COMPAQ
White Paper

Contents

Knowledge Management: Approaching Solutions

Abstract: Knowledge Management (KM) is an emerging discipline that is driving a dialogue between the information technology and business management communities. The term is applied in such an inconsistent variety of contexts that there is not — and cannot be — a common model for a "KM solution" that is accepted and understood in the market.

The purpose of this paper is to provide the Compaq community, our partners, our customers and ourselves, with a common language and conceptual framework to use in exploring, designing, planning, implementing, and managing Knowledge Management solutions. It addresses the questions:

- What are some of the key business themes incorporating the language of Knowledge Management?

- What are the key infrastructure technologies that enable today's Knowledge Management solutions?

- What are the emerging disciplines and best practices in Knowledge Management systems and programs?

- What are the critical success factors in the design and implementation of Knowledge Management programs and systems?

This document draws extensively from examples of Compaq's internal expertise in developing its intranet applications to support knowledge workers, and from the experience of the Compaq Professional Services Knowledge Management programs and initiatives.

Help us improve our technical communication. Let us know what you think about the technical information in this document. Your feedback is valuable and will help us structure future communications. Please send your comments to: patti.anklam@compaq.com

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Knowledge Management: Approaching Solutions
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Introduction

The term "Knowledge Management" gained currency beginning in 1997 and has captured the mind share of a diverse audience of practitioners. The concepts and language of knowledge management — intellectual capital, best practices, communities of practice, knowledge repositories, tacit vs explicit knowledge, portals, and so on — resonated across enterprises, from CEOs to quality managers to technical writers, human resource managers and organizational development consultants, to webmasters and corporate communications professionals.

A growing number of companies today are pursuing IT solutions for Knowledge Management because of its promise to let them better leverage their collective knowledge through the use of intranets, groupware, relational databases, search engines, and other software tools. Another growing number are creating Knowledge Management programs to foster knowledge acquisition, creation, and innovation. The number of companies that have Knowledge Management initiatives in place jumped from 28% in May of 1997 to 51% in April of 1998.[1]According to a 1999 survey of 200 IT managers by *InformationWeek* Research, 94% of companies consider Knowledge Management strategic to their business processes. A similar survey of CEOs by the Foundation for the Malcom Baldridge Quality Award[2] found that Knowledge Management is the #2 priority of CEOs. The language has captured management attention. But implementing Knowledge Management is difficult because it involves managing the interaction among people, experience, and problems — and then systematically capturing the results of those interactions and sharing them across global boundaries via technology.

As an emerging business practice, Knowledge Management has wide applicability across industries, markets, and professions. It is not a new application or solution domain: it provides an engaging conceptual model and language for positioning IT strategy and organizational change initiatives. Many companies are feeling increased pressure during the current shift to a knowledge-based economy to better manage:

> *"The productivity of knowledge and knowledge workers will not be the only competitive factor in the world economy. It is, however, likely to become the decisive factor…"*
> — *Peter Drucker*

- Intangible assets: dynamic human expertise

- Information assets: the captured documents, designs, physical or electronic, and other fruits of that expertise

- Innovation: corporate strategies that leverage these assets for competitive advantage

Knowledge Management as a strategic activity consists of the systematic management of the intellectual capabilities of people within enabling business, organizational, and technical infrastructures. Why? In most companies, the intangible assets represented by ideas, concepts, capabilities, and R&D have become more significant than book value in determining a company's market value.

The most concrete way to provide accessibility to those capabilities is by understanding how to discover, organize, share, and synthesize the fruits of the intellectual activity.

The first step to understanding a Knowledge Management framework is to be clear about the activities in which knowledge is transferred, and then to understand the distinctions among the data, information, and knowledge. Figure 1 shows a general model that helps to think about the activities and the tasks that people perform in organizations to acquire, identify, collect and use

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[1] The Delphi Group, ongoing research. Results from a marketplace poll in April 1998, reported in Market Advisory, April 30, 1998.
2 "The Nation's CEOs Look to the Future," Study No. 818407 July 1998 http://www.quality.nist.gov/ceo-rpt.htm

knowledge — either tangible information artifacts or knowledge and learning that is in the minds and experience of colleagues.

Figure 1: Knowledge Activities

Knowledge management has become a meeting point for so many disciplines, solutions, ideas, and consulting methodologies, that it is important for understanding to use models and to become familiar with the language embedded in new concepts. In Compaq, we use models extensively to share concepts, so in this paper we are going to draw on these models to show how we link business goals to both organizational practices and enabling technologies for Knowledge Management. We use the language of knowledge management throughout. At the conclusion of the paper, we offer an approach for adopting a Knowledge Management perspective on existing and new corporate initiatives.
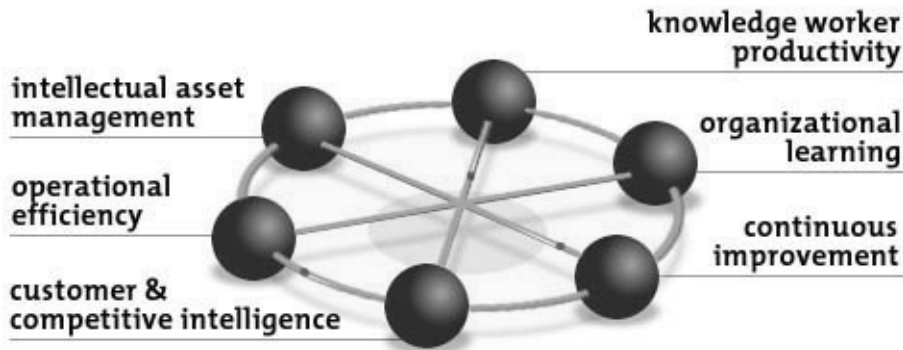
Knowledge Management Themes

Knowledge Management shows up in a number of themes in business today. Any of these themes, by itself, provides a specific set of business challenges and opportunities. Consider:

Intranets, Mail & Messaging	Collaboration & Communities	Global Supply Chain
Document Management	Data Warehousing	Distance Learning
Directories, Corporate	Enterprise Applications	Globalization
Yellow/White Pages	Customer Relationship	eBusiness
Searching	Management	

The language of knowledge management can provide perspective and focus for an integrated approach to this array of themes that intersect and complement one another. These themes also show up as potential solutions to specific business drivers — real business problems— represented in Figure 2.

**Figure 2: Knowledge Management Business Drivers**

In the following sections, we summarize each of these business drivers and related common business problems that are referenced consistently in the context of Knowledge Management. Note that none of these application areas is new, but Knowledge Management offers a new frame of reference that provides fresh insights into ways to solve these problems.

Intellectual Asset Management

Figure 1 seems simple enough if we are talking about data and information, but gets complicated when we think about knowledge, as in the classic triangle shown in Figure 3. We know how to manage data, and we know how to manage the experiences, values, and judgments of people who are operating with a specific cultural environment? Knowledge is framed in the context of the environment, culture, and experiences of an organization, its communities, and its individuals.

Figure 3: Data, Information, and Knowledge
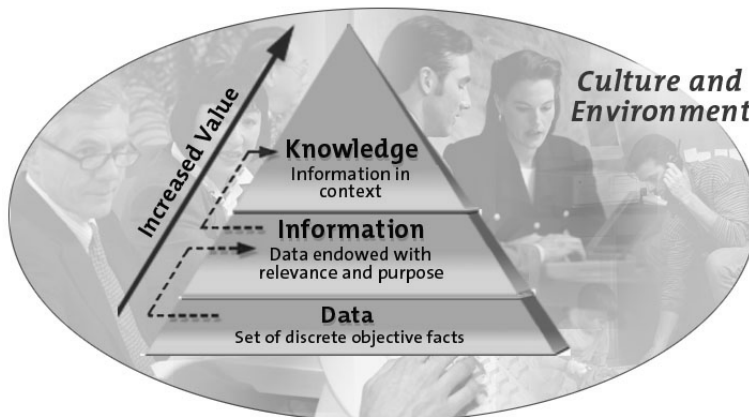
There are several specific aspects to intellectual asset management, including the following two key business drivers: innovation and protection.

Innovation: Businesses grow by expanding into new markets, developing new products and services, and by constantly discovering new ways to add value to and please their customers. Ideas are precious, but they are also fleeting, dispersed, and difficult to capture and act on. The capability to support human creativity and the cycle of innovation — embodied in appropriately integrated processes and technologies — is a primary focus of Knowledge Management.

Knowledge Management systems designed to support innovation emphasize a communications infrastructure that supports:

- Rapid interchange of ideas and documents in real-time

- Enterprise-wide accessibility of online discussion forums, research notes, and product and project information

- Disciplined capture and sharing of best practices, methods, and processes

- Capability and competency development programs that effectively catalog current and future skills, talents, and expertise necessary for the business in partnership with organizational development and organizational learning programs.

A primary theme in the literature of Knowledge Management is of communities, including communities of practice,[3] microcommunities[4], communities of interest, communities of purpose. Community — shared understanding and access to the work and minds of others — is a principal element in an innovation strategy.

Asset Protection: What people know walks out the door with them every night. In many companies, a key element of a Knowledge Management program is to guard against a recurrence of the widespread "organizational memory loss" that occurred in the wave of downsizing in the early 1990s. A company cannot protect against the loss of the human creative energy that leaves the company, but it can develop a well-managed, verifiable repository of the artifacts of results of that energy: patents, research, analysis, and project experience. Such artifacts, and the expertise required to manage them, provide a necessary hedge against what might otherwise be unsustainable loss through ill-planned downsizing or catastrophic events. Focused attention to the development and documentation of methodologies that embody the work is also an integral part of the asset retention process, as is the establishment of communities to broaden the base of experience.

Human Resource Management: The mapping of organizational knowledge — identifying what the company knows, what the company needs to know, and how capabilities and competencies will be maintained and developed is a key attribute of many knowledge management programs.

Naturally, effective Knowledge Management programs may also encompass systemic and proactive programs to retain — through systems of tangible and intangible reward — the people who provide the intellect, knowledge, wisdom, and experience that sustain corporate advantage.

Human resource managers and organizational development consultants are therefore key members and stakeholders in Knowledge Management programs.

Operational Efficiency

Increasing speed and cutting cost are not business problems unique to the domain of Knowledge Management, but there are some elements of Knowledge Management practices that put a new perspective on these classic business problems.

Responsiveness: Time-to-market, time-to-profit, time-to-solution, and time-to-delivery are all critical business drivers that hinge on a company's ability to respond rapidly and effectively. Companies must be able to respond to customers and partners with a vital piece of information, a

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[3] Etienne Wenger, *Communities of Practice: Learning, Meaning, Identity*, Cambridge University Press, 1999. See also "Communities of Practice: The Organizational Frontier," Harvard Business Review, January-February 2000

[4] Georg Von Krogh, Kazuo Ichijo, Ikujiro Nonaka, *Enabling Knowledge Creation*, Oxford University Press, 2000

project proposal or bid, or the name and availability of a person with a particular skill set. Responsiveness has two key ingredients:

- The availability of carefully selected, filtered and delivered external information about partners, customers, markets, industry and geo-political news events delivered in a timely fashion

- The ability of knowledge workers to reuse and re-purpose existing documents and other knowledge artifacts rapidly without sacrificing quality or information integrity

- The ability to make rapid decisions in a complex, changing environment

For a knowledge worker in a time-compressed environment, "How fast can you turn that around?" is a question that continually begs a better answer. In a customer services or call center environment, the ability of a service representative to respond to a customer — *in the moment and in the context of all of the customer's previous interactions of all sorts* — is a critical success factor.

Reuse: Good ideas deserve reuse. Effective Knowledge Management includes methods and systemic rewards for sharing and reusing work ideas and artifacts, and storing them in a form that makes them accessible and usable for others. In a professional services company, the practice of capturing both work artifacts (proposals, design documents, software programs, user guides) and methods (questionnaires, checklists, procedures) used during the course of work are the essential knowledge-building activities. In the Compaq Professional Services group, the Knowledge Management program is focused on the disciplined capture of such artifacts. Reusability is a cornerstone of quality improvement, productivity gains, and increasing profitability.

Customer and Competitor Intelligence

Customer Knowledge: No one disputes the value of maintaining a rich set of current information about customers. Thomas Stewart cites "customer capital" as one of the three legs — human capital and structural capital (information systems and infrastructure) are the other two — of an enterprise's overall intellectual capital assets.[5] In an Ernst & Young[6] survey of 431 executives, 97% of the respondents listed customer knowledge as one of the most strategically important issues.

Today, most customer knowledge is dispersed among:

- Sales and financial reporting systems in the IT infrastructure

- Captured responses, patterns, and "clicks" from Internet Web sites

- Marketing information accumulated from focus groups and research

- Usage information compiled from product support databases

- Acquired knowledge from sales and customer support representatives, as well as consultants who interact with customers on a regular basis.

While this last type of knowledge is the most difficult to collect and manage, it is probably the most valuable. The collection of products and technologies that supports this type of capture and

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[5] Stewart, Thomas A., *Intellectual Capital*, Currency Doubleday, 1997.
[6] Cited in "Poor Knowledge Management Practices Threatens Competitive Advantage", Canada News-Wire via DowVision 11 May 1998. Other high-scoring issues: best practices/effective processes (87%) and their own competencies and capabilities (86%).

analysis is called Customer Relationship Management (CRM) systems. An enterprise Knowledge Management strategy needs to address the linkages among the types of customer information collected and the opportunities for transforming that knowledge into better relationships and improved value to the customer.

Competitive Intelligence: Competitive intelligence is about being aware of, sharing knowledge about, and creating intelligence with regard to companies, regulators, special interest groups, and other external forces in your industry. The collection and interpretation of data and information about these forces lead to the insights needed for establishing a new value proposition, deciding on which businesses to enter or exit, identifying and evaluating merger and acquisition candidates, and creating more value to customers than competitors. In the context of an overall Knowledge Management strategy, previously independent competitive intelligence (CI) departments are building ties to corporate strategic planning groups, integrating the CI databases and data warehouses with the customer databases and support systems, and tapping enterprise-wide knowledge.

Knowledge Worker Productivity

Productivity for today's knowledge workers involves:

- Acquiring useful, relevant information about their environment in a timely fashion.

  Employees in a global, distributed workforce must have equal access to timely information and personalized delivery of the information. Employees sometimes learn new information about their company from the press before they hear about it from their own management. If the news is about new product offerings or strategic initiatives, the result can be merely embarrassing or it may be actually costly.

- Ready access to the tools, information, and people they need to perform in their work.

  Users must have access to the information they need to effectively perform their jobs, but it is not easy to ensure that employees receive what is relevant and useful in their context. A key trend in intranet design is to create personal portals: customized interfaces tailored to the needs and requirements of a specific class of knowledge worker. Intranet portals are an updated version of Electronic Performance Support Systems, also called "workbenches," which have been evolving over the past decade. Sales Force Automation (SFA) systems are a specific application of workbenches that include workflow and contact management.

- Access to information in a reusable form.

  The electronic publishing revolution brought the ability to create, modify, store, and exchange documents to the desktop. Document management systems can capture, categorize, and control revisions and access to product and research data, client information systems, and other vital structured business documents. Internet technologies unleashed an explosion of internal publishing and information sharing. Companies are increasingly recognizing that a key to understanding all of what they "know" is bringing this information — ranging in form from highly structured to completely unstructured — into a cohesive, accessible, and manageable base of corporate knowledge.

In a knowledge-based economy, these elements must be supported by easy-to-use tools that enable tacit (unarticulated) knowledge to be represented explicitly. Word processors, spreadsheets, graphics, and presentation editors are the standard toolkit for knowledge workers to capture what is in their heads and put it into a form where it can be transferred to others electronically.

Organizational Learning

People engaged in Knowledge Management initiatives quickly realize potential synergies with programs in human resource departments — especially those that have been focused on organizational development and learning. The development of skill inventories and capability planning tools dovetails with efforts to map corporate intellectual assets and identify knowledge clusters as well as gaps. Organizations need to identify competencies needed for new programs, and put training and development initiatives in place quickly to respond to new market requirements. Frequently, the IT applications that record and track competency development and manage the acquisition of skills are in HR departments: thus HR professionals are key partners in Knowledge Management programs.

Distance Learning: Training departments are increasingly looking to distance learning solutions to provide focused training solutions to employees worldwide at the point at which the training is needed. Such systems, integrated into business processes and knowledge worker "portals" support strategic and rapid capability deployment when a business is entering a new product area, new market, or new geography. These systems must be designed to ensure the appropriate mode of learning with the appropriate elements of real-time, online, face-to-face, self-led and instructor-led training to ensure maximum impact.

Teaming: People learn individually, in small teams, in microcommunities and in larger communities of practice. The infrastructure to support organizational learning must provide not only places and spaces — conversation forums, electronic and physical meeting places, team archives — but also support for human processes, different learning and expressive styles, and incentives for sharing.

Continuous Improvement

Continuous improvement of core business processes is a staple ingredient of many quality programs, as it must also be of Knowledge Management programs. In particular, enabling technologies offer solutions for improved responsiveness and for creating and sharing "best practices."

Product Development: Many document management systems have been developed specifically to support product development processes. These programs enable the capture of *information* about product specifications, schedules, vendors, customers, problems reported by customers, and the many details that must be managed to support new product development. The information in these systems can provide an essential knowledge base for action when the information is structured and managed in such a way as to provide a perspective that enables product or process improvement. Many of the techniques developed for concurrent engineering projects are put to good use as knowledge management practices. One specific discipline is the use of whole product teams. All potential team members with relevant knowledge are included in the project from the very beginning, so the knowledge transfer occurs so the knowledge can be best put to use.

Best Practices: In many enterprises, the sharing of best practices has evolved from origins in the TQM (Total Quality Management) benchmarking initiatives of the early 1990s to the realm of Knowledge Management. The methodologies for benchmarking are well advanced and appropriate for capturing and cataloguing Knowledge Management practices. Many companies use a variety of forums to ensure that departments and groups cooperatively share their experiences — more commonly called "good practices" now — in streamlining processes, nurturing innovation, improving quality and capturing learnings.

Knowledge Management: Enabled by Technology

Although IT is critical for capturing and sharing intellectual capital, successful Knowledge Management also involves changing business practices and corporate culture. With a Knowledge Management program in place in its professional services organization since 1997, Compaq understands that Knowledge Management encompasses more than technology. Our experience bears out the rule of thumb that "less than one third of Knowledge Management involves technology; two thirds is about people and involves culture change and behavior modification." If you look at Knowledge Management from a technology viewpoint only, implementation and organizational institutionalization are likely to fail.

Yet it is technology that is the enabler of Knowledge Management. Knowledge Management has become a viable topic because the technologies that emerged to support networked businesses and communities are now globally available and increasingly pervasive. It is important to understand those technologies as the underpinnings of a Knowledge Management strategy.

Successful Knowledge Management is more than simply repositioning existing products or technologies. The best solutions start with an analysis of the actual business problem that needs to be solved. The business problem areas described earlier are all good starting points. However, it is also useful when talking about solutions to have an understanding of the technologies that may provide the platforms on which to develop a solution. In a systemic, architected approach to knowledge management, all the key technical domains supported in an enterprise must be positioned with respect to how they will support, enable, or focus Knowledge Management initiatives. Figure 4 illustrates the key domains that participate in a systemic approach to knowledge management.

Figure 4: Technical Domains for Knowledge Management

Users interact with systems from a variety of platforms, in a variety of modes — connected and disconnected, in teams and singly, in a hurry or at leisure. The goal of any knowledge management system should be to support and enable people to access what they need, when they need it, in a form they can use and in a context that enables them to act successfully. The implications of this fundamental Knowledge Management principle are that each of the technical domains must be attuned to the needs of the users.

Internet and Intranet

The transformative impact of the Internet and the World Wide Web has not yet been felt in all enterprises, but the implications are becoming clearer. Companies that have not yet been transformed are experiencing the pain of the proliferation of local department, workgroup, and skunkwork intranet projects.The lightning speed at which intranets became a primary source of internal knowledge exchange has forever changed the nature of both information technology and organizational systems. It is not coincidental that "Knowledge Management" emerged as a business problem at the same time that increasing amounts of information became more readily accessible to employees via Web browsers. The IT problem shifted from making information *available* to making *meaningful* information available. The simple difference is that meaningful information leads to action and hence business advantage.

The primary requirements for intranet-based knowledge management are:

- **Easy to find.** There must be an easy-to-use search engine or portal appropriately configured to index and retrieve enterprise information.

- **Easy to share.** The collection of documents and other artifacts that represents knowledge work must be manageable; users must be able to easily post, distribute, and update their own intellectual contributions and work products.

- **Easy to use.** The information artifacts that are shared within the enterprise must be created in standard ways that encourage effective reuse, consistent branding, and quality content.

- **Easy to maintain.** Currency of information is important in motivating users to seek information and to trust its value.

The key practices that promote an effective intranet are:

- A clear understanding of the purpose of the intranet and what success looks like for both the intranet sponsor and the end user

- The development of an information architecture and a user interface that supports and enables users

- A strategy for the implementation of portals to support different user audiences

- Selection of a Web server and associated tools that provides flexible content management

- A disciplined categorization and search implementation strategy

- Mechanisms for monitoring the ongoing contribution and use of the information it stores

- Services and support for end users (the knowledge workers) to ensure that they can find, share, and use the intranet site

- Extension of the intranet's resources to corporate users via Virtual Private Networks (VPNs), enabling secure and authenticated access from anywhere on the Internet.

Web servers and software applications from most vendors are evolving rapidly to provide the foundational support required for these key practices.

As bandwidth and universal access to the network via optical and wireless technologies become pervasive, the ability to broadcast and view multimedia programs, including live videoconferencing, "webcasting" of important events, and sophisticated distance learning technologies will become common.

eMail and Collaboration

Until the advent of intranets, the locus of discussion about technologies for collaboration was on messaging-based electronic mail and discussions systems such as Lotus Notes®, Microsoft® Exchange, or Novell Groupwise® and the Internet mail, newsgroups, and related technologies. In the era of Knowledge Management, such messaging products are easily repositioned and enhanced to support common Knowledge Management activities, as summarized in Table 1.

Table 1: Knowledge Management Activities Supported by Capabilities in Mail and Messaging Technologies

Knowledge Management Activity[7]	Mail and Messaging Capabilities	Knowledge Management Benefits
Discover: identify, create, capture	Global directory services	Locate people worldwide with particular expertise
	Subscription-based electronic mail distribution	Receive internal news and communications to selected sets of employees worldwide
Organize: index, categorize, structure	Mail and discussion hierarchies, categorization, and indexing	Search database of email messages, conversations, and shared files
	Integration of Internet search engines with mail and messaging products	Archive, index, and search personal or shared mail folders
Share: Transfer, Publish, Learn	Electronic mail coupled with private, ad hoc, or global distribution lists	Exchange ideas and requests for information on an individual or workgroup basis
	Workflow-enabled messaging	Route and manage project documents
Synthesize: apply, team, learn	Public folders and discussion (news) groups	Participate in shared discussion groups or electronic bulletin boards

One of the most important of the messaging technologies in knowledge management solutions is the use of directories, many of which are now built on common standards such as LDAP (Lightweight Directory Access Protocol). These directory services enable people, artifacts, and system components to be uniquely identified, located, and characterized. In the knowledge management, the ability to access and communicate with people based on their skill and experience profile is a signal attribute of a mature system.

Document Management

A key distinction — and choice in Knowledge Management solutions design — is between structured and unstructured documents. Document management systems have supported many of the key knowledge management activities — discovery, organization, sharing of documents, which are in effect "knowledge artifacts" — for a long time. And these systems are appropriate for business processes that require detailed record of changes and modifications to specifications, records of various sorts, and research and development details.

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[7] Refer to "Figure 1: Knowledge Activities" for reference to this column.

However, in an expanding Web-centric world, the majority of documents are now created and stored in individual and team file stores, in eMail folders and repositories, discussion databases, Web sites, and so on. As the XML (eXtensible Markup Language) standard and practices associated with it find their way into the next generation of desktop productivity applications, unstructured documents may become as easily manageable as those originated in mature document management systems.

Key advantages of mature and robust document management systems include:

- Web-based search and access

- Versioning, archiving, and workflow

- Mail-based event notification

- Support for multiple file formats and conversion of formats to standard display formats

A document management system is particularly powerful when it is integrated within an enterprise intranet. Figure 5 illustrates how an aggregate of document management repositories would be integrated in an intranet environment.

Figure 5: Document Management System in an Intranet
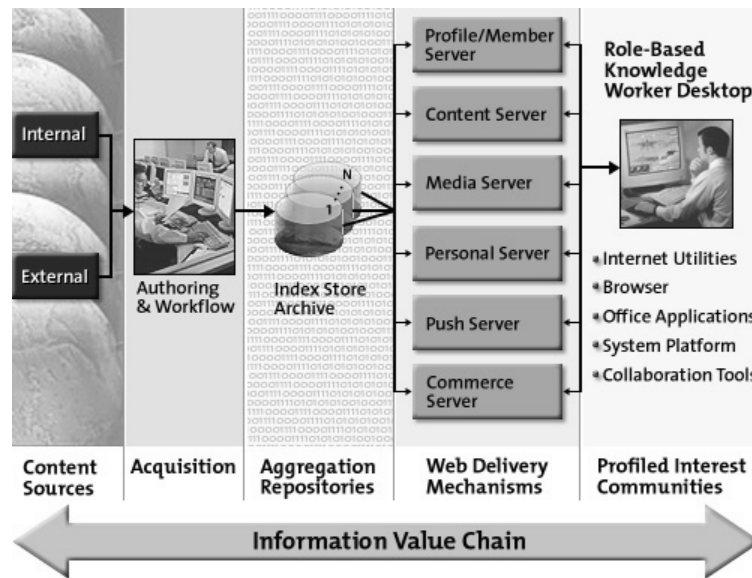
In this model, content is acquired and aggregated into both indexes and archived storage. Different applications, implemented as Web servers with specific purposes, provide two-way interaction with knowledge workers using a set of common desktop applications. The breakthrough in the use of Web technologies that was a primary enabler of Knowledge Management is the universality of the desktop: the Web browser makes it possible to have the same user interface to all applications and data.

Database Technologies

The purpose of a data warehouse is to collect information from multiple databases and put it in a common format (scrubbed and sanitized) for use in decision-support systems, while shielding the actual operational systems from ad hoc queries. The use of data has evolved from accounting for resource tracking to overall operational efficiency, to optimization of the business model. Data warehouses provide a starting point for mining information because they can:

- Provide snapshots and summarized data for trend analysis

- Provide modeled enterprise-wide information in a common format

- Support multiple levels of granularity

- Hold integrated subject-oriented horizontal views across business lines

A key difference between data warehouses and operational systems is that operational systems are designed to answer close-ended questions like how many, what color, how much. Data warehouses are designed to answer open-ended questions such as why and where, offer insights into future trends, and collect and organize massive amounts of customer and competitive intelligence. Typical examples include customer relationship management in banking and insurance, inventory modeling for retail, and target marketing. When data warehouses make information meaningful and actionable, they can be viewed as key elements in Knowledge Management systems. Figure 6 illustrates the transformation of data to knowledge for consumption by an end user.

Figure 6: Data Warehouse View of Knowledge Management
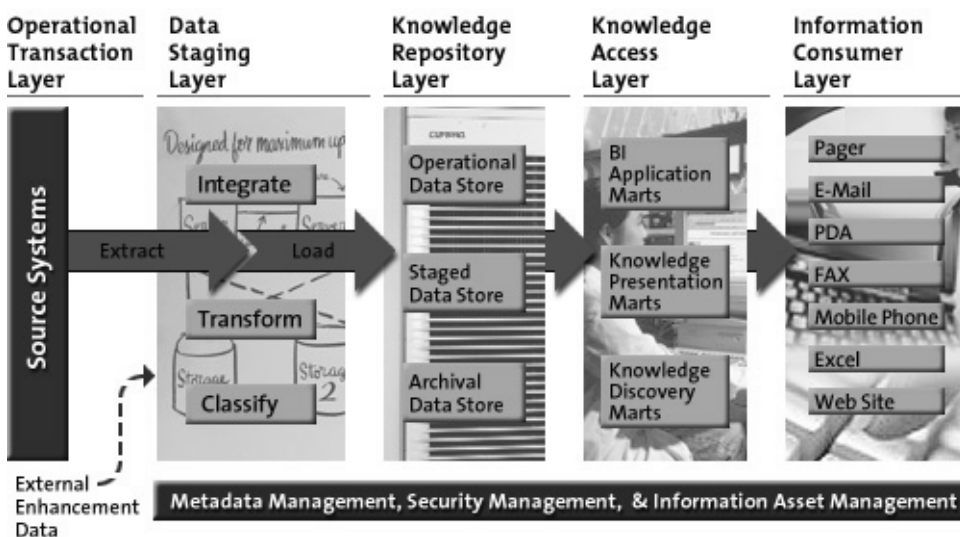
In this model, data is extracted from source systems, and integrated (in data warehouses) using established metadata, security schema and rules for asset management. The "staged" data is stored in a knowledge repository layer, from which it is accessed by data "marts" established for specific purposes: BI (business intelligence) applications, and presentation and discovery (data mining) tools. In decision-support systems, information is obtained from data warehouses by data mining, OLAP (online analytical processing), content-based searches, or ad hoc queries against a database for presentation to information consumers.

Increasingly, tools that enable or support the visualization of the data's characteristics or changes or time provide the most powerful tool for managers and knowledge workers to make informed decisions when there is a large amount of complicated data that must be correlated. Research and practice in the development of expert systems, natural language processing, and artificial intelligence have all continued with renewed interest since the emergence of Knowledge Management as a "top of mind" concern for CEOs.

Enterprise Information Solutions

The corporate information systems manager, or CIO perspective, provides yet another approach to Knowledge Management. To the keepers of the corporate information systems, Knowledge Management provides another way for users to access corporate data. The types of data and applications include operations data, repositories, information collection, case-based reasoning, use of metadata, taxonomies, thesauri construction, integration of structured and unstructured data, and integration of the variations in delivery of external information.

Knowledge Management systems that evolve from business information systems are most likely to be focused on either decision support or on enhancing the global value chain. Key steps to create a Knowledge Management infrastructure beginning with enterprise information systems include:

- Determining the key imperatives for managing corporate information

- Creating a high-level knowledge map of the enterprise

- Identifying and distinguishing transaction-based systems information from content collection and information management systems

- Designing the enterprise information systems architecture for integration

- Looking for integration opportunities

A principal opportunity for enabling integration of transaction-based or corporate-held data into a Knowledge Management solution is to establish baseline reference data for the corporation. In this activity, experts would remap the data fields in enterprise applications to ensure that all systems use the same taxonomies and data fields for core information such as customer IDs, part numbers, employee numbers, and so on.

A supply chain is the network that includes planning, design, and producing and delivering products and services. The global value chain optimizes the business's ability to efficiently move its business assets (products, transactions, and information) from their source of origin to their point of delivery.

Figure 7 shows a model of the components in the global value chain. In this model, "Knowledge Management" is a component that offers the opportunity to provide added value through point-of-transaction information capture in various supply chain components linked through the enterprise application. These component applications are data sources then available for data mining within the data management systems.

Figure 7: Knowledge Management in the Supply Chain
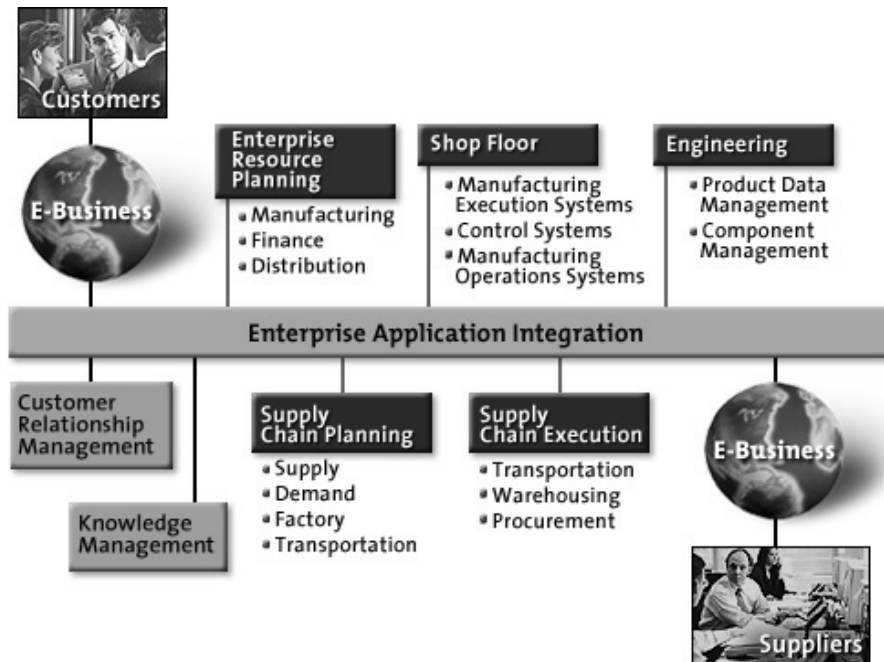
Portals

The most promising — though currently expensive — approach to support knowledge worker creativity and productivity is the design and implementation of role-specific desktop user interfaces. These designed interfaces have a number of antecedents:

- Electronic Performance Support Systems[8], also often called workbenches
- Enterprise Information Systems (EIS)
- Information Centers (InfoCenters), or plain old Web "home pages"

Today, these techniques are joined by an emerging set of technologies that have been designated as "portals," to indicate that they provide openings and views into a rich set of information and knowledge bases. Today's types of portals can be distinguished among:

- Web portals
- Commercial portals
- Corporate portals
- Knowledge management portals

Web Portals

A web portal is a web site or service that offers a broad array of resources and services, such as eMail, discussion forums and chat rooms, search engines, and online shopping. These portals increasing offer users the ability to customize pages, and given increasing sophistication of Web

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[8] This concept has been well developed and practiced by many companies since its introduction by Gloria Gery in her book, *Electronic Performance Support Systems*, published by Gery Associates, September 1991.

analysis technologies are able to offer personalized information to users. Yahoo and AltaVista are two examples of well-known web portals. They are shown in Figure 8: Web Portals.

Figure 8: Web Portals
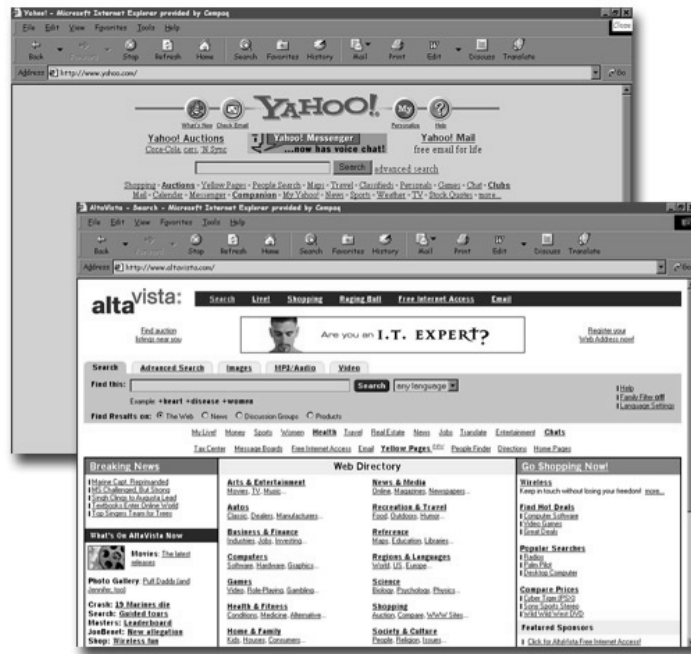
Commercial Portals

A commercial portal is a company's web presence — whether it is a "dotCom" company that exists only on the internet or is the company's electronic interface to its customers, partners and suppliers. Three of the most common business drivers for these portals are to conduct business, market the company's identity or support sales and marketing initiatives, or to enhance customer and partner relationships. Compaq's ActiveAnswers site is a commercial knowledge management portal that provides Compaq customers, partners, and employees with a shared knowledge base for information on services, products, and programs. The ActiveAnswers portal is shown in Figure 9.

Figure 9: ActiveAnswers: A Commercial Knowledge Management Portal

Corporate Portals

Most existing corporate portals (also called Enterprise Knowledge Portals, or EKPs[9]are typically "static," that is, they do not change dynamically and are essentially the same for everyone who access it. The static content on such pages is normally augmented by automatic news feeds or other dynamic content that may be based on an individual user's preference. Compaq's enterprise intranet portal illustrated in Figure 10 is an example of an Enterprise Knowledge Portal.

Figure 10: Compaq Inline Portal Page

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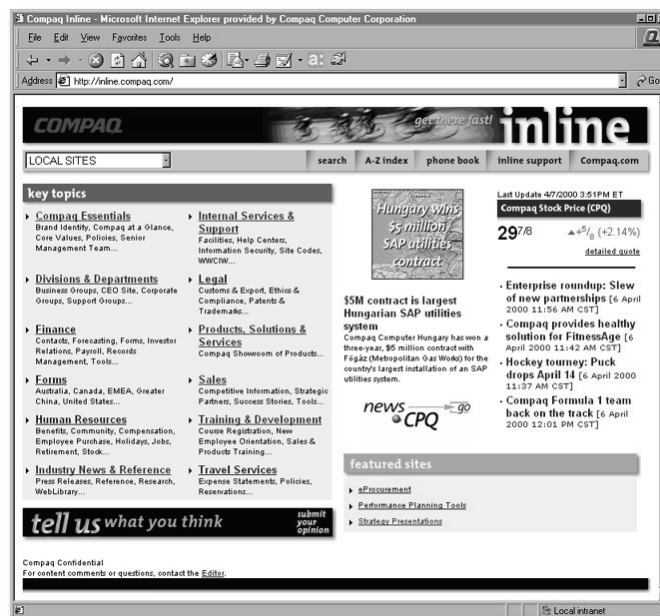
[9] See Murray, Gerry, "Connecting Communities," International Data Corporation Report, 1999.

Knowledge Management Portals

By definition, a workbench is an interface that is tailored to a specific worker's set of tasks. In one workbench model, called a Sales Force Automation (SFA) system, access to all the user's business programs and tools, as well as reliable information sources, are integrated into a single user interface. The challenge in the design of knowledge management portals is to:

- Define the audience clearly

- Define the information needs of the audience and the sources for the information needed

- Identify the key portal services that must be available to ensure that the portal will be attractive to users and meet their basic needs.

- Identify the communities in which users may participate and provide access to those communities through the a consistent interface to the portal

- Integrate the applications — group, enterprise and personal productivity applications— that must be accessible to the user in the context of the portal

Figure 11 shows a portal page and highlights content that has been integrated into the portal specifically to support a specific community of knowledge worker.

Figure 11: Portal Interface for a Knowledge Worker
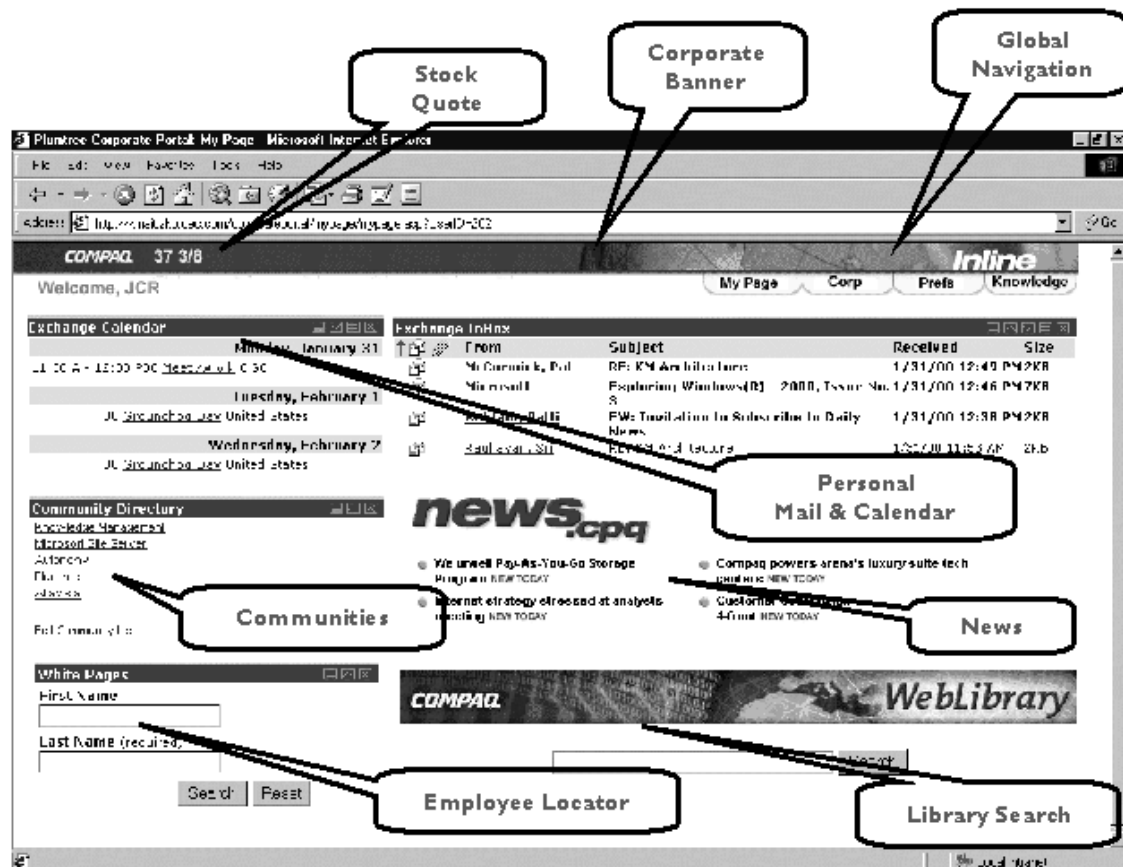
A role-specific user interface for a knowledge worker provides specific views or overlays to common information, but it is presented in the context of the user's work tasks and context. The model for such a knowledge worker interface is shown in Figure 12.

Figure 12: Information Accessible from a Knowledge Worker's Portal
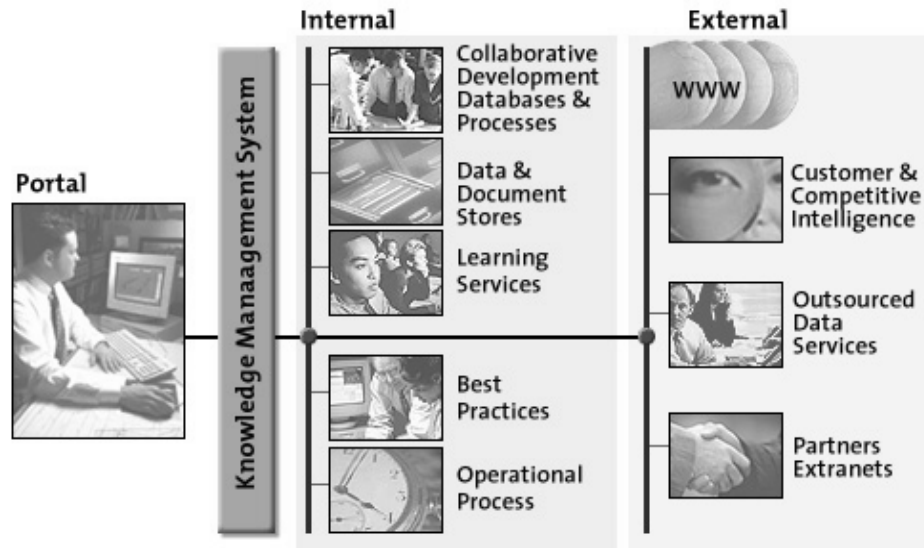
Portals are rapidly becoming a popular antidote to the "information overload" experienced by knowledge workers in today's exploding electronic community. The choice of portal type, application vendor, or solution or service provider is one that must be taken carefully. Each type of audience or user community will have different needs and requirements, and the portal itself must be integrated with a potentially large number of existing corporate applications. It is critically important to plan and design the portal with a business- and user-driven approach. The architecture of a portal within an enterprise must take into account that there may in fact be multiple portals built using a variety of vendors, with different audiences and different design centers. The opportunity in meeting this architectural challenge is to enable each community to design the knowledge base according to its needs but to make its community knowledge accessible to other communities via their own portals. This concept is known as the "federation of portals."

Mobile Technologies

By the end of the year 2000, there will be more than 20 million mobile devices connected in real time to the Internet, and most of those will also have access to a corporate or personal Intranet. The information technology industry is racing to fulfill the end user demand for these technologies to be universally available, secure, reliable, service-rich, and easy to use.

Mobile technologies support a variety of devices: laptop PCs, PDAs (personal digital assistants which usually include miniature keyboard or handwriting recognition for information entry), devices optimized for eMail access, and even telephones themselves. In addition to the proliferation of hardware devices, there are competing operating systems for software applications, and an the communication of electronic information (such as stock quotes, email, and content), the Wireless Application Protocol (WAP) WAP, the equivalent of HTML for small devices, represents a tremendous opportunity to extend the reach of the internet and e-commerce. Although not approved by any standards bodies yet, WAP is being endorsed and implemented by a wide variety of major vendors in hardware, telecom, and other industries.

The opportunities for using such devices include just-in-time news, information, and instructions to support field consultants, repair people, sales representatives; and for instant communication with a worldwide, geographically distributed team.

Note that there is synergy between the portal concept and an evolving portal concept for mobile, or pervasive, computing. The latter is a single source of information and applications tailored in presentation and interaction for devices limited by mobility requirements. A portal can eliminate the need to make mobile-oriented changes to all the information source — a big saving of effort and a big boost to consistency. Portal products built with mobility support in mind will have a significant competitive advantage.

Summary

This section has provided a review and overview of the principal technology platforms on which Knowledge Management solutions are built: Internet/Intranet, eMail, mobile technologies, document management, data warehouse, enterprise infrastructure, and portals. Within any company, specific programs and initiatives using Knowledge Management approaches are most likely underway in a variety of these. Almost all can benefit from the application of best practices as they are currently understood — and many of which provide organizational and business perspectives to complement the technical approaches.

Knowledge Management Disciplines

A review of trends and emerging disciplines shows what others have done, and most importantly provides success models and examples on which to build. This section summarizes the conventional wisdom about the essential knowledge management disciplines:

- Information architecture
- Indexing and searching
- Content management
- Expertise location
- Customer relationship management
- Subscription-based, personalized mail and information services
- Communities and collaboration
- Extranets
- Distance learning

Each of these disciplines provides a theme for the sharing of best practices — examples, archetypes, templates, and lessons learned — that are shared among practitioners in the Knowledge Management community.

Information Architecture

The role of information architecture in the design of an intranet for Knowledge Management cannot be over-emphasized. It is foundational work that supports the content creation, indexing, management, and searching — and ensures that an organization's information types and document formats support the work of the organization.

Architecture, in the IT context, describes the principles, models, and standards that provide a unifying coherence to a complex system project. Information architecture is the art and science of organizing information to help people effectively fulfill their information needs. There are a number of different models that are used to describe the information design process. Although the

models sometimes differ in terminology or the number of distinct functions, the basic structure is always the same:

Function	Description
Business Requirements Analysis	Analysis, clarification, and agreement on the business goals, constraints, intended audience, and user expectations for the business problem being addressed.
Architectural Design	System design for information. At a high level, the architecture defines the information components (publications, web sites, applications) and structure that make up the total solution.
Detailed Design	Definition of the internal content and structure of each component (e.g. each book, web site, publication, etc.).
Implementation	Production and delivery of the information products.

All information projects tend to include the latter two functions (detailed design and implementation). Business requirements analysis and architectural design are often ignored or assumed, resulting in inconsistent or conflicting designs or information products that simply do not meet the business need (since it was never clearly defined).

Figure 13 summarizes some of the key elements and activities that operate in an integrated approach to information architecture. The concentric circles represent the planning, design, and implementation activities in information architecture

**Figure 13: Elements of Information Architecture**
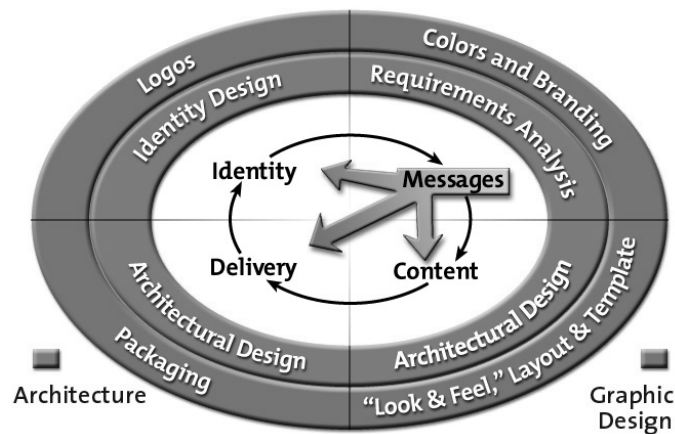
- Messages: Content, Delivery, Identity. Each unit of content must exist with respect to some key purpose, business goal, or message. Additionally, the type of content is associated with a required or preferred delivery mechanism, in a particular form that identifies it to the user.

- Design: critical design elements in the information architecture include the identity design (look and feel, branding, and so on), consistency of the artifact with respect to other artifacts in the system, and templates available to help users create new artifacts. This aspect of information architecture is particularly important to making information easy-to-use both for the creator (who needs not worry about details of formatting and design) and reviewers or consumers of the document (who can concentrate on the content).

- Implementation: the architecture needs to specify for each information type its physical format, location, accessibility, attributes, ownership, standards associated with it, and other system-dependent details. For example, it should specify which tools (and versions thereof) are used to create and modify files, the file attributes that must be specified, and so on. In the example of the consulting unit, the architecture would specify a location for proposals to be kept, a hierarchy for storing them, a taxonomy of keywords to be associated with them for searching, and a range of security attributes. Such attributes, when encoded with the information artifact itself, are usually referred to as metadata.

One of the key activities of information architecture is the development of taxonomies, or the categorization of information. A clear structure to information, showing the relationship among elements and the association of topics with keywords as well as with hierarchies, is essential for the usability of knowledge management systems. Some knowledge management portals might make use of a visual representation of a taxonomy as a starting point for sorting and categorizing enterprise information, as shown in Figure 14.

Figure 14: Enterprise Intranet Taxonomy
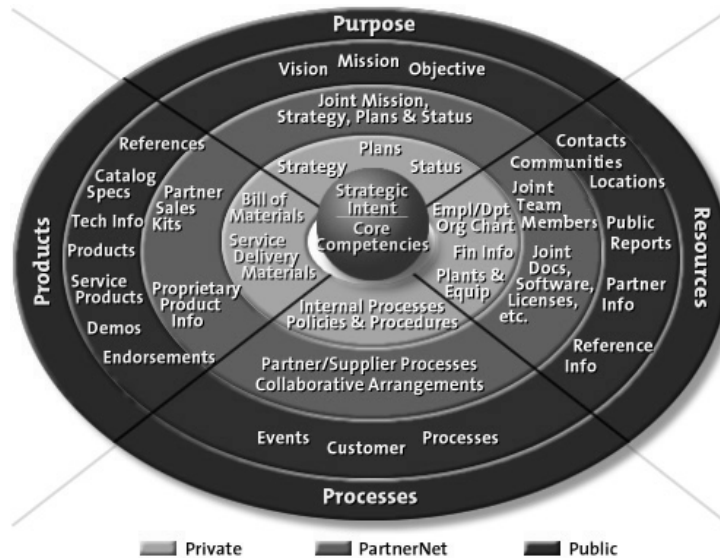
The overarching goal of this architectural model is to aid the design of an intranet so that qualified employees, customers, and partners find the information they need, in a form that is useful to them.

Indexing and Searching

Structuring and labeling knowledge artifacts so that they can be easily retrieved is a major problem for Knowledge Management. Each technical domain — enterprise applications, document management, mail and messaging, and Web — provides search capabilities. However, as the volume of information sources increases, the ability to search across document and data types in a context-specific way becomes more and more important.

There are a number of approaches and technologies for searching:

- Enterprise data and document management systems offer database-style queries

- Intranet and groupware technologies offer either full-text search or hierarchical navigation, generally by category

- Pattern-matching technologies identify and encode the unique "signature" of the key concepts within text documents. This signature of the concept then seeks out and uncovers the presence of similar concepts in volumes of content.

In reality, most intranets and public Web portals that have implemented enterprise-wide search and navigation use both of the first two forms. This ensures that users with different cognitive styles and needs will be able to find what they need. An enterprise intranet portal provides access in a hierarchical manner and a search index provides full-text access, as illustrated in Figure 10. Notice also in Figure 10 that there is an alphabetic look-up scheme provided for the site as well. The requirement to provide this type of search was identified in focus groups of Compaq users worldwide.

Search capabilities are vital for ensuring that "easy to find" is "easy to find the right information" *at the time that it is needed*. Intranet search products continue to evolve to meet an expanding list of requirements:

- Ability to search all types of documents and databases, including documents residing on user file shares, in mail folders, and so on.

- The ability to specify catalogs or collections of documents within which to conduct a search.

- Adopting the XML (eXtensible Markup Language) standard for indexing and categorization. XML supports the inclusion of metadata, including user-specified keywords, author information, creation date, expiration, and other information that provides context about documents on the intranet and that is specified in the information architecture.

- Performance enhancements that enable the indexing to take place more frequently without degrading overall system performance, thus ensuring that the index is always up-to-date with the information on the intranet.

- Ability to search multimedia content. For companies with a large investment in videotapes, audiotapes, and images, there is no question about the intellectual value contained in these artifacts and the difficulties to date in indexing and finding specific information in them.

- Incorporation of intelligent search agents.

Today's enhanced Web server applications provide Knowledge Management tools that let users help one another search. That is, an individual user can create an index of a specified set of Web sites that are known to provide useful information — by category or topic — and make this index available to others. Thus, a user who has been designated the resident expert or knowledge coordinator in a particular topic will be able to provide a search index on that topic.

Emerging technologies and products are advancing the sophistication and usability of enterprise-wide searching. Some of the work includes:

- Automatic taxonomy creation and tagging of documents

- Automatic profiling of users based on preference ratings and previous searches

- Simpler query interfaces

- Visualization of the resulting hits and their contextual relationships

- Improving the range and flexibility of the types of questions that can be asked.[10]

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[10] Andrew Lawrence, "The Searchers", in *Computer Business Review*, Volume 5, Number 10, October 1997. "The new generation of search tools will need to duplicate the way a human flicks through a bundle of old newspapers, instantly knowing the difference between advertisements, letters, news, stories, and features, processing pictures, graphics, and text, recognizing shifts in tone and style…"

Two years ago, we had the choice of full-text search (AltaVista^{TM}) or content-based hierarchical (Yahoo^{TM}). Today there are a number of search engines (Google^{SM}, Oingo^{TM,} and Northern Light, are only a few examples). Because of the newness of the technologies and the choices currently available, the selection of the most appropriate search product is one of the most difficult for an enterprise — and it is one of the most critically important to ensure discovery, access, and surfacing of vital information sources.
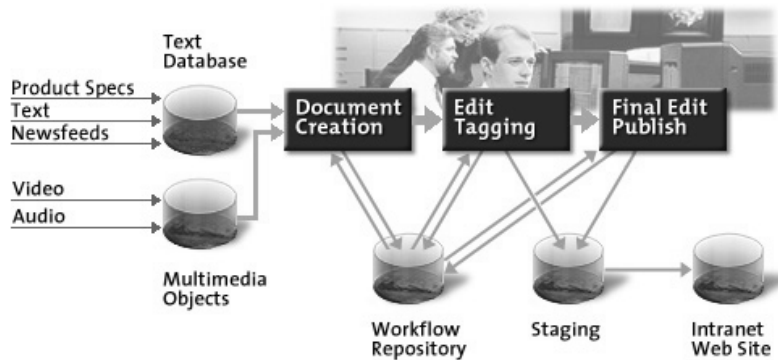
Web Content Management

The World Wide Web is an environment where anyone with access to a Web server can publish anything. In intranets, the spread of ad hoc publishing quickly raises problems associated with the integrity and security of information. Many companies refer to the current state of their Intranets as "the wild wild west," as an acknowledgment of the chaotic state created by internal experimentation and local development, which has caused service downtime, security breaches, and a growing distrust of the content on an intranet.

How can you ensure that the information posted on the intranet, and accessible by a full-text search engine, is to be trusted when you cannot be sure of the source? How do you ensure quality? How do you ensure that only authorized people have access to sensitive information? How are Web pages created? How do you establish policies, processes, and practices for submitting, editing, posting, and refreshing information? These questions must be addressed in the context of an Intranet redesign project that may have multiple initiatives:

- User- and usability-driven information architecture for redesign of look and feel, navigation, and information organization.

- Enhancements to search engine and strategy

- Workflow approach and program to automate submission, editing, acceptance, and posting processes and the introduction of XML to enhance document tagging, version control, and maintenance

- Design and creation of a publishers toolkit and content solutions that are consistent across the enterprise, launched with a full complement of training choices to ensure maximum acceptance and minimal frustration

- Moderated user / publisher forums to provide timely answers and a sense of community

- Pursuit of new technologies to enhance Inline functionality and assist the employee

There are a number of models to chose from for the basic content staging and editing process. One such model that includes the moderation of live content is shown in Figure 15.

Figure 15: Staging of Content in a Managed System

Some of the key content management capabilities available in Web server products include:

- A tagging capability to enable authors and editors — or professional librarians or indexers — to add keywords and other metadata to categorize documents.

- Publishing workflow features that let multiple users submit documents or pages for posting — while giving the site owner, webmaster, or designated editor-in-chief the ability to specify editorial reviewers and content approvers.

- Personalization and membership services which are linked to the indexing capabilities and the corporate network security infrastructure — so that when a user searches for information, the only files that are found are those that the user is authorized to access.

These features are critical in an environment where information content needs to be trusted and reliable. One emerging practice in the intranet management is the requirement to "certify" Web pages — that is, to specify that content on a particular page is verifiable, that it has a responsible owner, and that it is subject to regular review and update. Note that in Figure 15 there is no pruning or removal activity, which is a vital part of managing the life cycle of content.

Expertise Location

To work effectively, people need to work together. Businesses spend a lot of time organizing and reorganizing to make this happen. The recent trend toward leaner, flatter, and more distributed organizations has introduced the challenge of getting the right people focused on a task. The bar is raised even higher when people need to work across companies to develop and manage large projects. Inside and across enterprises, access to expertise can mean either finding the right person to talk to or finding the right place to ask a question.

To support rapid access to the right source of knowledge, employee and resource directories as well as adaptive knowledge hubs are key Knowledge Management tools. These can take many forms:

- **Individual or group Web pages.** Intranet policy may dictate or support the creation, indexing, and maintenance of Web pages that can be tagged and indexed to ensure that employees do not waste time finding internal resources or help.

- **"Ask-anything" discussion groups.** These corporate electronic "water coolers" can be built using any-discussion technology. Anyone can ask a question and anyone can answer. These groups become more powerful if they are moderated to validate answers, prune out-of-date material, and provide closure for open-ended questions.

- **Corporate electronic mail directories, yellow pages, and employee locators ("people finders").** These tools help employees find one another in different contexts and can be particularly effective when linked to employee or group Web sites.

- **Skills databases.** Team leaders and project leaders often need to assemble groups of people based on a required set of capabilities. Employee databases that maintain current sets of skills and training certifications are usually protected from universal access, but when appropriately managed can position a company to respond rapidly to changing market conditions or customer problems.

- **Adaptive question-and-answer forums.** New software products are available that support interpretation and routing of questions to appropriate experts inside and outside a company. Some of these technologies from companies like Abuzz® and Orbital Software's Organik provide the infrastructure for public web sites where people learn from one another in the world wide web.

The emphasis in a company on the use of technologies to support expertise location should be based on the style of the company and the nature of its business. For example, a recent *Harvard Business Review* article distinguished consulting companies based on whether they should use a codification (document-management based) approach or a personalization (expert) approach.[11] The readiness and willingness of users to participate by providing detailed expertise and experience information on a corporate intranet often runs into cultural roadblocks.

Customer Relationship Management

A company that is defined and driven by information is actively seeking new ways to collect, analyze, manage, and act on customer data. The ability to identify individual customers and analyze their current and potential value to the institution is fundamental in turning data into knowledge.

Customer relationship management (CRM) systems typically assemble customer information from various sources and provide ways to extract and aggregate the information. For example, a CRM system can give decision-makers knowledge of each customer's entire relationship with the company so that an individualized plan can be developed for each targeted customer. New business processes can be implemented to ensure that resources are used more effectively and more efficiently, producing better yield.

Call centers, many of which use a technique called case-based reasoning, provide a key collection point for customer data. As customers call for support or to find out about products, the questions and answers are stored for future aggregation and analysis. The sum of the information about the customers collected in such applications provides a tremendous amount of knowledge both about individual customers — enabling one-to-one marketing programs — and about market and customer trends.

Subscription-Based Services

While much of the focus on Knowledge Management is on the collection and accessibility of internal information, there is an increasing recognition that business innovation and responsiveness require information about events and conditions outside the organization.[12] Components of external information management include:

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[11] Morten T. Hansen and Thomas Tierney, "What's Your Strategy for Managing Knowledge?", *Harvard Business Review*, March-April 1999.

[12] Peter Drucker, "Looking Ahead: Implications of the Present," *Harvard Business Review*, September-October 1997.

- Electronic publications, including trade publications, conference proceedings, and market research

- Government files for artifacts such as patents and SEC filings

- Real-time news feeds from satellite systems

The challenge in providing access to external information and events is as great, if not greater, than in managing internal information:

- Ensuring that each knowledge community has access to the appropriate information, packaged for groups or individuals, or available for self-service

- Integration of information that may arrive in different file formats or media

- Authentication or certification of the material's source

- Categorization scheme for tagging information (the corporate taxonomy)

- Licensing agreements for redistributing copyrighted material

Many news services are available for subscription based on topical interest areas. Individual, Inc. was an early adopter of Internet technology for customized news delivery. (This project was implemented by Compaq Professional Services in 1996.) There is also a trend for corporate library organizations to take the lead in bringing individualized news services to knowledge workers. Compaq's WebLibrary is an example of a service that provides customized, integrated, Web-based access to:

- Daily news articles and abstracts

- Analysts' reports and competitive analyses

- Research and technology reports

Figure 16 shows a customized information page, designed for focused access to daily news information on specific market and technology topics. This type of customized interface provides a collection of content relevant to a business problem.

Figure 16: WebLibrary Page with Options for Customization

The WebLibrary won the *Innovation in Technology Award* from the Special Libraries Association in 1998.

Communities and Collaboration

A collaboration focus is particularly important in the domain of sharing *tacit knowledge. Tacit knowledge* is knowledge that is not articulated: how to do things, why to do them in a particular way, how to interpret events, and how processes operate. Such knowledge is not easily captured or written down, and often the people who have it are not aware that they have it. Yet, in terms of intellectual capital and organizational capability, it is as important if not more important than the capturing and management of *explicit knowledge. Explicit knowledge* is embodied in artifacts such as documents and reports, as well as in documented processes and procedures.

The groupware (also called computer-supported collaborative work, or CSCW) field has also been invigorated by the interest in Knowledge Management.

Figure 17 shows the classic collaboration matrix[13] with a summary of the technologies that support knowledge-sharing activities.

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[13] Popularized by Robert Johansen, Institute for the Future.

Figure 17: Designing Collaboration Systems for Time and Location

Same Time, Same Place
- Events
- Meeting rooms
- Collaborative work spaces
- Group decision support
- Chart pads and white boards
- Intelligent projectors

Different Time, Same Place
- Situational ("war") rooms
- Calendar
- Shift logs

Same Time, Different Place
- Teleconferencing
- Screen sharing
- Electronic whiteboards
- Desktop videoconferencing
- Document sharing

Different Time, Different Place
- Team portal or activity "room"
- Electronic mail
- Intranets
- Messaging
- Workflow
- File servers

"Same Time" Knowledge Management activities received an incredible boost from inexpensive (or free) technologies such as CU-See-Me® and Microsoft NetMeeting®. The low cost of setup for these technologies has made real-time videoconferencing widely accessible to individual desktops, enabling real time interaction with peers and colleagues dispersed worldwide. For many workers in research-driven businesses such as pharmaceuticals, this real-time collaboration is vital to innovation and time-to-market. That's why it is important in the design of a knowledge base to incorporate opportunities for one-to-one interaction, either live via video/teleconferencing or at a minimum by asynchronous discussion groups.

It is also important to understand that there are types of community. Some of the common distinctions are:

- **Communities of practice.** Individuals who participate in these communities are actually practitioners, and apart from using and applying their knowledge on a particular project or work task are also engaged in the furthering of knowledge: their own and the community's.

- **Communities of purpose.** These are simply teams, or workgroups, or organizations: the individuals in these communities share a common goal or purpose, and it may be project specific in scope (including detailed deliverables, tasks, and dates) or mission-oriented.

- **Communities of interest.** These are communities who share an interest or passion for a topic, but may not be engaged in a communal task or mission, nor be using the work of the community as a developmental task.

Content management is important for communities of practice who are working in related areas of research. Such communities want to be able to share work-in-progress and look to others to refine, polish ("scrub") and make information shareable to a worldwide community. One functional model for such community-based content management is shown in Figure 18.

Figure 18: Community-Based Content Management
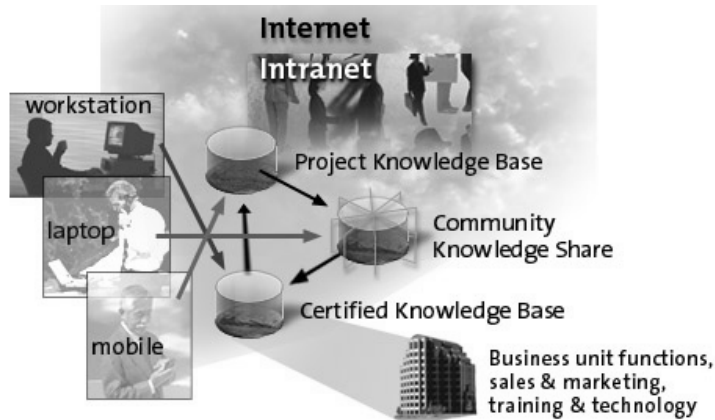
Community members share their current work in whatever form they have accessible, and the project knowledge base and the community knowledge are available on a "trust" basis. After material is validated by corporate or departmental experts, it migrates to a "certified" knowledge base where its access is controlled by appropriate governance policies.

Collaboration systems — particularly those with a high real-time content —place new requirements on an enterprise's networking infrastructure to support the bandwidth requirements of video, voice, and multimedia documents. For this reason, many Knowledge Management programs begin with an assessment of the current and necessary networking requirements. Then, as specific requirements are identified for the individual communities themselves, these can be integrated into an overall architecture for the collaboration infrastructure of the enterprise.

It is particularly important to understand that communities cannot be dictated, but can only be facilitated, and that the facilitation occurs at all levels in the system: organizationally, functionally, through information systems support, and as a result of natural work processes.

Extranets

Many companies have discovered that Internet technologies provide an increasing number of opportunities for exchange of business information as well as data. An *extranet* is an extended intranet that gives selected customers, suppliers, and partners Web access to applications and data inside a company firewall. Figure 19 shows a simple illustration of services available on extranets.

Figure 19:   Extranet System Model

Some typical examples of collaboration and Knowledge Management applications you can place on Extranets include:

- Project documentation, status, and interactive discussions

- Product research, document reviews, presentations, and white papers

- Real-time demonstrations, idea sharing, using, and information gathering

- Problem reporting and quality assurance for products in field test

- Training, either in real-time using collaborative technologies, or self-paced

In 1997, Compaq Professional Services helped Kvaerner, a multinational ship-building conglomerate, develop an extranet that linked its hundreds of partner companies worldwide. The collaborative forums and document sharing capabilities made it possible for the companies to share their learning experiences and best practices as each designed their intranets and linked them with their partner companies.

Today, this is a common activity. Also, many Internet service providers (ISPs) offer "extranet" services for companies that want to rapidly set up a shared "space" to share project documents, collaborate in discussion forums, and so on.

Distance Learning

Intranets, extranets, and the World Wide Web provide the technology platform for the integration of multiple modes of learning. In particular, they provide a number of ways to support distance learning. Distance learning enables employees worldwide to access course materials, self-paced instruction, training schedules, live events, and so on. A Knowledge Management strategy should include an integrated design for employee development based on the reuse and packaging of intellectual content. One approach is to design or to work with an application service provider, to create a complete learning infrastructure that includes components for course creation, administration, student registration, testing, and tracking, and content management. A complete architecture for such a system is shown in Figure 20.

**Figure 20: Architecture for a Distance Learning System**
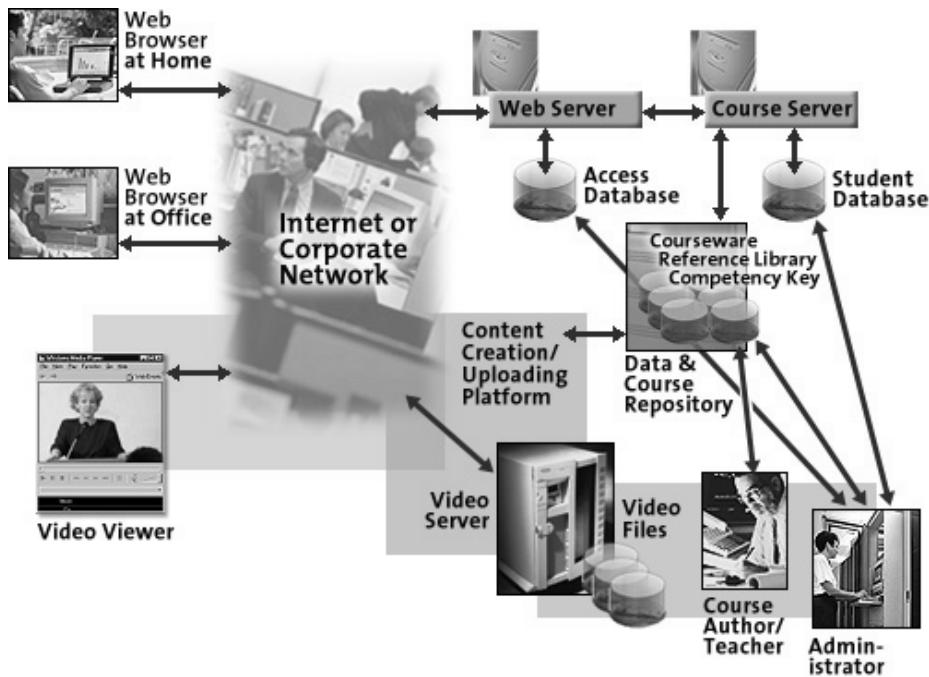
Learning strategies should aim to integrate multiple modes of instruction, including:

- Instructor-led, event-based training (lectures, seminars)

- Structured self-paced instruction (computer-based)

- Ad hoc self-paced learning

- Mentoring and cognitive apprenticeship

The last of these is, of course, the richest mode for transferring tacit knowledge. Working side-by-side with an expert in a particular area is the best way to learn how to see, hear, feel, model, and interpret events as the expert does. However, as organizations adopt the Knowledge Management perspective and learn to identify the requirements for transferring both tacit and explicit knowledge, their Knowledge Management systems will evolve to include more opportunities for distance-enabled, real-time collaboration and communication.

Figure 21 shows a sample screen from Compaq's intranet. We use a Web-based tool that enables one-to-many sharing of presentations over the intranet. At the same time the presentation is broadcast, attendees listen via teleconference. The calls are recorded so that people who cannot attend at the time of broadcast can see and hear a synchronized audio and video version at their convenience.

Figure 21:   Access to Real-Time and Archived Web-Based Training Sessions
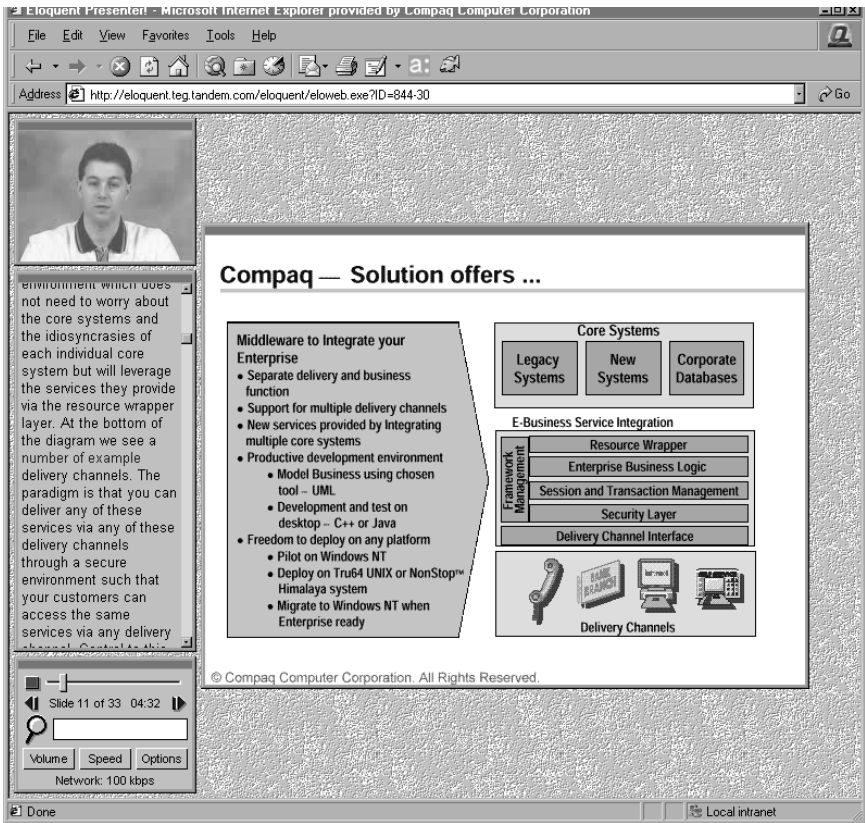
Critical Success Factors

What we have said about Knowledge Management is that it is not a turnkey solution to a specific business problem, but that it is a perspective from which to view, or to "reframe" a variety of business problems. One of the useful attributes of this reframing is that it helps you make a decision about how to approach a Knowledge Management program or initiative. The approach you choose may be based on:

- The organization's most clearly articulated business problem, which can be derived from a needs assessment

- The existing technology infrastructure and its maturity

- End user or departmental demand, or interest in adopting a best practice

Critical Success Factors
▪ **Link to economic performance or industry value**
▪ **Technical and organizational infrastructure**
▪ **Knowledge-friendly culture**
▪ **Clear purpose and language**
▪ **Change in motivational practices**
▪ **Multiple channels for knowledge transfer**
▪ **Senior management support**
▪ **Some level of knowledge structure**
▪ **Modicum of process orientation**
— *Tom Davenport and Laurence Prusak*

In the preceding sections, we have reviewed the common business problems for which Knowledge Management provides insight, the key technical domains from which to build enabling infrastructure, and conventional wisdom about organizational practices that provide starting points for Knowledge Management activities.

This section uses examples from the implementation of Knowledge Management in Compaq Professional Services to illustrate critical success factors in Knowledge Management solutions design and implementation. The next section provides a review of the technical implementation considerations underlying the system design.

Tie Knowledge Management to Business Process and Organizational Goals

A Knowledge Management solution or technology must be tied to a business goal and must also take into account organizational and personal goals.

In Compaq Professional Services, a consulting organization, support for a Knowledge Management program was immediate and unqualified based on the following compelling business goals:

- To be able to rapidly generate quality proposals, which are vital for winning successful business

- To have the ability to rapidly acquire, assimilate, package, and reuse knowledge of new technologies, products, and processes

- To have access to work-in-progress in areas of emerging technology so consultants can provide customers with credible trusteeship

Most successful Knowledge Management activities similarly begin with a clear understanding of the business goals, coupled with clear and continuous management support. When Teltech Resource Network Corporation, a knowledge services company, set out to research successful knowledge programs, it did not qualify for inclusion any project that was not linked to a strategically important activity.[14]

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[14] Hildebrand, Carol, in "Making KM Pay Off," *CIO Enterprise Magazine*, February 1999.
http://www.cio.com/archive/enterprise/021599_ic_content.html

Identify and Leverage Existing Repositories, Processes, and People

Once a focus for Knowledge Management activity is identified, it's important to understand the existing repositories (whether structured, ad hoc, or unstructured) and how they will be used to support the Knowledge Management initiative. In the case of Compaq Professional Services, there were many existing structures:

- A repository designed for capturing program management methodology and reusable project artifacts.

- An extensive corporate intranet Web and messaging infrastructure that included the WebLibrary, a global information repository, and worldwide access to communities of practice.

- A centralized, static Portal for Professional Services that provided structured links to local geography Web sites, services development and methodology sites, and sites for the headquarters functions including sales and marketing, technology, and human resources.

- A community of knowledge "managers" who are committed to evangelizing and facilitating the adoption of Knowledge Management practices.

The focus for getting the program underway was to understand and put in place processes to feed these knowledge bases with the distributed, local information contained on local file shares and Web servers located worldwide.

Focus on the End Users

"Culture Trumps Everything," says Thomas Davenport.[15] If the culture and organizational reward systems do not support and encourage sharing and reuse of information, Knowledge Management systems will fail. Extensive research in the design and deployment of Knowledge Management systems supports this conclusion. The system design must include the people who will be the primary users of the system and must address some sensitive issues regarding reward systems:

- How the system tracks contribution, access, and reuse of information artifacts. It is not enough that people contribute many things to a system; it is important to understand how useful those artifacts are to others.

- The ability to reward and/or acknowledge users who freely share, exchange, and transfer knowledge that is not artifact-based.

Organizational strategies to stimulate and reward knowledge sharing include:

- Evaluation of contributions to the knowledge base as part of the standard performance review template.

- Creation of job roles and responsibilities for knowledge managers who are measured and rewarded on soliciting and editing contributions to the knowledge base. When the individuals selected for these roles are senior people with local credibility, they can serve as champions for the organizational and cultural shift that needs to occur.

- Withholding project bonuses until the completion of the project review and assessment.

Whatever the organizational strategies are, they must be accompanied by a commitment to evolve the technical system, tools, and processes with a focus on ease of use.

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[15] In lecture at Babson College CIMS conference on Knowledge Management, December 1997.

Be Committed to Ease of Use

A recent KPMG survey[16] revealed that a significant number of the failures of Knowledge Management system occurred because of a lack of attention to the employee needs. We also have useful lessons from the experience of introducing groupware applications a decade ago:[17] "A factor contributing to the application's failure is the disparity between those who benefit from an application and those who must do additional work to support it." One aspect of the design of a Knowledge Management system is the style of interaction. One set of distinctions that helps to define how users interact with systems is shown Table 2.

Table 2: How Users Interact with Knowledge Management Systems

Interaction Style	Work Characteristics
Assisted	Knowledge managers work with employees and teams to codify and retrieve important information. IT implements stand-alone Knowledge Management applications to support storage and access.
Self-Service	Workgroups do their own codifying, IT develops links between core business applications and Knowledge Management tools to deliver information.
Organic	Codification and dissemination happen as a matter of course while employees and teams do their work. Knowledge Management functionality is embedded in core business applications and employee productivity tools.

At the organic stage of work, the reward for sharing and reusing is intrinsically reflected in the tools used to create, edit, access, and share information. Some of the key design strategies for the development of user interfaces to move systems to style include:

- *Usability*. Successful interfaces are designed by usability experts, many of whom have expertise in cognitive psychology. In a customer project in Australia, Compaq Professional Services designed a workbench for a training group. The initial project team comprised a usability engineer and an instructional designer. The engineering work did not begin until the cognitive design was complete.

- *Presenting information in the context of the user*. It is vital that interfaces be designed by working with users in the context of their work. To develop an interface to support Compaq Global Account Managers, the team used a contextual inquiry process[18] of observing the work of managers through the course of several days to develop the insights required to design a useful system.

- *Listening to what your users tell you*. As a part of the Compaq Inline corporate intranet redesign, the usability team interviewed dozens of users in worldwide focus groups. The feedback, suggestions, and ideas of this group were instrumental in creating a design that provided multiple ways for users to find and access information, as well as requirements for the detailed process of developing a robust content management system.

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[16] Knowledge Management Research Report 2000, KPMG, http://www.kpmgconsulting.com
[17] "Why CSCW applications fail: Problems in the design and evaluation of organizational interfaces," Jonathan Grudin, MCC Technical Report Number ACA-HI-211-88.
[18] The Contextual Inquiry methodology was developed during the late 1980s at Digital Equipment Corporation. It is one of a number of user-centered design processes that are practiced in the user interface design and usability community.

Taxonomies

The only way to deal with information overload is to work within an agreed taxonomy of information and to give users control over which categories of content they want to receive. Web servers support these capabilities by:

- Simplifying the establishment of a basic hierarchy of information, often through simple wizards or standard site templates

- Providing the ability to categorize and tag Web pages, documents, and other artifacts that are stored on a Web server

- Enabling selection lists in the search user interface that let a user select the categories of information within which to perform a search

To develop a good categorization scheme, there are four mutually reinforcing implementation considerations:

- The information architecture work must include a relatively complete information taxonomy and model

- The information creation and editing tools must facilitate tagging artifacts with keywords and categories, as users create, edit, and use them

- The taxonomy must be flexible; that is, it must allow users to add keywords and categories, and to specify and add synonyms for terms.

- The infrastructure must support the tagging scheme across all document types, databases, and repositories.

However it is implemented, the taxonomy is the fundamental basis of the technical infrastructure for Knowledge Management solutions.

Personalization

Personalization services make it possible for an Internet or intranet site to present unique content automatically to specified users through a variety of delivery mechanisms. Using the taxonomy developed for the site, users can specify content areas of interest. The Knowledge Management system uses the user's profile containing a personalized preference list to select information to send or display to users:

- Selection of information to display as the result of a search.

- Selection of information to display on personalized Web pages.

- Distribution of broadcast electronic mail on particular topics or information to "push" to users' desktops.

Figure 22 shows a model for the implementation of personalization.

Figure 22: Personalization
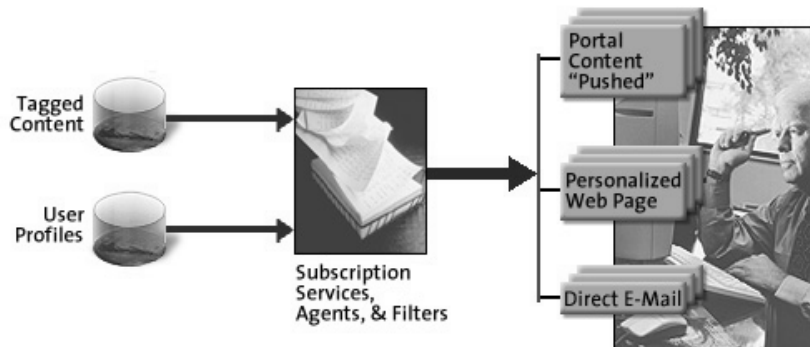
Note that users profiles can be based both on preferences and interests with respect to content and also with respect to roles. So, for example, as any individual participates in multiple communities, the profile may include subscriptions, filters, and roles based on the the multiple roles within the various communities.

Security

Users must trust their knowledge management system. Security issues include:

- Return of metadata and documents as the result of searches

- Intellectual property and copyright protection

- Confidentiality of personal employee information

- Placing "Chinese walls" around data and documents pertaining to customers whose intellectual property must be protected

- Legal issues related to fair use of information, public distribution, and so on

The basic security of a Knowledge Management system comes from ensuring that only authorized users have access to information. To be authorized to access or place information in a system, users must first be authenticated. That is, users identify themselves and supply passwords or personal identification numbers (PINs). Once users are correctly identified, they have the capabilities to do their own work — and only those capabilities. If a user is not authorized to see a certain type of information, access will be denied. Conversely, an effective security mechanism ensures that users will always have rights to use certain information or applications.

At the highest level, access rights are determined by corporate security policy. That policy defines access rights for individual users or groups of users, information or classes of information, application functions or classes, as well as the actions that are allowed by a user with respect to each. For example, anonymous users might be allowed to view abstracts of an information artifact, but not to download an entire document. The policy governs activities that take place: any permitted activity is allowed *but nothing more,* and any precluded activity is stopped *but nothing more*.

Beyond the security that can be provided for physical access to systems and files, there is the even more important aspect of security with respect to being in a trusted environment. That is, people must feel safe about sharing what they are learning, what they are creating, and what they have achieved. That is why, in designing and implementing systems, it is important to take a systemic approach.

An Integrated Implementation Approach

Once the business problem has been identified and the critical solution requirements are identified, the next task of the Knowledge Management architect is to develop an architecture that integrates the business, user, and technology views. For example, if a customer has made a significant commitment to a particular view of its knowledge assets — intranet-based, messaging-based, document, business intelligence, or enterprise application — then it makes sense to approach the Knowledge Management solution from this domain.

Compaq's Approach

Creating a Knowledge Management solution is a highly contextual endeavor. Wherever you start, you will soon see that you are working with a very large problem set and you will want to scope the problem. Compaq's approach to integrating and designing a custom Knowledge Management system is based on its experience in designing complex solutions that require the integration of new technology with legacy information systems.

Figure 23: Knowledge Management Services Transformation Framework
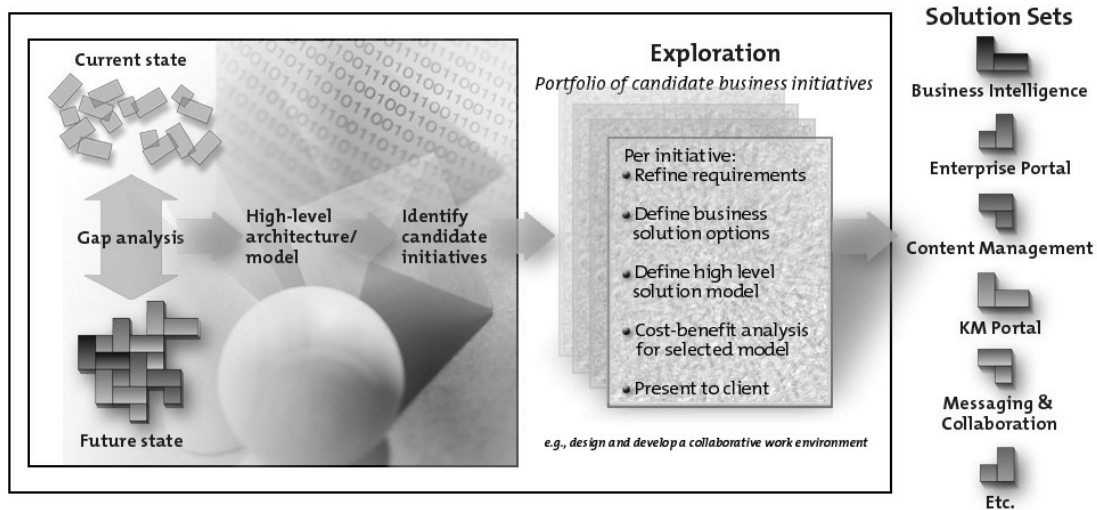
Compaq's approach, shown in Figure 23, begins with an assessment of the current state against a future state that may be constructed based on:

- A vision for a knowledge-based enterprise

- Business drivers and concrete business goals associated with those drivers

- An understanding of the work model, organizational dynamics and interactions, and business model of the organization

The result of a first series of consultations and workshops is a high-level architecture model from which multiple candidate initiatives would be identified. This assessment process may be followed by a rigorous exploration process that refines the requirements, solution options, and analyzes potential solutions based on their benefits. From this analysis we derive a prioritized set of potential solutions and based on specific technologies, products, and tools. An overall program plan provides a Project Manager with a management tool and communications vehicle. A Solution Architect uses the high-level architecture developed as a continuing source against which to validate the completed system elements against the agreed principles, models and

standards and from which result detailed architecture blueprints and system implementation plans.

Creating a Knowledge Model

The most appropriate starting point for customers who have some experience with intranets, and who want to integrate various Knowledge Management practices, is either a workshop or a needs assessment. A workshop provides a highly interactive participatory process from which both the customer and the consultants achieve a shared model of what's needed and how to get started. Some organizations prefer an interview-based needs assessment process, which may be more time-consuming in terms of elapsed time, but is less demanding of large chunks of scheduled time for the group of stakeholders. In either case, the first milestone is an understanding of the business requirements, priorities, scope, and clearest opportunity for a pilot or planning session.

A knowledge model provides an organization-spanning view of the knowledge processes in an organization. The knowledge model for the Compaq Professional Services organization is shown in Figure 24.

Figure 24: Knowledge Model for Compaq Professional Services
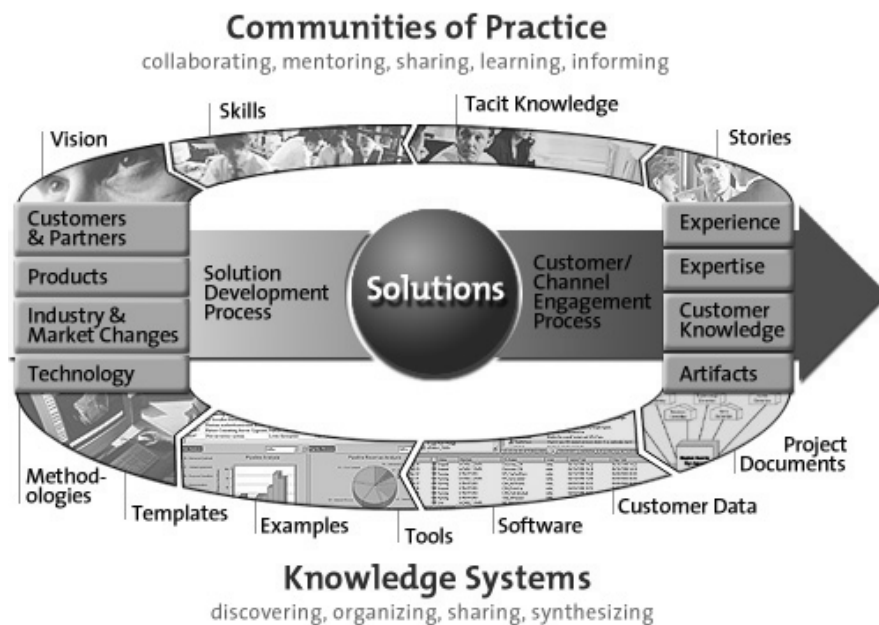
This model summarizes the key business process of knowledge creation: from inputs, insights, and knowledge about the industry and technology as well as directions from customers, partners, and product groups, we use a proprietary process to capture the real-time experience and results of technical projects. This process creates reusable solutions consisting of systems, software applications, and methodologies to deliver to customers. Through our engagement process (also supported by methodology), we create value for the customer while acquiring new knowledge, artifacts, expertise and experience. The upper arm of the model ("Communities of Practice") shows the exchange and development of tacit knowledge. The lower arm ("Knowledge Systems") shows the knowledge activities and specific information types. The model proved very useful in

determining which areas of our system needed improvement, and in helping to scope specific, measurable projects. It also enabled consultants and developers throughout the company to understand our business and how they relate to its knowledge processes.

Pay Attention to People and Process

As outlined earlier in this document, technology represents less than a third of the problem area. Knowledge creation, transfer, and transformation also involve people and processes. It is very dangerous to think about a Knowledge Management solution without paying attention to the people who will be using the system and the purposes for which the system is to be put in place. Because knowledge entails the discovery and sharing of the elusive knowledge that requires human interpretation and processing, Knowledge Management solutions must describe the new and changed organizational roles of individuals at work in the system.

Knowledge Management presents both an opportunity and a challenge in re-framing current organizational models and processes. To ensure completeness of a solution design, Compaq Professional Services uses a systems model as shown in Figure 25, as a tool for designing implementation plans.

Figure 25: A Systems Model to Ensure Completeness in System Design
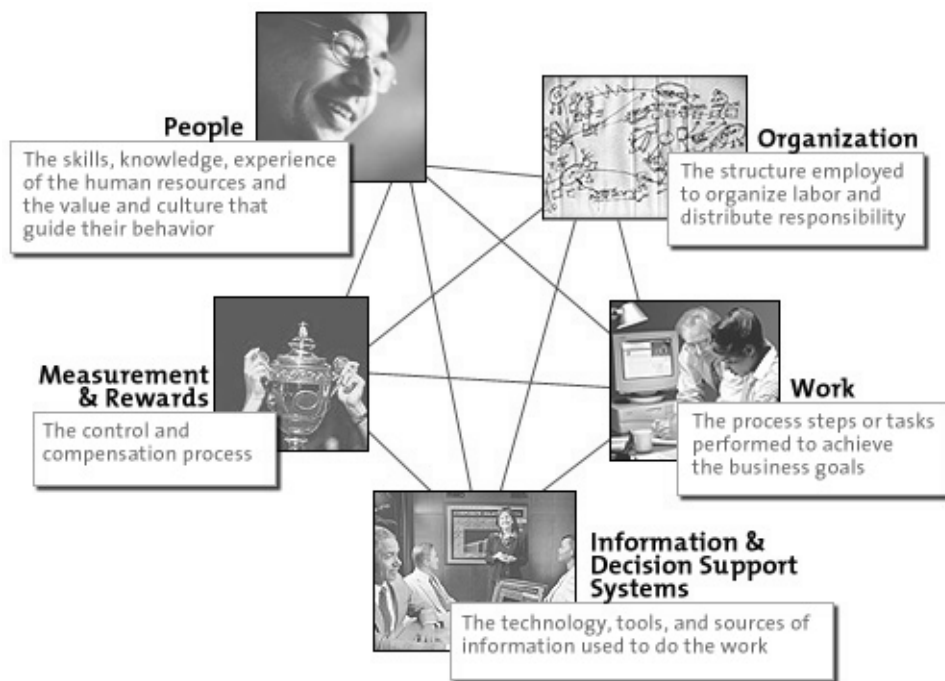
Success is in the details, and in the development of Knowledge Management systems there are many details. Some details emerge from using the Fit Model shown in Figure 22. Others may be directly connected to the overall implementation of the Knowledge Management system architecture and tools design. For example, in this paper we have discussed communities of practice and collaboration systems. Technologies to support communities of practice have been available for long enough that research is available on the social and organizational effects. Such research consistently points to the need for facilitated human support to augment the technology investment. Therefore, a program to design and implement a collaboration system should plan for

the identification of team facilitators or conference moderators who provide the social and organizational infrastructure required for success.

Knowledge Maps: There are a number of methods and techniques for creating "knowledge maps," that is, visual representations of where knowledge (or capability, or competency, skills, experience, expertise) reside in an organization and how it is (or is not) transferred to other parts of the organization according to need. A simple framework such as we showed in Figure 1: Knowledge Activities (Gather, Organize, Share, Synthesize) can provide a starting point for identifying the activities that people are engaged in, within their own groups, in teams that cross organizational boundaries, and so on. The maps are best generated in interactive workshops where representatives of the knowledge communities collaborate to create a shared map of both the current state and a possible desirable future state. The conversation that occurs in such workshops tends to provide perspective on other system elements (information systems, organizational structures, metrics that hinder or facilitate exchange, and so on).

Establish the Opportunity Scope

You can frame any of the business problems summarized at the beginning of this paper — Innovation, Responsiveness, Efficiency, and so on — in the context of Knowledge Management. None are particularly new problems; all have existing solution approaches, if not out-of-the-box solutions available to help companies solve them. The opportunity for working on Knowledge Management solutions becomes more interesting and complex when you decide how you want to scope the problem:

- Departmental solution, enterprise-wide, or a combination of both?

- Enterprise only, or extended to business partners and customers?

- Manage internal information only, or internal and external information?

- Deal with new content only, or provide systems to integrate legacy content and formats?

As you might imagine, given the range of problems that can be addressed by Knowledge Management solutions, there can be a dramatic increase in complexity when you add customers and partners to the collaboration or knowledge sharing environment. Therefore, it is very important to approach projects in the area of Knowledge Management with an understanding of the overall scope and to map an approach that balances immediate needs (to produce immediate results) with long-term business strategies and goals.

There are a number of approaches to implementing and managing the implementation of an overall Knowledge Management solution:

- Start with a critical business problem.

- Start with the solution domain.

- Start with a strategic assessment of your Knowledge Management goals and develop an overall knowledge model and architecture.

- Pick some things that you can measure

Whatever approach you start with, be sure that you scope the work so that the organization has realistic expectations of when solutions will be in place. One emerging trend is to implement systems organically but systemically. Organizations that are adopting this mode will establish key operating principles and ground rules for workgroups and business functions and let solutions emerge from the bottom up. This approach reflects emerging management practices based on

complexity theory.[19] You can establish a guiding body, such as a program office, as a clearinghouse and forum for disparate groups to share emerging best practices, propose standards and process changes, help measure results, and even offer consulting and production services.

Establish and Communicate Principles

If you begin with a realization that Knowledge Management principles and practices will have an impact across your enterprise, you may want to start with activities that generate a vision and principles. From a set of strategic principles, you can map your organization's knowledge assets and develop a program and a roadmap for how you will move your people, processes, and technologies toward that vision over time. Principles are agreed-upon goals or values that will guide the design, implementation, and evolution of a Knowledge Management system over time. Some examples of Knowledge Management principles might be:

- All documents must be developed and written as if they are going to be reused.

- Business processes will be designed to ensure that knowledge assets are captured at the point of creation.

- Information is presented to the user based on the user's stated preference and history.

- Everyone knows how to find the information they need, and the information is readily available to them.

Principles such as these lead to the specifications and standards on which a Knowledge Management system will be built. They will also guide the alignment of the Knowledge Management activities and processes with the organization's cultural values.

Distinguish Knowledge Management Projects from Information Management Projects

There are subtle but important differences in the approach to a project when it is a Knowledge Management project, even though to many it might look like just another "information management project." Table 3, from the Ernst and Young Center for Business Innovation℠, provides some useful distinctions:[20]

Table 3: Knowledge Management vs. Information Management Projects

Knowledge Management	Information Management
Goals emphasize value-added for users	Goals emphasize delivery and accessibility of information
Supports operational improvement and innovation	Supports existing operations
Adds value to content by filtering, synthesizing, interpreting, pruning content	Delivers available content
Usually requires ongoing user contributions and feedback	Emphasizes one-way transfer of information
Balanced focus on technology and culture	Heavy technology focus

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[19] "Simple, Yet Complex", Megan Santosu*s. CIO Enterprise Magazine,* April 15, 1998. Megan cites work by Roger Lewin and Birute Regine, including a work-in-progress from Simon & Schuster.
[20] David W. DeLong, Tom Davenport, and Mike Beers, "What is a Knowledge Management Project?", Research Note, Ernst & Young LLP, April 1996.

Requires ongoing human inputs whose variance precludes automating capture process	Assumes information capture can be standardized and automated

Plan to Evolve the System

One way of looking at how companies approach Knowledge Management is shown in Figure 26, which maps the technology domains and specific technologies to stages in a company's understanding and adoption of Knowledge Management practices and techniques.

Figure 26: Evolution of Knowledge Management Systems
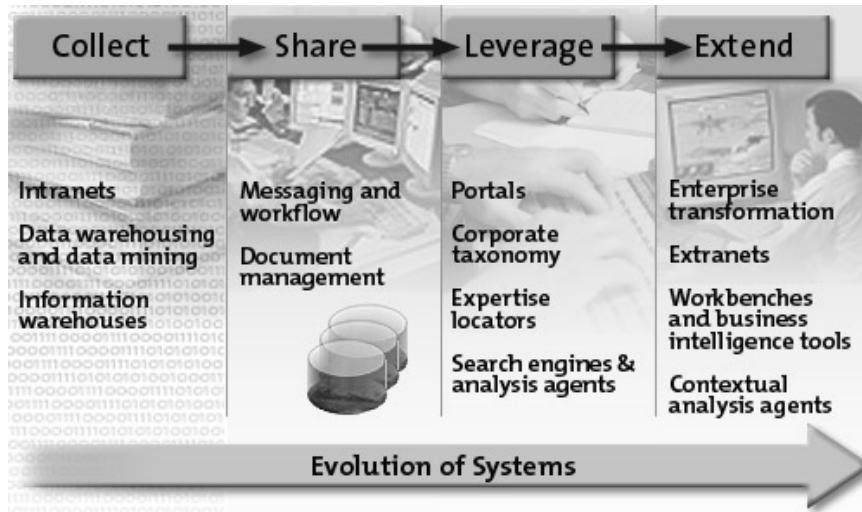
This model shows an evolution of practices from bottom to top: from focusing on existing knowledge assets and artifacts (data, documents, static Web pages) toward exchanging and reusing artifacts, toward an active focus on making information accessible across the enterprise. Customers who are looking for Knowledge Management solutions may be at different points along this evolutionary path. Within an enterprise, there may be multiple initiatives at different points along this path.

Do not assume from this figure that this evolution is only about technology. Understanding of knowledge management practices continues to expand and evolve in the area of human facilitation and face-to-face interaction. There are two trends in particular that point to the evolution of organizations' knowledge sharing and creation capacity toward human dynamics:

- Storytelling. Many companies are supporting and encouraging the development of expertise in the telling of "stories," about projects, about the company, about its people. Programs range from capturing "lessons learned," to the writing of detailed case studies and examples, to knowledge sharing events, to the construction of stories based on archetypes, all the way to multimedia story creation and exposition.

- Physical space and building design. Many companies are beginning to see how the actual physical environment in which workers meet and interact affects productivity and innovation. Spaces that maximize "serendipitous" encounters, and spaces designed for large group events are showing an impact on both knowledge creation and knowledge worker retention, as workplaces focus on social interaction, "an essential feature of creative and innovative efforts.[21]"

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[21] "The Knowledge Workplace," Gartner Research Note 29 February 2000

What happens as the system (or as communities within the system) evolve, they will extend to the next level of collection, sharing, and leveraging information: the Internet has seen an increasing extension of communities from inside organizations and groups to larger and larger "communities of communities" and "systems of systems."

Other organizations prefer a more top-down management approach, and often provide visibility and credibility to Knowledge Management initiatives through the appointment of a Chief Knowledge Officer (CKO). The role of a CKO is completely contextual: the individual who holds the position (or equivalent directorship or title) will bring his or her own passion, perspective, and principles to the work.

## Align the Strategy with the Infrastructure IT and E-Business Context

A Knowledge Management perspective on the information and intellectual assets of a corporation ultimately impacts the IT infrastructure in profound ways. If a role-based user interface design calls for integrated access to decision support systems, then the Knowledge Management system is reaching into the deepest levels of the corporate IT infrastructure. For example, if this design is being implemented at a time when the company is redesigning its infrastructure or implementing wide-scale renewal projects, then it is possible to impact the overall design and architecture in a way that supports the Knowledge Management program.

As companies increasingly rely on Internet technologies to stay connected with suppliers, partners, and customers, they find they must adapt their business models to the paradigm of electronic business. Internet-enabled enterprises are reaping the rewards of operational efficiency, business agility, and customer intimacy.

Compaq believes that those enterprises that most rapidly embrace and exploit the Internet will be the market leaders of the future. Our goal is to enable our customers' success in this new global Internet economy. With our strategic focus on eBusiness solutions and services, we can help them leverage their networked systems to increase revenue, improve productivity, and enhance customer satisfaction with faster response time.

Knowledge Management is one of the three customer need focal points for the Compaq *NonStop*™ framework of eBusiness solutions, services, products, and technologies that enable enterprises to compete effectively in a global 24 x 365 marketplace. As you can see in Figure 27, Knowledge Management is one of three — overlapping — perspectives from which to approach an e-business strategy. All three are supported by an e-commerce infrastructure and underlying applications, systems, and networks.

Figure 27: Compaq *NonStop^TM* eBusiness Solutions Framework
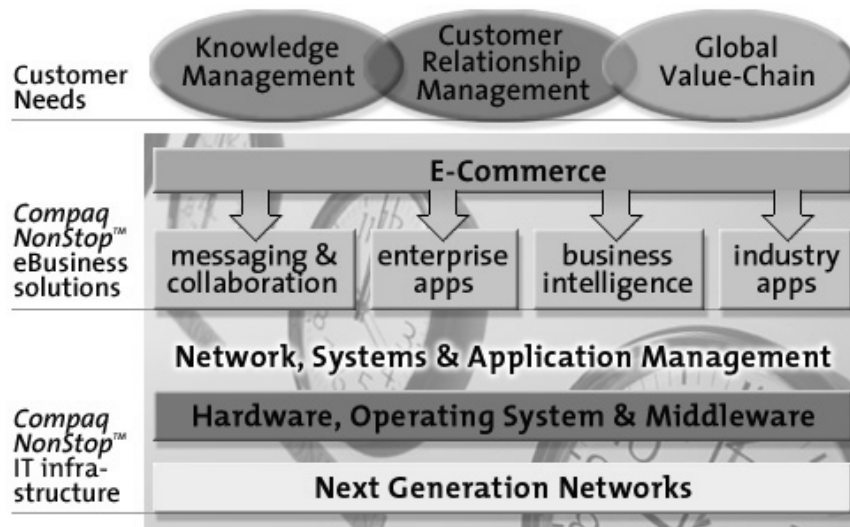
A complete eBusiness strategy will account for almost all the elements in this framework. Sound business and IT management practices are required to ensure that corporate programs and initiatives are suitably positioned, prioritized, and planned in accordance with an overall business vision and mission. E-business initiatives provide a number of entry points into Knowledge Management. For example, in the design of a Web-based e-commerce system, it is important to ensure that the system captures and stores all customer interactions with the system. The information captured will certainly be useful for e-commerce marketing and planning. If properly understood, customer interactions can also provide useful knowledge about patterns that can direct the design of new products and services. Similar opportunities exist in the design and development of customer relationship management systems and in global value chain initiatives.

Manage the Program Knowledge

Managers, designers, and knowledge workers engaged in the implementation of Knowledge Management programs must be proactive about sharing their work and progress. This establishes and models the cultural change that is envisioned for the program. As the tools evolve to meet the needs of the users, and the organization's knowledge base grows and meets the business needs for which it is designed, communication is essential. Communication models and processes to consider include:

- Establish a program office, knowledge program manager, or core team and give them visibility in all the appropriate organizational vehicles. Many companies have created Chief Knowledge Officers to manage the overall programs.

- Maintain an accessible map of the overall project areas, program plan, and program status and updates on the intranet. Develop and implement an ongoing communication plan about the program. Integrate the communications into the knowledge base.

- Train users in how to use new technologies and introduce the Knowledge Management tools at all possible internal conferences and symposium events.

- Communicate and track metrics.

The Knowledge Management program must work within the context of goals, some of which may be tangible, based on return on investment — and some which may be less tangible, such as employees' satisfaction with their work environment. Whatever the goals, the program must facilitate, coach, and connect a number of grass-roots Knowledge Management activities and projects.

Conclusion

Knowledge Management is not itself a solution, but a powerful collection of themes, disciplines, technologies, and practices that that support innovation, organizational learning, operational efficiency, knowledge worker productivity, competitive intelligence and customer knowledge. It has become an increasingly important part of the e-business strategy for forward-thinking companies.

Although information technology and information systems are critical for capturing and sharing intellectual capital, successful Knowledge Management also involves changing business practices and corporate culture. The selection and adoption of technology should occur through a transformation process in the context of how people work. Solution design must occur in the context of identified business problems to be solved and the available and acceptable technologies and methods.

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