

DEVELOPMENT OF A MODEL FOR MANAGING ORGANIZATIONAL KNOWLEDGE

By Barbara Ashdown* and Kathy Smith†

Managing Knowledge—One Step Up on the Information Chain

The proliferation of interest in “knowledge management” in the last few years is a reflection that information has finally gained visibility as a major corporate asset. Furthermore, sharing information across the organization to support greater learning and competitiveness has resulted in moving to the next level of information management (IM)—knowledge management. Those of us who have been in the information business for a while have to contain our amusement as we have seen a society preoccupied first with data (anything that is observed, measured, counted, or collected), then information (organized data), now knowledge (selected information), and, perhaps next, wisdom (integrated knowledge).‡ As Thomas Stewart defines it in *Intellectual Capital: The New Wealth of Organizations*, “Intelligence becomes an asset when some useful order is created out of free-floating brainpower—that is, when it is given coherent form (a mailing list, a database, an agenda for a meeting, a description of a process); when it is captured in a way that allows it to be described, shared, and exploited; and when it can be deployed to do something that could not be done if it remained scattered around like so many coins in a gutter. Intellectual capital is packaged, useful knowledge.”§

Given the lack of effective representation of information as a critical corporate asset within most technology-based information resource management plans, a major challenge for organizational leaders working with information and technology will be changing the framework of thinking from a systems/applications framework to an information/knowledge-based framework.

For many organizations, knowledge management has become equated with developing systems and approaches to sharing information about customers and products and services to enhance competitiveness and improve those products and services. Within the U.S. Department of Energy (DOE) complex, both Sandia and Los Alamos national laboratories have been engaged in projects to capture the nuclear weapons knowledge base in response to the U.S. mandate to ban nuclear testing as a method for gathering information about nuclear weapons. These knowledge management projects have included organizing written documentation as well as interviewing people to capture their individual knowledge.

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‡ W. B. Eubanks, *A Vision of Information Resource Management*, personal communication, June 3, 1993.

§ Thomas Stewart, *Intellectual Capital: The New Wealth of Organizations*, Currency Doubleday: New York, 1997, p. 66.

For our organization, knowledge management includes not only management of the diverse and distributed collections of information that represent our corporate knowledge base but also the definition of processes, technologies, and leadership strategies to ensure that staff have ready access to this knowledge. Our corporate knowledge base includes scientific and capabilities information, internal intelligence, and information about customers. Effective access includes transparent and intuitive approaches, as well as shared and open access.

Pursuing the Elusive Knowledge Management Model

We recognized that we needed to define a vision of how to harness the vast amount of internal, organizationally based knowledge as well as externally derived knowledge sources to support the laboratory's mission—the conduct and communication of scientific research and development that leads to conceptual breakthroughs and new applications that support national and global well-being. Vision may be described as an image or mental model of how things could be or could operate. Included in this mental model is how broad concepts and processes work together, as well as the cultural values needed to sustain the overall vision.

The model for managing diverse and distributed collections of organizational knowledge that I was looking for would include enabling greater sharing and openness in the use of that knowledge and in supporting an overall “learning organization” environment, as described in Peter Senge's classic book, *The Fifth Discipline: The Art and Practice of the Learning Organization*.^{*} Often, the greatest breakthroughs in scientific discovery are the most serendipitous, engendered by circumstances that support freedom of intellectual pursuit and ready access to people with a variety of backgrounds and ideas and to a diverse information base. Therefore, the relationship between users of the knowledge, effective access to all sources of knowledge, and the organizational values and culture must all be considerations in developing a model that truly reflects this vision. As Hanover's Chief Executive Officer Bill O'Brien states, “In the traditional authoritarian organization, the dogma was managing, organizing, and controlling. In the learning organization, the new ‘dogma’ will be vision, values, and mental models. The healthy corporations will be ones which can systematize ways to bring people together to develop the best possible mental models for facing any situation at hand.”[†]

The search for a model that describes the relationship between the user, access to knowledge, and the culture of the organization led to a reexamination of existing information models. Various examples of life-cycle (creation, storage, reuse, and destruction) models are available (e.g., the DOE “Scientific and Technical Information Transfer” chart[‡]). The view of information as a tangible asset in an input-output model

^{*}Peter M. Senge, *The Fifth Discipline: The Art and Practice of the Learning Organization*, Currency Doubleday: New York, 1990.

[†]Senge, p. 181.

[‡]DOE Office of Scientific and Technical Information, “Scientific and Technical Information Transfer” chart, *Statistical Indicators of Scientific and Technical Communication* (1960–1980), Vol. II, May 1976.

suggests a more dynamic view than existing models, (e.g. as in a model developed by José Marie Griffiths for assessing the performance of libraries^{*}).

Another factor in searching for an appropriate model was a desire to reconcile the relationship between technology architecture models and information content models. Many models have been developed for use in the design of technology architectures (e.g. the DOE Departmental Architecture Conceptual Model or the Department of Defense Technical Architecture Framework for Information Management, see http://cio.doe.gov/iap/documents/vol3_guidance/guide_4.htm#4.2 and <http://www.opengroup.org/public/arch/tafim.htm>). These models do not adequately describe elements of managing information content. I wanted to find a model that would help communicate the relationship between content and technology to clarify how the two functions are integral to one another and to support the need for a different approach in developing an overall “technology” architecture. In addition, it was important to represent the relationship between the user and access to distributed collections of knowledge through technology-supported interfaces.

Another issue in developing a model is recognizing that it is often a strategic representation of high-level processes and not of tactical solutions to current IM issues. The model must become iterative with prototypical projects designed to test and refine its construct.

Finally, with the advent of the World Wide Web, traditional life-cycle models of information do not reflect the dynamic nature of the potentially inexhaustible quantity of knowledge. One recent model developed by Anna Nusbaum and Carmen Ward,[†] Sandia National Laboratories, somewhat represents the dynamic relationship between knowledge level and knowledge diffusion, reflecting their attempt to define relationships among users, access, and culture. This model, however, is also incomplete. Overall, I found no satisfactory model that would help communicate knowledge management concepts to my colleagues; a new model was needed.

Developing a Knowledge Management Strategy and Model

Recognition of the need to develop a model that describes a knowledge management strategy for our organization led to the formation of a team to attempt to describe this model. The team consisted of information professionals and an information systems consultant. Members of the team include Randy Hoffman, our library manager; Becky Lawson, our records manager; Dave Hamrin, our technical information and classification officer; Deborah York, our web manager; Bob Conrad, a library systems specialist; and Kathy Smith, an information systems consultant.

^{*}Dr. José Marie Griffiths, “Model for Assessing Performance,” personal communication, Nov. 18, 1992.

[†]“Knowledge, Information, and Records: A Management Continuum for the Future,” 1998 DOE Records Management Conference, Mayflower Hotel, Washington, D.C., July 20–23, 1998.

Defining Initial Issues and Scope

The team characterized issues faced by our internal customers, as well as problems faced by us as information professionals. In characterizing the IM problems customers are asking us to help them solve, two trends were evident: (1) people need help finding information; and (2) they are asking for tools, including guidance and technical support, to help them conduct their own IM processes, preferably from their desktop. The need to develop multidisciplinary programs is one of the big drivers behind many requests.

Our organization faces multiple problems in responding to customer requests. One of the more challenging problems is that most of the information systems and much of our staff's thinking reflect an IM focus that is too narrow to solve today's problems; we are not capturing much of the information we need. For the information we are capturing, we don't have the right tools to facilitate access and amalgamation across information collections and systems. Additionally, although desktop tools provide the means for people to create and manage lots of information, few mechanisms exist to ensure that information gets incorporated into the Laboratory's knowledge base. Corporate downsizing, reduced funding, increased demand for customized information products, and rapidly changing technology have also affected our ability to respond to customers.

The issues identified by our team reemphasized the need to develop strategic direction for managing our organizational knowledge. We identified the following steps as essential to supporting strategic direction:

- Identification of critical knowledge issues and how to deal with them.
- Definition of roles in providing direction.
- Development of a new model describing how the organization will support knowledge management.
- Development of a method for sharing the knowledge management concept.
- Development of strategy to seek resources to support the strategy.

We agreed that success would be achieved if our ideas were incorporated into the infrastructure development of the organization, if we were included in developing new systems and processes to support knowledge management, and if visible cultural change occurred as a result of implementing the strategy.

Identifying Knowledge Issues

In attempting to assess the knowledge issues for our organization, we defined the functional information needs of our internal users through a high-level inventory, the status of supporting systems and collections to meet those needs, and the accessibility of those collections to users. In defining accessibility level, we relied on an article from the Forrester Group* describing knowledge management. This article includes helpful

*Ron Shevlin, Russ Maney, Joe Sawyer, and Beth Edwards, "The Stages of Knowledge Management," *The Forrester Report—Leadership Strategies*, Vol. 3, No. 2, Forrester Group, November/December 1997.

definitions of three stages of knowledge management, describing the relationship of the user to accessibility to content. The first stage is defined as “assisted,” where the user works with information professionals to retrieve needed information. The second stage is “self-service.” At this stage, users have access to core business applications and knowledge through links and tools. In the third stage, “organic,” knowledge management functionality is embedded into core business applications and employee productivity tools. The transition from assisted to self-service to organic requires changes in culture and employee work habits.

We used these definitions to help us assess our organizational level of access to our information collections. We developed a matrix of inventoried information collections, showing the relationship between users’ needs, accessibility, and existing collections and formats (examples from the matrix will be described during the presentation). A useful source for helping organizations inventory information assets is *InfoMap: A Complete Guide To Discovering Corporate Information Resources*.*

We used a process called “opportunity mapping”[†] to assess degree of difficulty compared with importance to determine the effect of the knowledge needs of staff on competitiveness and overall performance of the organization (an example of the opportunity maps will be described during the presentation). Based on the opportunity mapping, we assessed the following areas as having the greatest potential for meeting current gaps in the knowledge needs of staff:

- Current research/latest technology
- Existing and potential sponsors
- Competitors
- Promotional experience/marketing
- Funding sources

Defining Roles While Defining Direction

Increased recognition of the importance of information as a corporate asset supports a redefinition of how roles and responsibilities are defined in managing information and technology. For example, most corporate information officers have been focused on managing systems and applications rather than on assessing and managing collections of corporate knowledge. The model we have developed is intended to help support redefining roles and responsibilities for leaders in information and technology. More work is forthcoming in our organization on this process.

* Cornelius F. Burk and Forest W. Horton, Jr., *InfoMap: A Complete Guide To Discovering Corporate Information Resources*, Prentice-Hall: Upper Saddle River, N.J., 1988.

† Wilson Learning Corporation, “Input Group Opportunity Maps,” *The Innovator Facilitator Guide*, Appendix A, pp. A1–A6, Eden Prairie, Minn., 1991.

Creating a Knowledge Model

As stated earlier, many existing IM models are based on either a technology/application view or a life-cycle view. The challenge is to develop an IM model that represents management at the individual, group, division, and enterprise levels and that describes the integrating infrastructure needed to provide a unified resource base to the end user in search of information. We created three models to represent a comprehensive knowledge model:

- Stages of Knowledge Management Model (Forrester)
- Expanded Life-Cycle Information Management Model
- Organizational Knowledge Management Model

In building a series of models, we started with an attempt to create a graphical model that illustrates the ideas outlined in the Forrester article (*Leadership Strategies*, Vol. 3, No. 2, November/December 1997). We then expanded and detailed a life-cycle model. Neither of these effectively reflected how to manage the complexities involved in weaving local, enterprise, and global information into an easily navigated resource for end users. We finally began to synthesize these ideas into an Organizational Knowledge Management Model. This model acknowledges the relevance of life-cycle management for different granularities of information collections and places it in the context of the integrating infrastructure needed to assist end users. (These models will be featured during the presentation.)

Sharing the Knowledge Management Concept

Completing the model is essential to being able to share the concept. Our current strategy is to work with a few computing leaders to clarify some of the technology infrastructure. We have initially defined a stakeholder's group with which to share the concept and get input. Presenting this paper is another form of getting input from the information community.

We have also defined three potential pilot projects to help us refine the model:

- Development of an organizational capabilities database
- Development of a virtual proposal support center
- Use of meta tags to improve search and retrieval of web pages

Conclusions: Taking the Next Steps in Strategy Development

As described, we will pursue several pilot projects that will support the identified knowledge or infrastructure gaps. Results from these projects will be used to help refine our model. We intend to communicate these concepts to key stakeholder groups to get feedback and buy in. We will also help clarify roles and responsibilities across the

organization in developing strategy and infrastructure, particularly with the chief information officer.

Pursuit of a model that embodies our vision of knowledge management for our organization has resulted in a greater understanding of knowledge issues and in clarification of the relationship among information collections, users, technology, and accessibility. In addition, we have recognized that the most effective way to support this model is through the pursuit of discrete projects that will fill knowledge gaps for our users.

Presentation to Inforum

May 5, 1999

*Development of a Strategy
for Managing
Organizational
Knowledge*



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Building an Organizational Knowledge Strategy Has Been a Team Initiative



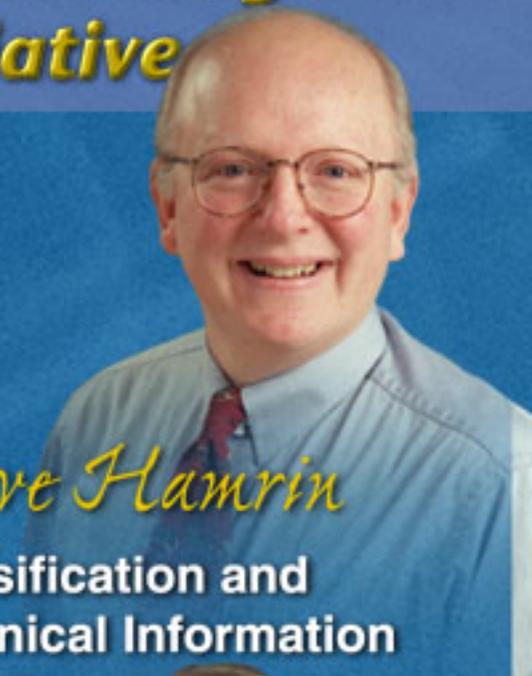
Bob Conrad

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Records Manager



Deborah York

Web Manager







Oak Ridge National Laboratory is a Multiprogram Science, Technology, and Energy Laboratory with Strengths in

- **Materials science and engineering**
- **Neutron science and technology**
- **Energy production and end-use technologies**
- **Mammalian genetics**
- **Ecological research**
- **Unique user facilities**



Approaches to Managing Organizational Knowledge Are Proliferating

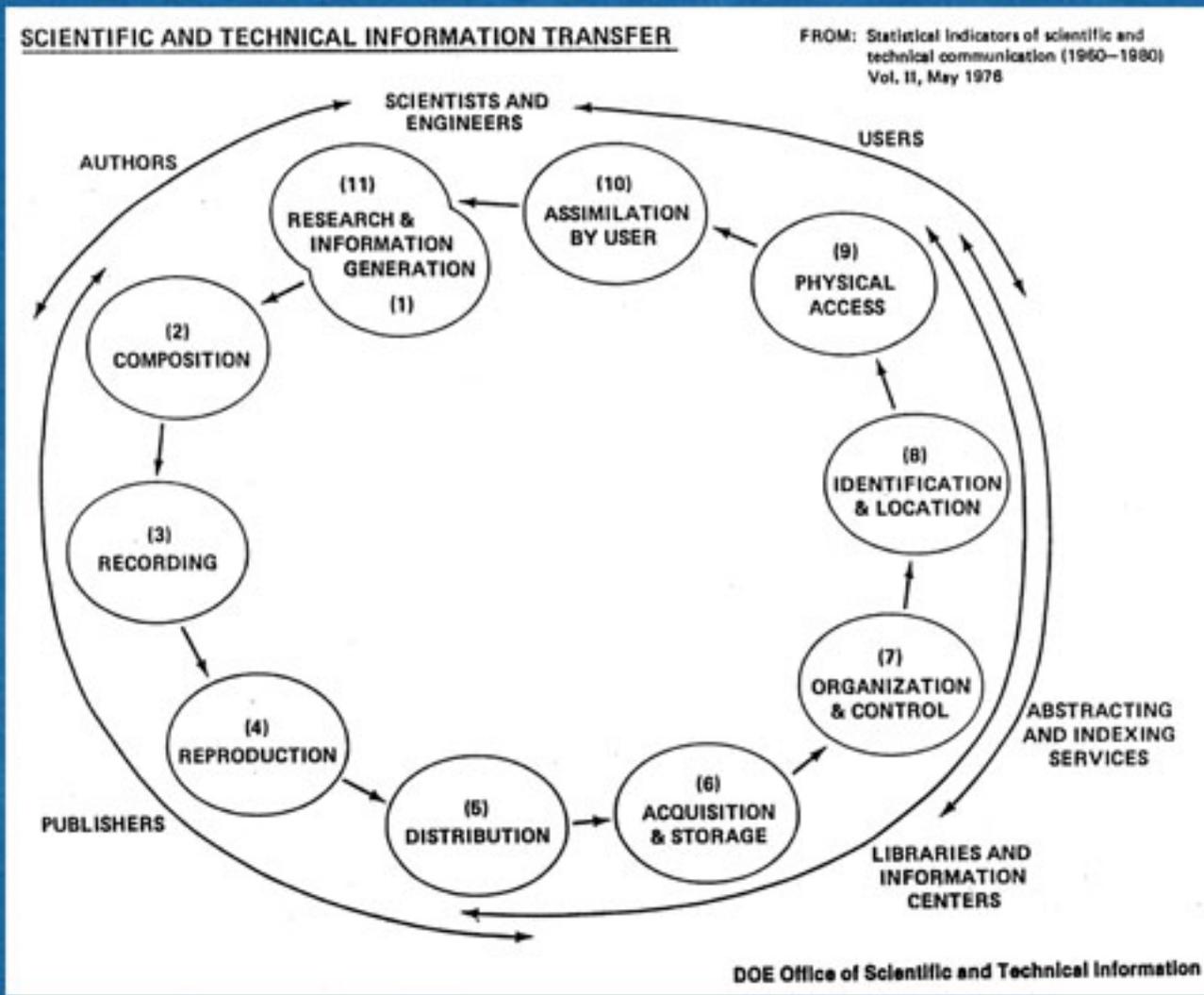
- **Technological tools are now available**
- **Nature of work and the "new" worker demand more information**
- **Organizational cultures now support sharing internal knowledge**
- **Information technology and information content management are more aligned**
- **Worldwide collaboration is increasing globalization of science**



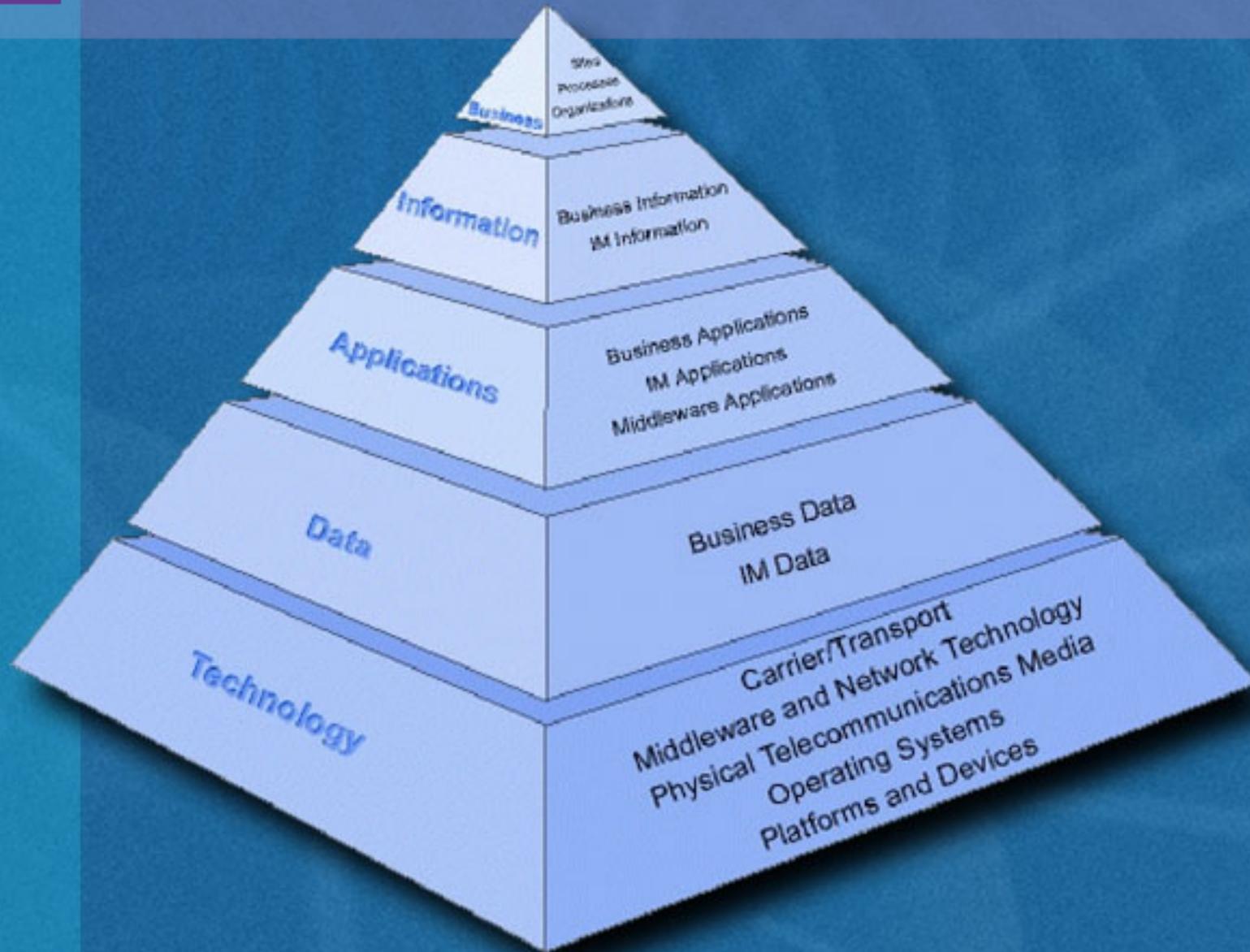
Organizational Knowledge Management Strategy Requires a Model

- **Models describe broad, complex relationships and processes (often visually)**
- **Knowledge models need to consider relationships among users, access to knowledge, and organizational values and culture**
- **Information life-cycle and technology architecture models are available**

Example - Life-Cycle Model



Example – Technology Model



ORNL *Scientists Need A New Knowledge Strategy*

- **Want more access to:**
 - internal capabilities,
 - work others are pursuing,
 - archival information,
 - funded and unfunded proposal information, and
 - information about sponsors
- **Need support to pursue more multi disciplinary projects**

ORNL *Scientists Need A New Knowledge Strategy* (cont'd)

- **Want tools, guidance, and technical support to do their own information management work**
 - at the desktop,
 - remotely, and
 - through cross-organizational collaborations
- **Want information packaged and organized to promote their programs (e.g., images, graphics, and video)**
- **Want organizational knowledge readily accessible at the meta-data level**
- **Want their own information in easily retrievable electronic format**

Current Constraints Drive the Need for a New Knowledge Strategy

- **Some needed information is still in people's heads**
- **No integration of information across disciplines, functions, and databases**
- **Inadequate staff or resources to build tools to assist with access (indexing)**
- **Lack of appropriate skills to meet current and future knowledge management needs**
- **Knowledge available in many different formats, each with different standards and requirements for management**

Current Constraints Drive the Need for a New Knowledge Strategy (cont'd)

- **Perception that technology alone can resolve all issues**
- **Guidance for transition to electronic information management in transition stage**
- **Organizational culture still driven primarily by independent initiatives and traditional scientific field lines, resulting in knowledge hoarding**

Steps in Developing a New Knowledge Strategy

- Creation of a multidisciplinary team to develop strategy
- **Identification of critical knowledge issues and how to deal with them**
- **Development of a new model describing how the organization will support knowledge management**
- Definition of roles in providing direction
- Development of a method for sharing the knowledge management concept
- Development of a strategy to seek resources to support the strategy

Identification of Critical Knowledge Issues

- **Conducted a high-level inventory of functional information needs**
- **Determined accessibility level to collections for users**
- **Assessed the status of systems and collections to meet needs**
- **Evaluated areas of greatest potential for meeting customer needs**

Inventory of ORNL Collections

- Personnel
- Financial
- Current Research/Latest Technology
- Historical/Past Research
- Other Researchers
- Existing and Potential Sponsors and Sources of Funds
- Facilities
- Organizational Structure
- Competitors
- Scientific Capabilities at ORNL
- Scientific Skills at ORNL
- Customer Profiles
- Funded Proposals
- Promotional Experience/Marketing
- Funding Sources
- Areas of Opportunity
- Administrative Procedures/Processes
- Consumer Information/Experience
- History of ORNL
- Legacy Data

*Three Stages of Knowledge Management for User Accessibility**

- **Assisted**
- **Self-Service**
- **Organic**

*A Matrix Was Developed to
Describe the General Status of
Collection Accessibility*

Example from Matrix

Information Collection	Activity	Service	State	Category	Description
3. Current research/latest technology (internal and external)	a. Current research (internal)	CPPR	E	SS, BP	Researchers need to know what's going on at ORNL
	b. Current research (mostly external)	Current contents	E	SS, B, I	Researchers need to know what's going on in their field
CD-ROM databases		E	SS, B/F, I		
Online databases		E	A, B/F, I		
SCI		E	SS, B, I		
Journal collections		E	SS, F, I		

E = Existing

N = Needed

A = Assisted

SS = Self-Service

F= Captures full text

B = Captures bibliographic information

P = Captures some full text

I = Indexed

Use of Opportunity Mapping Identified Areas of Greatest Potential

- **Current research/latest technology (internal)**
- **Existing and potential sponsors**
- **Competitors**
- **Promotional experience/marketing**
- **Funding sources**

Creating a Knowledge Model Required Three Phases

- 1. Stages of Knowledge Management Model**
- 2. Expanded Life-Cycle Information Management Model**
- 3. Organizational Knowledge Management Model**

Knowledge Management Model

Self-service Information Management

- Develop communities of interest
- Information professionals to assist in what goes in community databases, for how long, and enhance categorization schemes
- Links between databases and categorization schemes
- Links to core mission apps
- Member profiles to guide information access

Organic Information Management

- Knowledge management happens in background
- Functionality embedded in applications
- Information delivered when needed by active networks

Infrastructure and Tools

Overarching:

- classification structures
- codification schemes
- community database
- categorization schemes
- search engines

Tools to categorize assets

Push tools

Synchronized directories

Core mission apps

Synchronized data models

Intranet/Extranet

Assisted services

- Information professionals to help codify
- Information professionals to categorize and to assist in finding experts and information
- Knowledge Centers: toll-free lines, email, and rapid response teams of librarians

Organic Information Management

Self-service Information Management

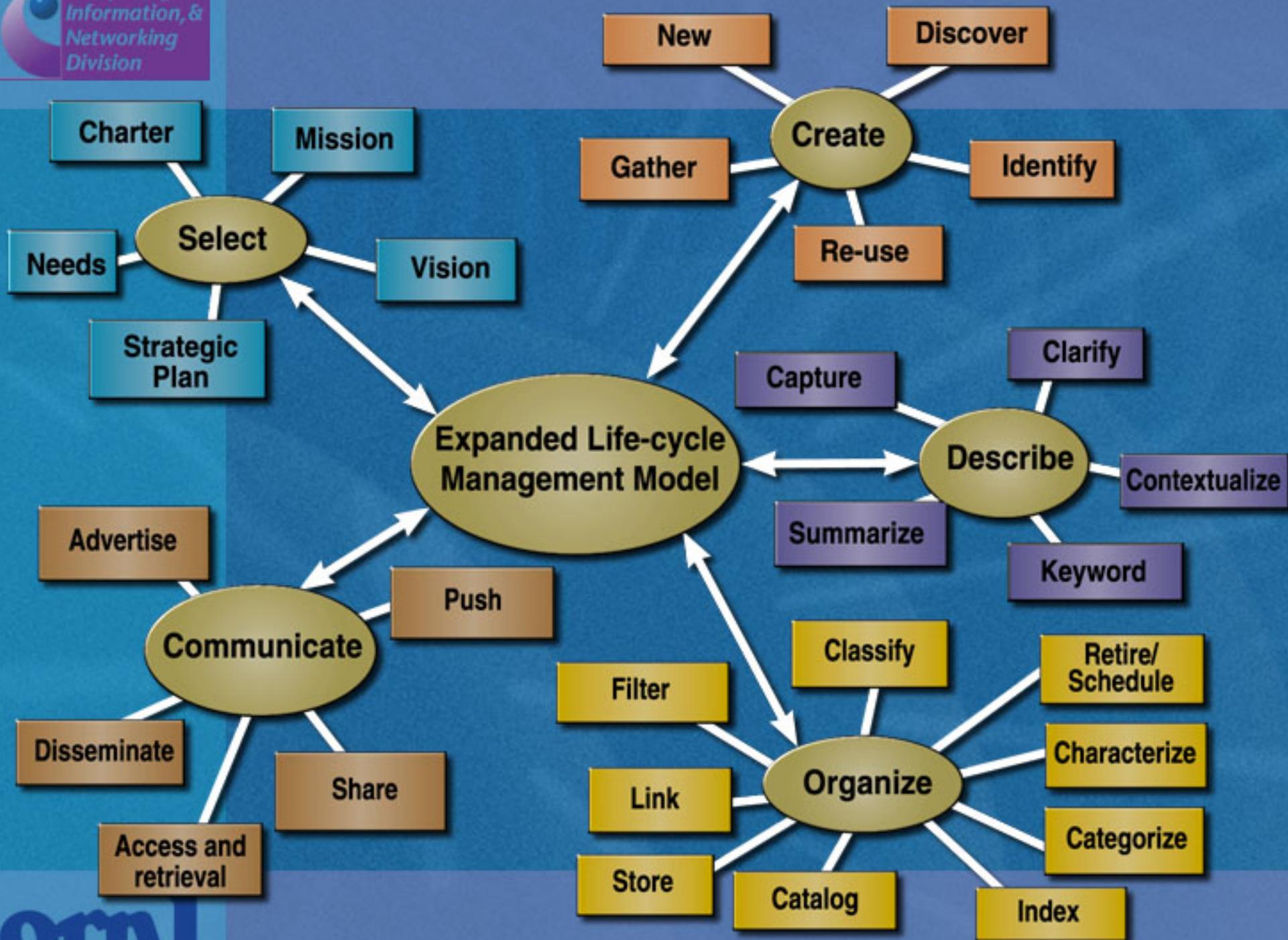
Assisted services

Infrastructure and tools

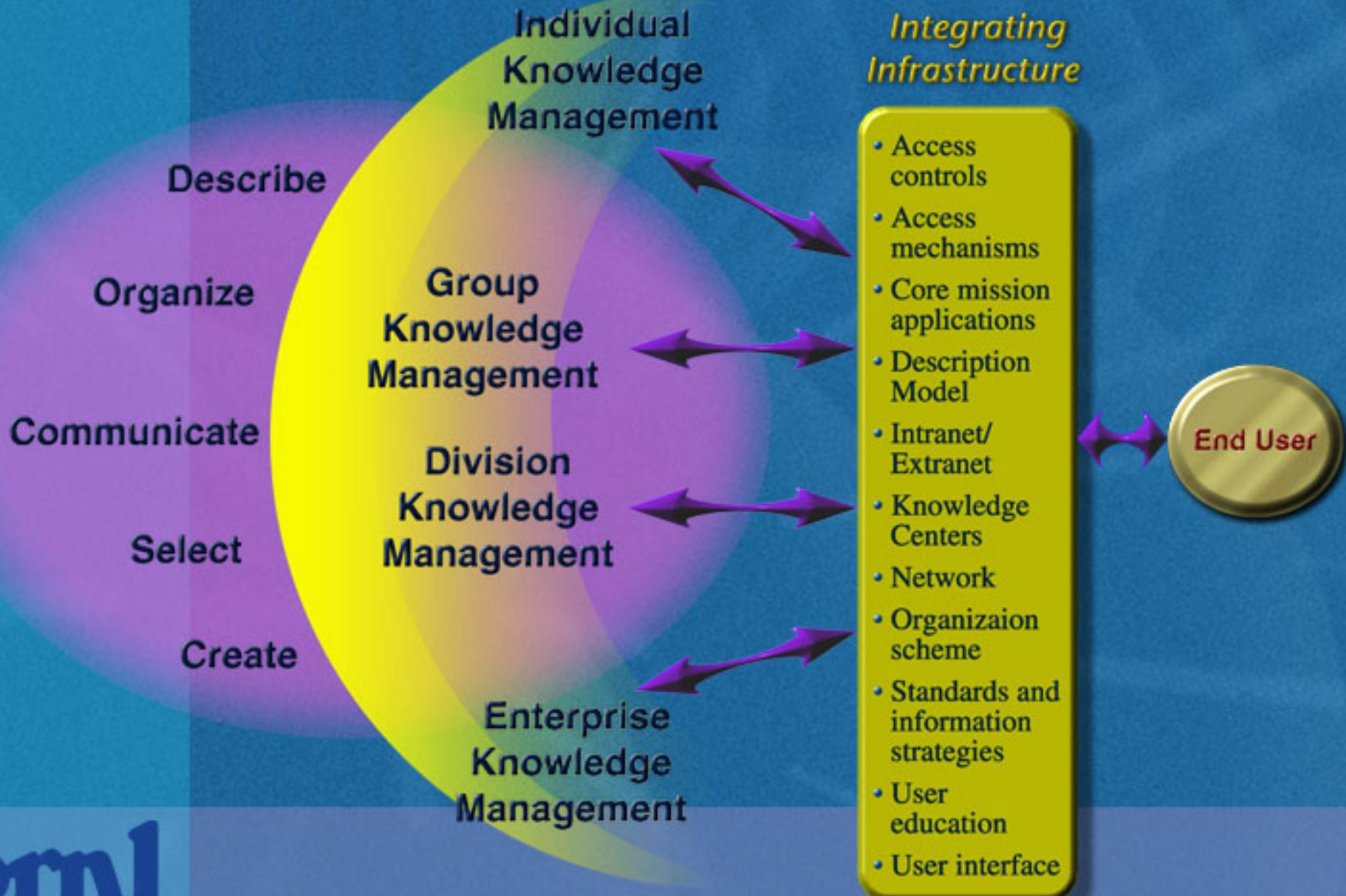
Strategies, standards, guidelines

Strategies, standards, and guidelines

- XML
- Identification of information that supports mission needs
- Reward knowledge sharing
- Integrate codification and dissemination skills into career path requirements
- ???



Knowledge Management Model



Integrating Infrastructure

- **Access Controls** - describe security
- **Access Mechanisms** - include search engines
- **Core mission applications** - contain all knowledge needed to run the business
- **Description model** - includes “thesaurus”
- **Intranet/extranet** - refers to content available at the desktop
- **Knowledge centers** - provide specialized expertise supporting various subject areas

Integrating Infrastructure (cont'd)

- **Network** - includes wires, drops
- **Organization scheme** - includes classification, categorization, indexing, and directory synchronization
- **Standards and information strategies** - include templates
- **User education** - includes guidelines, training, and user aids
- **User interface** - includes user profiles

Sharing the New Knowledge Management Strategy

- Integrate the strategy with that of the CIO and our Division
- Work with information technology staff to clarify technology infrastructure model
- Gain further input and clarification from a stakeholders group
- Pursue pilot projects to help refine the model:
 1. Organizational Capabilities Database
 2. Virtual Proposal Support Center
 3. Use of meta tags to improve search and retrieval of web pages

Implications of Implementing a New Knowledge Strategy

- **Requires a new organizational culture that fosters knowledge sharing and collaboration**
- **Requires leadership support at all levels of the organization**
- **Requires strong collaboration between information technology and information management disciplines**
- **Requires development of new skills and new ways of working**
- **Requires time, persistence, experimentation, and flexibility**
- **Information management professionals must proactively lead the way**

Questions