immediately within a structured workspace created for that purpose. An online workspace can make it possible for people to work together more easily and less expensively.

4. EVOLUTION OF IT TOOLS IN KNOWLEDGE MANAGEMENT

4.1 Some Categories of IT Tools Commonly Associated with Knowledge Management

Some categories of IT tools commonly associated with KM are shown in Table 1.

4.2 Categorisation of Tools Based on Different Types of Knowledge

Four different types of knowledge and the different types of KM tools that can be used to manage or facilitate knowledge transfer are shown in Table 2 [7]:

4.3 Web-based Information Technology Tools for Knowledge Mangement

Web offers a very powerful platform for tools supporting all stages of KM. The web allows for an unprecedented degree of integration of different representational and communicational media.

Table 1. IT Tools commonly associated with knowledge management

Technology	Description/examples
AI technology	Expert systems, learning systems.
Communication and collaboration systems group	E-mail, teleconference, video conference, chat, IM, forum, Listserv, groupware calendar, log, shared information spaces workflow management system, group decision support system.
Documents management system	Management of electronic documents, a system to search, edit, distribute, retrieve, archive and otherwise mange the complete lifecycle of documents
Content management system	Management of electronic content including multimedia files.
Intranet	A network contained within the enterprise. It is used to share information and computing resources among employee as well as to facilitate group working.
Search engine	Tool that searches the contents of a web.
Learning system	Distance learning, e-learning and computer-based training.
Knowledge mapping tools	Any resource that locates people by their knowledge; human resources skill set inventory system.

Table 2. Types of knowledge and different types of knowledge management tools

Explicit knowledge	Know how	Know who	Tacit knowledge
System tools	Collaboration tools	CRM tools	Video conferencing
DBMS	E-mail	Social network analysis	Face-to-face facilitation
Data warehousing	Groupware	Knowledge portals	Other technologies

4.1.1 Traditional Database Tools

These tools attempt to allow users to create general data properties implicitly within a database. They allow for the creation of objects that have certain properties, can communicate with other objects and so on.

4.1.2 Process Modelling and Management Tools

Processes that involve the transformation of physical material have been the focal metaphor. Tools have been built to support these processes encode considerable knowledge of the process.

4.1.3 Workflow Management Tools

These are the process management tools for information-intensive organisations. Workflow tools allow for the specification of the movement of documents in information processes.

4.1.4 Enterprise Resource Management Tools

Enterprise modelling tools are being developed to provide all the modelling capabilities of ERP/ERM systems along with the explicit representation of organisational and environmental knowledge.

4.1.5 Agent Tools

These tools rely on agents, relatively autonomous programs that can perform a variety of tasks. Agents may be provided with the specifications of the information that the user is interested in and these will then search the web and specified other databases to find the information.

4.1.6 Search Engines, Navigation Tools and Portals

Some of the search engines perform automatic text-only searches while others relied on human "interpreters" who would access web pages and then analyse and classify them.

4.1.7 Visualising Tools

These tools have been developed to investigate the structure of knowledge domain and knowledge within domains. These tools have been used for data visualisation in the areas of financial market to molecular biology.

4.1.8 Collaborative Tools

These types of tools are provided for setting of bulletin board and for real-time video conferencing, whiteboards, and chat rooms.

5. NEW TOOLS FOR INFORMATION MANAGEMENT

A new group of web-based information management tools has emerged based on freeform social software that enhances individual knowledge work, group communi-cation, and collaboration. Information management tools for knowledge work and communication are not new. The new tools open up one-to-one and group communication to be viewed by many users if not the public. They differ fundamentally from the old suite of tools in that they are based on user participation and are mostly characterised by participatory services, where users create content. They usually allow users to manage and modify their own data within a given system—information that is usually made public for others' benefit. Thus the services get better the more people use them. Organisation or knowledge is drawn out of user actions like tagging or visiting sites. But by far the most dominant characteristic is that of participation. Participation is built into the actual architecture of the tool or service offering.

5.1 Web 2.0

Web 2.0 is also (perhaps most) often described as a group of people-driven tools that allow collaboration. These include blogs, tags, mash-ups and, wikis.

5.1.1 Blog

Blogs are most commonly used as an online version of a personal journal. Essentially, a blog is simply a web page that contains periodic, chronological ordered posts, additionally grouped by categories. Users visiting the blog can often add comments to posts. Administering a blog (updating it by adding new posts, creating links to other web pages, adding pictures, categorising posts, etc.) is extremely simple.

Setting up a blog can be more complicated but keeping it updated and posting end-user comments to it is very easy. User settings are typically highly configurable. Because of the emphasis on reverse-chronological posting, blogs are often characterised as promoting form over content. Blogs are most commonly used as an online daily journal or personal KM tool. For example, teenagers may post photos, poetry, game scores and other content to share with their friends. Others have used it as a log file, to record chronological data like system updates.

5.1.2 Tags

Tagging is essentially a form of social book marking. It allows users to tag or categorise web pages with words they create. When tagging a particular page, one can see words others have used to categorise the page, thereby synchronising our own categories with others to create an overall order. We can also see how many others have tagged the same page, any notes they wrote about that page, what other pages they have tagged, add them to a network of contacts and contact them. Tagging is also present in services like Flickr, YouTube and Yahoo's MyWeb. Tagging is a way to let structure emerge.

5.1.3 Wiki

A wiki is fundamentally a web of interlinked pages where each page typically contains a concept (a name) and a description of that concept (an article). Users are allowed to edit any part of the article, modify the description, add new names, add external links and add links to names (and their corresponding articles) that do not exist yet (so that another user can fill in the description of the new concept). They are extremely easy to navigate in and add content to. User security is usually set low, giving users as much power as possible to change the content. Page changes, old versions of pages and recent changes of pages are all well documented and manageable by users and/or administrators. Wikis, have become a tool for online collaboration and community building. They are the best suited for building a knowledge base from a variety of users' input. The most well known example of a successful wiki is Wikipedia.org, a free online encyclopedia composed of articles written by the general public.

6. KNOWLEDGE MANAGEMENT TECHNOLOGIES

Creating a learning/knowledge-based organisation can be done with the help of a new wave of ICT. Some of the main technologies are:

6.1 Case-based Reasoning Systems

Case-based Reasoning Systems (CBRS) essentially consist of a case library and a software system for retrieving and analysing the 'similar case' and its associated information. The case library has cases covering a broad range of ideas across different industries and business functions. Each case contains a description of the underlying competitive situation, the environmental conditions, management priorities, experience, values that allow a certain strategy to succeed, and moments of learning. A software system helps index each case such a way that a search yields modest number of "similar cases." The system can provide a complete explanation if the reasoning that has lead to each recommendation. If there is no case that exactly matches the given situation, then it selects the most "similar" case. An adaptation procedure can be encoded in the form of adaptation rules. The result of the case adaptation is a completed solution but it also generates a new case that can be automatically added to the case library.

6.2 Group Decision Support System

On a group level, the act of sharing and exchange allows learning as a group as well, but it also gives further input in the sense that experiences lived by others are used as input data for the creation of an individuals mental model. One can see the immediate application with sharing ideas and therefore in the creation of groups shared mental model. This process of group learning involves the individual, and is therefore a useful tool for individual learning, but it dose not focus solely on individual learning. A GDSS enables a group to work interactively using the networked hardware and software to complete the various aspects of the business process.

6.3 Artificial Neural Networks

Artificial Neural Networks (ANNs) are tools derived from artificial intelligence. They are also part of the new information processing paradigm that simulates the human brain. They are very strong tools in the pattern finding and structuring, without any prior information. They allow for the structuring of tacit knowledge, without making it explicit, but nevertheless making it accessible. ANNs are vehicles for creating "best principles" out of "best practices."

6.4 Semantic Search Engines and Link Machines

A semantic search engine uses a kind of an overlay of organization, based on keywords that are commonly used together. The search engines scan the text that is available and that is stored using a format that allows this kind of search. The search engine creates a semantic network of keywords, which allows translation of any given natural language query in a number of most probably related keywords. Then those keywords can be related to pieces of text where they appear dominantly. Once those keywords are identified, the text is codified with the keywords, and the semantic table is made. The system is then reading for both semantic queries and semantic linking.

7. CONCLUSION

The main idea driving KM is that knowledge must be managed like an asset. This involves creating, codifying and sharing knowledge. There isn't much agreement on what a KM tool is either. This is partly because the term has been overused and partly because a lot of different tools that were not built to be KM tools per se are used towards the overall goal of KM. There is a large group of tools like content management systems, decision support systems, and collaboration tools. The trend for IT tools, especially those that contribute to KM, is towards more communication and collaboration tools.

The new tools like 'Web 2.0' are unique because they are web-based applications that are free and thrive on user participation. They are tools that support individual knowledge work, communication and collaboration. Wikis are a prime example of such tools. As a tool for KM, they most closely resemble a cross between a content management system and groupware. Corporate uses reflect this as they have been used in a

wide variety of ways that span the gamut from pure content management to a mix of content management and groupware too purely as groupware.

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