Knowledge Structure and Services

A Framework to Analyze and Compare Knowledge Management Tools

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Introduction

In most enterprises, the effective selection and deployment of knowledge management software tools is a critical success factor in a knowledge management initiative. Further, KM tools are frequently very expensive, thus demanding careful selection and a detailed justification.

However, the broad and multidisciplinary nature of knowledge management problems allows a wide variety of software products to be marketed as KM tools. As a result, there is a deluge of tools claiming to provide a KM solution in the market. It can be a daunting task to analyze these tools and select the best one for the job.

We present a framework named Knowledge Structure and Services (KSS), which can support a business to win these challenges. Our framework provides a structured way to understand and describe the problems the KM tool is supposed to solve. This highlights the processes that are touched by the tools. This is a key factor in identifying the fit between problem and solution. It also helps to identify the processes where the return for the investment (ROI) on the tool investment should come from.

The Knowledge Structure and Services (KSS) framework is centered on the concepts of knowledge structure and knowledge services. Below we discuss these two dimensions, and how they are tied used into the KSS Matrix, a diagram that helps visualize a tools capabilities.

Knowledge Structure

There is a wide range of levels of formalization or structure in the ways knowledge is represented in KM systems. This is presented in Figure 1. From top to bottom, we increase the formalization and precision of knowledge, while from bottom to top, we accommodate more informality and ambiguity. Knowledge forms towards the top end are relatively easy for people to create and update, while knowledge forms to the bottom increasingly demand knowledge engineering and incremental analysis.

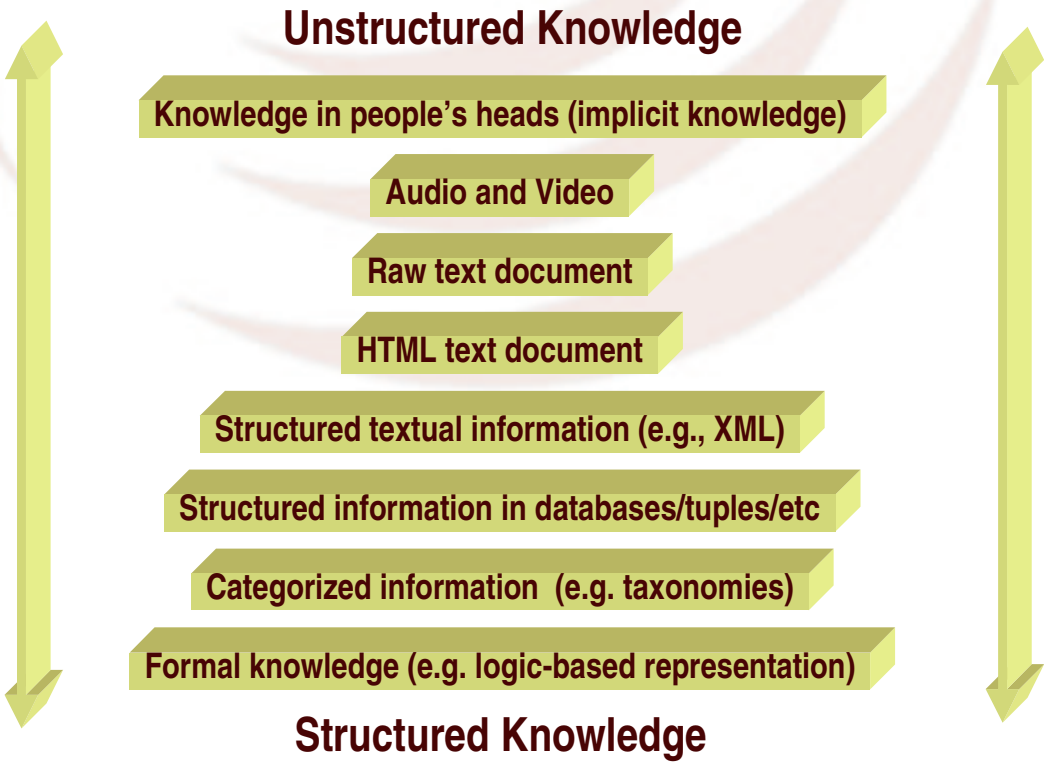

Figure 1: The Knowledge Structure dimension

Let us explain in detail the levels of knowledge structure shown in Figure 1. From the least structured to the most structured, they are:

- *Knowledge in people's heads* is intrinsically non-formalizable – yet, many organizations rely on this kind of knowledge and the support of tools to find out who knows what where inside an organization.

- *Audio and video* contain multiple "streams" of knowledge such as music voices, faces and objects. Humans have a much easier time than machine in interpreting and indexing this kind of knowledge, but recent advances have been made to improve automated management of this type of knowledge.

- A *raw text document* is the formal equivalent of an audio track. Its complexity is comparable natural language, and it is hard for machines to process.

- In contrast, an *HTML document* with markup tags can display the texts' structure. Patterns and regularities in the document structure can aid in interpreting the content. For example, there are now tools that "wrap" structural patterns in HTML text into semantic descriptions. This can allow, for example, to discover based on placement inside a document that a certain HTML markup contains the name of a country, or the arrival time of a flight.

- *Structured documents* using formats like XML (or its ancestor, SGML) explicate the semantics implicit in HTML markups. For example, an XML document may contain a tag such as <country name> USA </country name> that indicates that "USA" should be understood as the name of country.

- The next kind of knowledge structure is *"tuples" of data*, the essence of information stored in databases. For example, databases may contain lists of relationships between countries and their populations. Most databases are made for efficient storage and retrieval of this kind of information, but as a result, they are usually unreadable by human eyes. Recently, there has been a trend to use XML documents as a readable form of databases. For example, a sequence of tags can contain a <population> tag inside a <country> tag to indicate a relationship between the country and its population.

- *Categorized information* has roughly the same level as structured information in databases. Taxonomies such as the ones we use in biology are examples of categorized information. This kind of knowledge is used extensively by directory sites such as Yahoo to provide taxonomies of concepts, ideas or subjects

- *Formal knowledge* is used here in the mathematical sense, meaning logical statements such as theorems and equations. This kind of knowledge can be used in a very rigorous way to make sure all semantics are explicit and rules are followed.

The level of structure in the knowledge directly affects the amount of automated processing that can be performed because more structured knowledge employs powerful semantics. As a result, it is much easier to process and manage the contents of an XML document than the contents of an HTML document.

Managing highly unstructured knowledge requires more structured descriptions of the content. For example, because it is very hard to recognize faces or voices directly, many tools that manage audio and video knowledge employ simpler forms of knowledge to index the content, such as keywords, categories or close-captioned text.

Knowledge Services

Another useful dimension is the range of services KM tools provide. By services, we mean tasks or activities in handling knowledge that can be at least partially automated. While not all services are comparable, analysis of the knowledge services provided includes things ranging from e-mail to Intranets to data mining and customer relationship management (CRM). To make sense of these disparate services, knowledge services may be divided into three main types: infrastructure services, core services and packaged services. These services build on one another: packaged services make use of core services, which in turn rely on infrastructure services. For example, software that provides core services depends upon infrastructure services.

Infrastructure services

Infrastructure services are usually needed to implement any such KM solution. We identified five basic types of infrastructure services. Communication services enable electronic communication between users. Examples are e-mail, file transfer, and chats. Collaboration services allow for groups of people to communicate through online meetings, shared whiteboards, discussion groups, as well as directory services. Translation services transform knowledge from one file format to another or from one language to another. Workflow management services define processes and support their online execution and control. Intranets and Extranets are web-based applications that streamline the communication within an organization (Intranets) or between different organizations (Extranet).

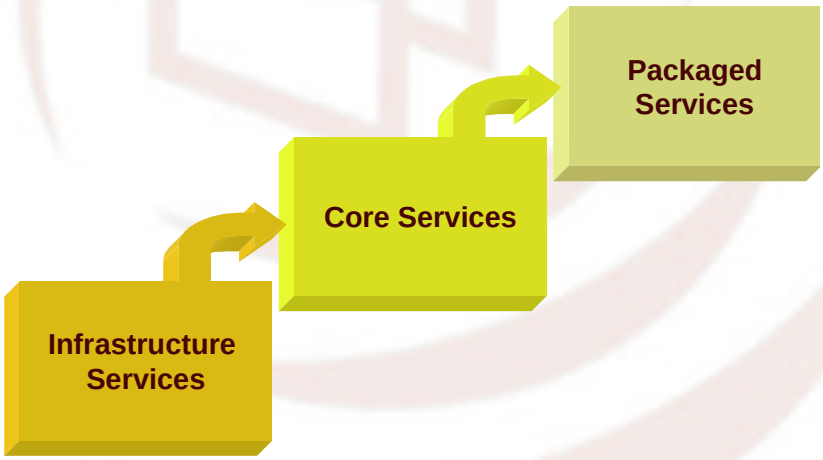

Figure 2: Major types of service offered by knowledge management tools.

Core services

Core services are central to defining KM problems and solutions because they are the services that explicitly and directly access knowledge repositories. Figure 3 shows how these core services are built around the core processes of creating, organizing, and using a knowledge repository. Different core processes involve people or systems with different roles including: knowledge producer, holder, organizer, and user. Key features of the five core services are the following:

- *Knowledge generation* services produce knowledge in forms that can be stored in the knowledge repository. Used by knowledge producers, these tools distill, refine or simply create new knowledge that is then entered into the repository. These tools frequently involve some kind of automated learning such as data mining or pattern recognition.

- *Knowledge capture* services facilitate addition to repositories. For example, capture tools allow users to add documents to repositories as well as meta-information to support indexing. A simple example of meta-information is the "document properties" mechanism of Microsoft Word, which allows a user to manage information about the document being edited such as author, revision number, subject, and date.

- *Knowledge organization* (indexing) services help knowledge managers arrange items in a repository to facilitate retrieval and use. Typical knowledge organization services manage knowledge about a repository and its items – e.g., taxonomies and directories.

- *Access management* services determine who can access elements of the repository. They control access to the knowledge repository and are usually based on directory services. A typical mechanism is to define permission levels for roles that are assigned to users.

- *Retrieval* services include searching and navigating functions as well as translation, visualization, and integration. They create value by making knowledge available for specific uses and may provide personalization and configuration services.

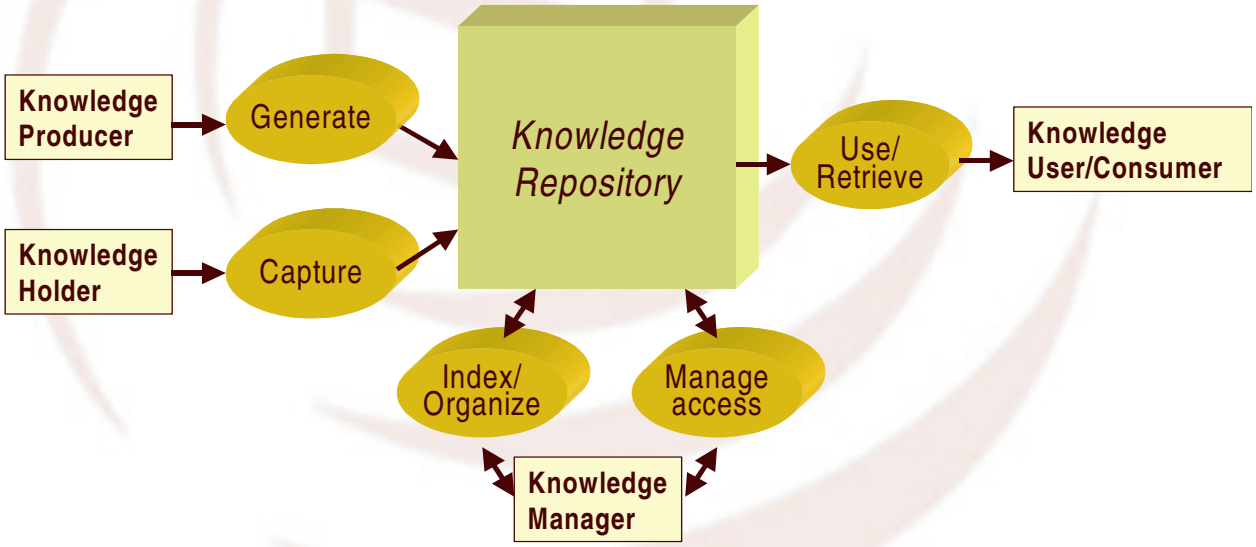

Figure 3: Core Knowledge Services.

Packaged services

Packaged services aggregate lower-level services to solve specific types of problem such as customer relationship management. A significant part of the knowledge management literature concentrates on packaged services. This focus is attributable to the fact that these types of problems are clearly connected to end user needs. For example, it is easier for a CIO to justify purchase of customer relationship management tools than search engines. Indeed, one can see these packaged services as vertical specializations of core or infrastructure services to a class of problems. Among classes of packaged services that have received special attention in the literature are Customer Relationship Management, Business Intelligence and Enterprise Information Portals.

The KSS Matrix

Different tools provide distinct arrays of services and manage specific types of knowledge. We use a diagram called the KSS Matrix to visually characterize KM tools in terms of the types of knowledge it handles, and the types of services it offers. The KSS Matrix ensures that the types of knowledge handled are intimately connected with the core services provided. Tools may support different sets of services for each type of knowledge. The KSS Matrix is displayed in Figure 4. The horizontal axis recognizes the five core knowledge services while the vertical axis displays the eight basic levels of the knowledge structure dimension

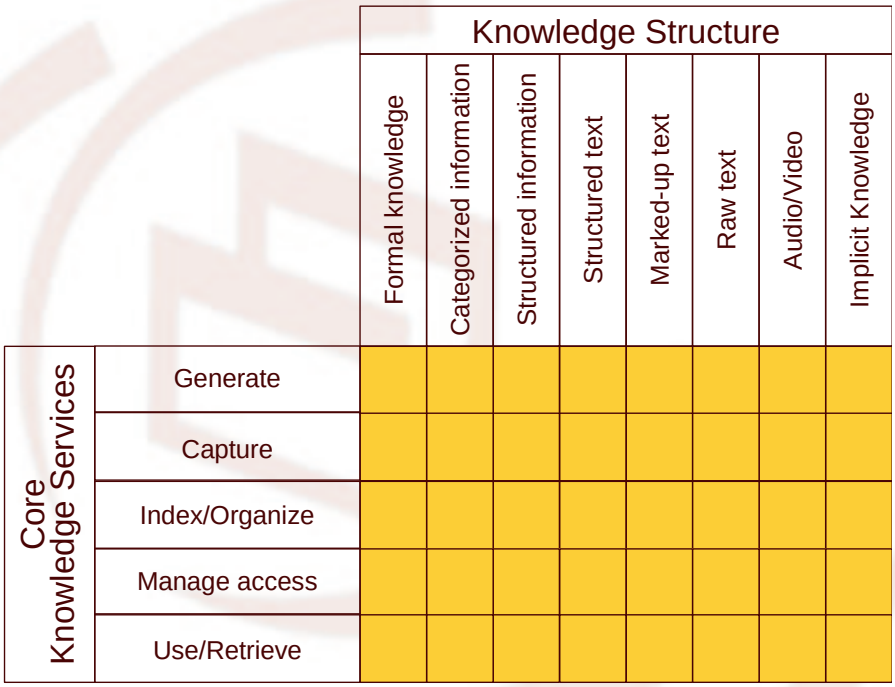

Figure 4: KSS Matrix.

One KSS Matrix is used for each tool analyzed, as well as for the problem that needs to be solved. A KSS Matrix is filled by adding small or large squares to each of the cells. Filling a cell indicates that the tool provides a specific service that manipulates knowledge with a given level of structure . The size of the square filling a cell represents the scope of the service offered by the tool. A large square denotes a major offering with a comprehensive set of features, while a small square marks a service that is offered in either a restricted scope or restricted functionality.

Using the Framework

An important problem confronting a KM project is how to find the best match between the specific problems and needs of a given enterprise with the available KM tools in the market. The KSS Matrix and the KSS Service Checklist provide a methodical means to perform this task. First, the framework can be used to specify what kinds of knowledge structures will be handled, and what kinds of services are needed for each of them. Second, the KSS framework can be used to analyze prospective tools for specific uses. The KSS diagrams built in the first step work as a “target” diagram to be matched with the capabilities of specific tools. The analysis may point to a single best tool, or show that the best solution may lie in a combination of two or more tools. It also helps in doing cost-benefit analysis, for example focusing first on some services and structures that provide the highest returns.

Conclusions

The KSS framework provides a convenient way of disentangling the confusion caused by the overuse of the term Knowledge Management in the context of tools that support KM. The framework makes it possible to characterize each tool by defining the types of knowledge it handles and the types of services it provides to support KM processes. Specifically, it provides a methodical way to find the best match between the specific problems and needs of a given enterprise with the available KM tools in the market.. First, we build a KSS Matrix specifying what kinds of knowledge structures will be handled, and what kinds of services are needed. Second, we build a KSS Matrix or each prospective tool. The KSS Matrix diagram for the problem works as a "target" diagram to be matched with the capabilities of specific tools. The analysis may point to a single best tool, or show that the best solution may lie in a combination of two or more tools. It also helps in doing cost-benefit analysis, for example focusing first on some services and structures that provide the highest returns.

Acknowledgements

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About KS Ventures

Knowledge Systems Ventures LLC (KS Ventures) provides leading edge consulting services to architect and build knowledge systems solutions for small and medium-size businesses organizations. We combine a large experience with knowledge systems technology with business savvy to provide cost-effective solutions that are highly aligned with the business strategies and goals of our clients. Our expertise covers technologies such as knowledge management methods and tools, expert systems, ontologies and taxonomies, search, and content management.

About Dr. Andre Valente

Dr. Andre Valente has fifteen years of experience and expertise in knowledge systems and knowledge management. He has designed and built knowledge management solutions for several companies in the Internet Media, Manufacturing, Aerospace and Defense industries.

Dr. Valente received a Ph.D. in Computer Science from the University of Amsterdam, with a specialty in knowledge systems and Ontologies, and an MBA from the University of Southern California. He has published three books and more than 50 technical articles on knowledge management, knowledge systems tools and business process management.