
Working with knowledge: how information professionals help organisations manage what they know

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Abstract

In order to manage knowledge, we need to understand the nature of knowledge in organisations. It is helpful to distinguish between three categories of organisational knowledge: tacit knowledge, explicit knowledge, and cultural knowledge. Tacit knowledge is personal knowledge, explicit knowledge is codified knowledge, and cultural knowledge is based on shared beliefs. We use this framework to discuss the role of the information professional with respect to each category of knowledge. Knowledge management initiatives led by information professionals in three organisations are then examined. An analysis of these experiences suggests many opportunities for information professionals to make important contributions in managing an organisation's knowledge for growth and innovation.

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Introduction

If we are to manage knowledge in organisations, we need first to understand what it is – what is the nature and structure of organisational knowledge, and what makes it distinct from other forms of knowledge.

Knowledge in organisations is neither monolithic nor homogenous, but evolves from different origins and is engaged in different ways. Research suggests that organisational knowledge may be divided into: tacit knowledge, explicit knowledge, and cultural knowledge (Choo, 1998a; 1998b). Implicit in this suggestion is the important idea that knowledge is not just an object or artefact, but also the outcome of people working together, sharing experiences, and constructing meaning out of what they do. The paper begins by introducing the three categories of organisational knowledge; we then discuss the roles of information professionals with respect to each class of knowledge; and finally we briefly look at knowledge management initiatives led by information professionals in the libraries at HP, Microsoft, and Ford.

Tacit knowledge

In organisations, tacit knowledge is the personal knowledge used by members to perform their work and to make sense of their worlds. It is learned through extended periods of experiencing and doing a task, during which the individual develops a feel for, and a capacity to make intuitive judgements about, the successful execution of the activity.

Examples of tacit knowledge at work would be the technician who can tell the health of a machine from the hum it generates, or the bank manager who develops a gut feeling that a client would be a bad credit risk after a short conversation with the customer. Since tacit knowledge is experiential and contextualised, it cannot be easily codified, written down or reduced to rules and recipes.

Despite it being difficult to articulate, tacit knowledge can be, and is, regularly transferred and shared. Tacit knowledge can be learned through observation and imitation.

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Thus, apprentices learn their craft by following and copying their masters; professionals acquire expertise and norms through periods of internship; and new employees are immersed in on-the-job training. According to Schon (1983), professionals reflect on what they know during the practice itself (for example, when they encounter an unusual case) as well as afterwards (for example, in a post-mortem), and in doing so test and refine their own tacit knowledge. Tacit knowledge can also be shared. Although not completely expressible in words or symbols, tacit knowledge may be alluded to or revealed through rich modes of discourse that include the use of analogies, metaphors or models, and through the communal sharing of stories. Storytelling provides channels for tacit learning because narratives dramatise and contextualise knowledge-rich episodes, allowing the listener to replay and relive as much of the original experience as possible.

Explicit knowledge

Explicit knowledge is knowledge that is expressed formally using a system of symbols, and can therefore be easily communicated or diffused. Explicit knowledge may be object-based or rule-based. Object-based knowledge may be found in artefacts such as products, patents, software code, computer databases, technical drawings, tools, prototypes, photographs, voice recordings, films, and so on. Knowledge is object-based when it is represented using strings of symbols (words, numbers, formulas), or is embodied in physical entities (equipment, models, substances). Explicit knowledge is rule-based when the knowledge is codified into rules, routines, or operating procedures. A substantial part of an organisation's operational knowledge about how to do things is contained in its rules, routines and procedures. Although all organisations operate with standard procedures, each organisation would have developed its own repertoire of routines, based on its experience and the specific environment it functions in.

Sullivan (1998) discusses an organisation's explicit knowledge that takes the form of intellectual assets, which he defines as "the codified, tangible, or physical descriptions of specific knowledge to which the company can

assert ownership rights. Any piece of knowledge that becomes defined, usually by being written down or entered into a computer, qualifies as an intellectual asset and can be protected. Intellectual assets are the source of innovations that the firm commercialises" (p. 23). Examples of intellectual assets may include plans, procedures, drawings, blueprints, and computer programs. Intellectual assets that receive legal protection are intellectual property. Five forms of intellectual property are entitled to legal protection in the USA: patents, copyrights, trade secrets, trademarks, and semiconductor masks.

Explicit knowledge codified as intellectual assets are valuable to the organisation because they add to the organisation's observable and tradable stocks of knowledge. Moreover, because they have been committed to media, ideas may be communicated more easily. Explicit knowledge serves a number of important purposes in an organisation. First, they encode past learning in artefacts and rules. Second, explicit knowledge facilitates co-ordination between disparate activities and functions in the organisation. Third, exercising explicit knowledge signifies technical skill and procedural rationality, and so helps the organisation to present a self-image of competence, legitimacy and accountability. Since explicit knowledge has been codified, it remains with the organisation even after its inventors or authors leave the organisation.

Cultural knowledge

An organisation's cultural knowledge consists of the beliefs it holds to be true based on experience, observation, reflection about itself and its environment. Over time, an organisation develops shared beliefs about the nature of its main business, core capabilities, markets, competitors, and so on. These beliefs then form the criteria for judging and selecting alternatives and new ideas, and for evaluating projects and proposals. In this way an organisation uses its cultural knowledge to answer questions such as "What kind of an organisation are we?" "What knowledge would be valuable to the organisation?" and "What knowledge would be worth pursuing?" The answers in turn depend on shared assumptions and beliefs about what business

the organisation is in, what are its core competencies, and how it wants to grow over time.

Thus, cultural knowledge includes the shared assumptions and beliefs that are used to describe and explain reality, as well as the criteria and expectations that are used to assign value and significance to new information. Leonard (1995, p. 19) describes how organisations supply and sustain values and norms that “determine what kinds of knowledge are sought and nurtured, what kinds of knowledge-building activities are tolerated and encouraged.” Although cultural knowledge is not written down (but is conveyed in stories, histories, and reward or evaluation systems), it remains with the organisation through employee changes and staff turnover.

There are well-known accounts of organisations in which cultural knowledge is misaligned with its efforts to exploit tacit and explicit knowledge. For example, Xerox PARC (Palo Alto Research Center) in the 1970s pioneered many innovations that later defined the personal computer industry but which Xerox itself was not able to commercialise. PARC had invented or developed: bit-mapped display technology required for rendering graphical user interfaces; software for on-screen windows and windows management; the mouse as a pointing device; the first personal computer Alto; and an early word-processing software Bravo for the Alto. Xerox was not willing to realise the application potential of these inventions because its identity and business strategy was still focused on the photocopier market. Many of the researchers working on these projects subsequently left PARC, taking their knowledge with them.

Information professionals and tacit knowledge

Tacit knowledge is personal knowledge that is in people’s minds. People with experience and expertise are the organisation’s most vital information resources, and it is imperative that information services provide access to, or at least information about, knowledgeable experts in the organisation even as they provide access to published sources. At the same time, there are significant challenges in providing access to human sources. To begin

with, information about knowledgeable human sources would need to be collected and updated in a systematic manner. One of the best methods of accomplishing this is for employees themselves to maintain their CVs online (perhaps in the form of Web pages), and to have them keep these résumés up-to-date. Human resources and other functional departments in the organisation may also be able to supply current information about training courses, conferences, assignments, and projects.

Next, an expertise directory would have to be developed. An increasingly common mode of providing access to human sources is through online “electronic yellow pages”. Designing a useful directory is harder than it sounds. For example, there are many alternative terms for describing expertise, and some form of thesaurus may help users to locate the appropriate experts or to suggest alternatives. Expertise may also exist at various levels of depth and breadth, and a directory could include some indication of the extent of an individual’s knowledge in an area. Finally, when a knowledgeable person is found, the system should simplify the identification or the contacting of the person – thus, electronic yellow pages often include links for sending e-mail or viewing personal home pages, as well as photographs or audio- or videoclips.

Information professionals themselves possess tacit knowledge that is critical to the organisation. Not only are they skilled at selecting and searching information sources, they also have the know-how to articulate and analyse information needs, evaluate the quality of information, extract and summarise important information, and relate and package the information found for a specific project or problem. Most of the time, this know-how is transparent to the organisation or hidden beneath the surface of day-to-day work. Information professionals should render the value of their expertise more visible by proactively contributing their know-how where appropriate. More and more information professionals in knowledge-intensive organisations are participating actively as members of project teams, where they continuously supply and analyse information to help the team solve problems and make choices.

Information professionals are increasingly taking on the roles of consultants and trainers

who supply specialised advice and assistance in selecting and using information sources. Some of this assistance is introduced in ways that are well integrated with users' activities. For example, on the search pages of an intranet, information professionals can pre-select sources, and present search examples or pre-packaged search strategies for frequently asked questions in order to save the time of users and increase the quality of their searches. The experience of corporate libraries (see example cases below) has been that growth in end user searching is accompanied by a growth in demand for information professionals to tackle difficult questions that users cannot handle themselves. In today's fast-moving information environment, information professionals must invest the time and energy to update their skills and knowledge, and to network with other experts in their own profession, through participation in library and professional associations.

Information professionals and explicit knowledge

Traditionally, information professionals have specialised in managing and providing access to written-down or recorded information in publications, documents, audio-visual materials, and so on. This skill extends naturally to embrace the management of an organisation's explicit knowledge.

Information professionals are working with subject experts to gather, harvest, and organise the intellectual capital of the organisation. There are at least three important features of this process that make it distinctive. First, valuable knowledge that is created by employees would first have to be identified and then codified internally, using a taxonomy or model that is able to describe the business objects and processes of the organisation. Second, the representation of organisational knowledge must include both the content and the context in which that knowledge is to be made sense of. Third, the objective of the codification and representation of organisational knowledge is not just to enable access and retrieval, but also to facilitate sharing, reuse, reflection, and ongoing learning.

In the codification and representation of organisational knowledge for access and

reuse, information professionals are often involved in many stages of the *knowledge processing cycle*:

- identifying, acquiring or extracting valuable knowledge from documents, discussions or interviews, usually accomplished with the help of subject matter experts;
- refining, writing up and editing "raw knowledge" (such as project files, presentations, e-mail messages), turning it into "processed knowledge" (such as lessons learned, best practices, case studies);
- organising the processed knowledge and making it accessible by adding index terms, subject headings, cross-reference links, and metadata;
- packaging, publishing, and disseminating knowledge through a variety of channels, including intranet Web pages, CD ROMs, subject-oriented pathfinders, and "knowledge portals" that are focused on particular business needs or issues;
- designing and managing the overall information architecture consisting of a set of well-defined standards and schemes for organising, classifying, publishing, and navigating the organisation's intellectual content.

Information professionals have the knowledge and training to design content representation schemes that reflect the information needs of the organisation. A growing number of organisations have found it useful to develop their own taxonomies to describe their processes, practices, projects, products, and customers. The resulting structure of content categories, subject headings and descriptors, are used to classify and index written-down knowledge. The taxonomy is then embedded in the design of computer-based information systems.

Due to the proliferation of information sources, it has become critical for organisations to implement powerful, yet easy-to-use, search engines as well as directory-like structures that facilitate browsing and personalised information viewing (as popularised by Yahoo and my.Yahoo). Indeed, the design of an online search function in organisational intranets has become a major undertaking. The search function might need to support three kinds of enquiries: a global search that looks up all

pages on a Web site; a focused search that not only specifies keywords and fields, but also the types of sources to be searched; and a pre-packaged search where search statements designed by the information professional are made available to the user.

The representation of the context in which knowledge is relevant poses a larger challenge, and we are still in the process of learning to do this well. One method of including contextual information is to define and make use of metadata elements to capture important attributes such as project names, project stage, product names or categories, authors, departments, dates, and so on. Since the same piece of knowledge might turn out to be relevant to a number of different problems and situations, a flexible way of cross-referencing knowledge items would be helpful. A few organisations include audio and video clips on their Web pages that show employees telling stories about the discovery and use of best practices.

Information professionals and cultural knowledge

Cultural knowledge consists of the shared beliefs that shape an organisation's purpose and identity, and determine the value and significance of new information and knowledge. Cultural knowledge is encoded in how the organisation tells its history and accomplishments – the stories, legends, heroes and villains, the triumphs and failures. It is also expressed in the norms and criteria that the organisation uses to evaluate projects and performance, and to decide about what is appropriate for the organisation, what is worth doing and going for. Shared beliefs are a crucial part of an organisation's knowledge because people in an organisation use these assumptions and beliefs to make sense of their environment, and to figure out the form and purpose of their actions.

Information professionals are working with cultural knowledge and helping their colleagues work with cultural knowledge through some of the following activities. A growing number of information professionals are becoming involved early in projects and decision-making processes. By doing so, they are helping to evaluate, filter, and interpret incoming messages in order to better understand the problem and its context,

clarify goals, and help identify promising alternatives. This proactive stance is a change from the more traditional mode of reacting to information requests and decisions that have already been made.

More libraries and information centres are finding it useful to combine internal and external information when giving answers to questions. This juxtaposition can help clients to connect new external developments to existing perceptions held by the organisation. More generally, it is frequently helpful to clients to be able to tap into the organisational memory, to access its history and past records, at the same time as they are trying to make sense of new developments. Certainly there is a fine balance to be struck between the need to reduce information overload by relying on user profiles to filter incoming news and route information, and the need to promote peripheral vision so that users avoid developing blind spots that prevent them from seeing emerging threats or opportunities. There are no simple answers to this dilemma: information centres have to be finely tuned to clients' information needs, while scanning the environment as broadly as is necessary.

Working with cultural knowledge is a social activity, where interpretation and the construction of beliefs take place through shared conversations. In this process, users should be able to participate actively in disseminating and discussing the information they receive, drawing attention or adding comments to the input when they wish to. Some corporate libraries support this sensemaking by creating settings that are conducive to discussion and interaction (informal talks, knowledge cafes, online forums). Some organisations also add the capability (through software or e-mail) for employees to escalate the priority of incoming news and to direct information to specific persons or groups.

One way of integrating tacit, explicit, and cultural knowledge is to create clusters of information resources and activities that directly support a set of knowledge activity. Owen (1999) suggests that information professionals develop "knowledge profiles" or topic areas that bring together various types of knowledge objects to support specific knowledge work. Examples are:

- *Individual topics.* Cluster all knowledge that is relevant for a specific employee or,

in a more generic sense, for a specific type of knowledge activity.

- *Project topic.* Cluster all knowledge that is relevant for a project team.
- *Contact topic.* Cluster all knowledge that is relevant in the context of knowledge exchange with external contacts.
- *General topics.* Cluster all knowledge that is relevant for specific tasks or activities within the organisation (Owen, 1999, p. 15).

These topic areas can provide: references to relevant documents and sources; profiles of employees with relevant knowledge or skills; information on current or previous related projects; external information resources (documents, organisations, persons), and contact of clients for whom knowledge of the topic may be important.

HP Labs Research Library

The HP Labs Research Library functions as the *de facto* corporate library of HP, handling over 70 percent of the total service requests. The library's mission statement is "to contribute to HP's success as a leader in the world's information marketplace by bringing together knowledge, access, and tools so that decisions are more informed, research is more relevant, and results are accelerated and sustained". The library's internal Web site is the gateway to over 215 gigabytes of information, including technical reports and more than 50 electronic newsletters and databases. However, very few of the library's databases are maintained in-house: the library manager's policy is to "Own nothing. Maintain nothing. Access everything". The library does negotiate the company-wide contracts with information vendors – almost all the library's resources are licensed under enterprise-wide contracts. Despite the success of the Web-based presence, the library still believes in the importance of maintaining a physical space for researchers and users who wish to get away from their cubicles and come to "the library."

One KM initiative is the creation of a consulting service for HP departments outside the labs (the library has a price for consulting by the hour). An example of a consulting project was the development of a Departmental KM Tool, in which the library created a Web tool that pulled together

disciplinary information from internal and external sources, and organised them by subject categories for a research department. Both the departmental members and the library staff can suggest new sources to be added, thus keeping the tool up-to-date. The Web page is hosted on the library's Web site and is accessible to all interested employees.

Another KM initiative is the library's role in building HP's company-wide portal site. A library staff member is consulting with the portal project team "to do for HP what Yahoo! has done for the Internet". HP's intranet is one of the largest company intranets in the world, and the plan is to develop partnerships with large publishers on the intranet, providing content and profiling features company-wide. The library staff is also involved in building a company directory, establishing metadata standards, and enhancing Web-publishing tools to improve subsequent retrieval.

A third initiative is the library's Information Research Project. The goals of this project are to accelerate the innovation process and eliminate information gaps in the HP Labs. The project arose from a realisation that the process of doing research has changed with the availability of online resources and pre-print sources, and the growing need to choose between sources based on an evaluation of their quality and validity. These are areas in which the librarian has specialised expertise and can make a contribution. Thus, the IRP project included developing a theoretical understanding of information needs and uses, removing information flow bottlenecks, functioning as an information laboratory, and providing expertise in customer perspectives.

A fourth initiative was the library's training program that instructed HP employees on how to conduct competitive intelligence gathering. The library used NetMeeting to deliver four 90-minute presentations. First, Web-based documents for the audience were created, including nearly 90 PowerPoint slides. Then the library's conference room was set up with NetMeeting software and hardware to deliver the Web content. Four sessions for 25 individuals each were held: two for employees in North and South America, one for the Asia-Pacific region, and one for Europe.

Microsoft Library

The Microsoft Library's mission is "to research and contribute critical information to Microsoft's business decision making and strategic planning processes". Since its establishment in 1983, the library has grown exponentially: from just one librarian, 50 books, and 20 software packages, to today's collection of over 50,000 items and a full complement of information professionals. In 1994, the library undertook a reengineering project to ascertain how it could better support its customers, which is how the library called its users. Employees responded that they needed the library to actively manage Microsoft's "collective knowledge". They did not want reactive services only, and they did not just want access to external information sources. They also wanted the library to help keep disparate groups informed of expertise and information across the company.

In 1995, Microsoft's Product Development Resources (PDR) department was developing a tool for exchanging and accessing research, development, and business knowledge and experience across Microsoft's product groups. The Library and PDR decided to combine their visions and collaborate in "Project Alexandria". Microsoft Library had established a homepage on the external Web a few months previously, and as they used this tool, the librarians realised that they could use the same technology to provide easy access and updating for the internal Alexandria project. This work soon led to the development of MSWeb, Microsoft's intranet service.

The Library's MSWeb team provides directory, full text searching, and page registration services for internal Web pages. It also provides customised intranet development and consultation on Web-related issues, and oversees the posting of daily industry news via the intranet. The Library's involvement in the intranet has created an entirely new business for its parent unit, the Information Services Department. In addition to providing new career paths for staff, the MSWeb project has raised the profile and credibility of the department.

The library's staff are instrumental in developing Microsoft's LibraryWeb intranet site as well as end-user products referred to

internally as Electronic Tools. Electronic Tools provide links and access to online information services that have been selected and purchased by the library. For example, one professional staff working as intranet specialist and library Webmaster created a link to an online information service on LibraryWeb so that when employees click on this link, all requisite user information is passed seamlessly to the service, allowing the user to sign up easily and without having to go through authentication processes every time. Another useful feature is the Examples Link. On this page, users can view sample search strategies, double click on them, and modify them if they wish.

On a daily basis, Microsoft Library staff choose and post important Microsoft related news on the intranet, and also e-mail that news to employees in different business divisions. Starting from a set of customised profiles created and maintained by the professional staff, an information vendor would FTP incoming news articles as HTML pages. Library staff then review these articles and select relevant items to be posted on LibraryWeb. These items are tagged with metadata (which in some cases are provided by the vendor) so that they are organised to facilitate future retrieval. In a typical month, Microsoft Library receives an average of 2,500 e-mail requests from employees or "customers" as the library calls them. Most of these requests are turned around within a 24-hour response period. To provide this level of service, the library has organised its professional staff so that individual staff specialise in handling requests from a particular business unit.

An important goal of the Microsoft Library is to put the power of information in the hands of those who need it every day – enabling employees who want to search information for themselves to be able to do so. This in turn frees up the information professionals who can then take on the more complex research work, and provide more high-end services for their clients. Microsoft Library's experience is that with the new user-orientation, it still receives the same number of research project-type questions as before, but these requests are now more complex and quite distinct from simple reference-type questions.

Ford Motor Company

Ford Motor Company's Research Library & Information Services (RLIS) is located in Dearborn, Michigan, within Ford's research laboratories. RLIS's 20 full-time staff maintains a collection of 30,000 books, 600 journal subscriptions, and a large audio-visual library. Although the library played no role in Ford's public Web site, it commands a strong role in the development of the company's intranet. There are three areas of concentration: content building or taking Ford content through the Web publishing process; bringing in commercial products and making them accessible on the intranet; and setting technical standards on how information is put up on the intranet. Of the 17 RLIS staff based in the USA, 11 are involved in intranet work, and the equivalent of 4.5 full-time employees are devoted solely to intranet activities.

The RLIS approach is to be "actively looking for products that could combine both commercial and proprietary information. We don't want to have a Web site with just a series of pointers to information outside Ford or to other places within Ford. We don't want merely to catalog. We want to build our own resources and build content on our sites" (RLIS Director, Robert Schwarzwald, cited in Pack and Pemberton, 1998). One manifestation of this approach is what RLIS calls its "tactical library strategy." RLIS will create virtual libraries in response to short-term business needs, and then bring them down when they are no longer useful.

As an example of knowledge management activity, RLIS staff combine internal and external information for their clients: "When someone asks a question, we not only find the answer, but also identify the resources within Ford that we can add to the results. So if someone asks a question on a particular technology, we search both external and internal databases, and we also use what we know about people within the company and the resources within the company and add that to the results" (Schwarzwald, in Pack and Pemberton, 1998).

An area where RLIS is developing new expertise is in data mining. Here, the library is looking at data mining as a tool for planning research activities and competitive intelligence. For example, RLIS staff are examining the patent literature as a source of hidden intelligence to be extracted: "We're

working with companies that are developing visualisation tools that allow us to take extremely convoluted and difficult literature, like patents, and resolve it in such a way that we can discern patterns – patterns our specialists might not have seen without reading everything there is on the topic."

RLIS director Robert Schwarzwald believes that "data mining has tremendous potential for our profession. It's putting a new face on what we do, and it's going beyond retrieval of information to utilise special tools to analyse that information. It's moving a step up the information food chain" (cited in Pack and Pemberton, 1998).

RLIS was involved in a special knowledge-sharing project between Ford and MIT. The library helped develop an extranet area linking both Ford and MIT: using the extranet to create a common platform for sharing information and ideas; a safe, secure workspace where Ford and MIT staff can interact and collaborate.

RLIS has also announced a new project that allows its users to customise electronic libraries according to their individual needs, by selecting from the library's in-house and pass-through content.

Conclusion

The vignettes presented above convey a common message: in the knowledge-based economy, the information centre and information professionals need to make the transition from being a cost centre to a value-added centre; from offering a service to meeting the needs of customers; and from acting as an information provider to participating fully as a knowledge partner (Ryske and Sebastian, 2000). The widespread recognition that effective knowledge management is the key to organisational innovation and growth presents a unique opportunity for information professionals to reaffirm their role in the organisation as well as to redesign the structures and methods by which they can create new value for the organisation. To reinvent their roles, information professionals need to move from being information custodians to knowledge partners who have the entrepreneurial energy, the business knowledge, and the specialised skills to lever the power of information. This attitudinal shift and role redefinition must

take place in a framework of a deeper and more complete understanding of how organisations create, share and use knowledge. Knowledge management is not the domain of a single profession but is the result of the collaboration across multiple streams of expertise.

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