Moving Libraries into Modern Knowledge Services

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Libraries are expanding their horizons. They are striving to work with knowledge and information in a myriad of forms to become an even more vital resource. They are growing non-traditional services to create, communicate, and capture knowledge for their parent institutions. When we, as librarians, focus only on information produced through traditional publishing processes, we limit ourselves and miss huge opportunities to be an effective knowledge resource. We can no longer view ourselves as professionals who only bring external information into our organizations; this is nothing more than a one-way path for information, and for our profession. Instead, we need to be information and knowledge professionals, observing our organizations' core activities, determining the information implications of those activities, analyzing information flows and needs, and diffusing new knowledge and information. We must be the providers of the solutions demanded by our organizations.

Today's information science professional understands how information and knowledge can be used and leveraged inside an organization to generate value. For our organizations to succeed, we must observe and be involved in our employers' mission-driven activities, continually analyzing the information environment inherent to those activities. We need to merge the body of knowledge belonging to library and information science with what would be regarded by librarians as "non-traditional" areas of information management. Today, the library can take the lead for its parent institution in information-intensive areas like digital libraries and electronic publishing, Web portal information architecture and content management, competitive and business intelligence, and knowledge management—particularly knowledge sharing.

This paper will introduce you to the odyssey of the Institute of Paper Science and Technology's (IPST) former William R. Haselton Library and Information Center and its experience of developing new knowledge-building services. The drivers behind developing the new resources and services will be discussed, as well as how the library was opportunistic in identifying the Institute's needs, marketing its ability to provide the services, and integrating them into the library's repertoire to create the new and improved Haselton Library and Knowledge Center.

The IPST Context

Founded in 1929 as the Institute of Paper Chemistry, IPST is a graduate university and research institute supporting the pulp and paper industry's need to conduct scientific research and create pulp and paper scientists. It is funded by member companies, businesses that produce paper and papermaking supplies. These companies contribute annual dues, which comprise our annual budget along with additional revenue that is generated through other research contracts. Today, the paper industry is undergoing enormous change. The chief driver behind this change

is the globalization of the industry — company mergers and acquisitions on an international basis. A growing non-North American infrastructure, such as abundant raw material supplies and product manufacturing and finishing operations, shape the new global characteristics of the industry. There is also a massive push to create more value for the consumer through new product platforms, to reduce operating costs, and to increase environmentally friendly manufacturing methods. Devising innovative responses to these challenges through science and technology is the mission of IPST.

The IPST Digital Library

In response to IPST's globalization efforts, the Haselton Library began in 1999 to build an internationally available digital library of IPST-produced research documents, comprised of its final project reports, annual project advisory committee reports, technical papers, and Ph.D. dissertations. This digital library is World Wide Web-based and accessible to individuals with access rights to IPST research information. After interviewing members of the IPST Research Advisory Committee, it became clear that research and development professionals as well as academicians in paper science and engineering research wanted more than an electronic system to deliver research documents. They wanted a system that would allow them to discover valuable IPST-produced research information so they could use the information to enhance their fundamental and applied research knowledge.

Today the phrase “digital library” means different things to different people. So, what is a “digital library?” It is much more than putting an HTML file of text or a PDF file of a document up on a Web site, or subscribing to an electronic journal. Digital libraries are “planned systems of technology and people that interact to select, structure, offer intellectual access to, distribute, preserve the integrity of, and ensure the persistence over time of collections of digital works so that they are readily and economically available for use by a defined community.”[1] IBM also offers a complimentary definition containing familiar functions for librarians: "…the challenge (for digital libraries) is to provide media asset solutions with sufficient storage capacity, scalability, speed, multi-level security, sophisticated searching techniques, and Internet access to reach new markets, preserve assets from loss or deterioration, and ensure copyright protection.”[2]

Libraries and librarians are skilled at building systems with these attributes. At IPST, we have approached our digital library as an information mining system rather than as a document management system. It is designed to search for information contained in documents, not just the document itself. This is achieved by utilizing SGML-compliant technologies such as the Text Encoding Initiative (TEI), a document-tagging scheme (or DTD) used widely in electronic text centers. The tagging scheme, combined with robust searching capabilities, allows the end user to not only search for bibliographic information tagged in the document but also to utilize other text searching capabilities to "mine" the text of each document across all documents in the digital library. Since TEI is an accepted set of guidelines and supported by a consortium of organizations, it can be used reliably to bring tagged information into new information systems. The information is thus preserved in the sense of ensuring access to it over time and across systems. IPST has produced over 70 years of research, and the nature of paper science is such

that continued interest exists in research that took place 50 or more years ago. Ensuring access to information over the long-term is a "real world" functional requirement for IPST.

Digital Libraries and Electronic Publishing

Librarians are familiar with creating databases and information retrieval systems, and they are developing a base of experience in building searchable digital libraries. However, creating the "up front" electronic publishing workflows from the point of initial writing to managing the entire scholarly communication process is lesser known. Yet this is where libraries can make an important impact in their organizations. Librarians don't need to passively wait for information creators to bring their works to them for storage in their physical or digital libraries. Instead, they can be proactive by going out into their organizations and identifying information-producing processes. Then, they can collaborate with the information creators, design electronic publishing workflows together, and produce electronic and print information for targeted users. Many organizations disseminate numerous kinds of reports and publications. Digital libraries can be promoted as systems for publishing and "re-publishing" these reports and other publications. Certainly, in a traditional sense, librarians have an intimate knowledge of the publishing industry and its practices. Learning how to build and manage these digital library systems means we are poised to become electronic publishers for our organizations.

Midway through designing and assembling the IPST digital library, we realized that the "back-end conversion" of existing print-based research reports into SGML-based digital objects was going to be slow, labor-intensive, and expensive. We began thinking about ways to change report generation processes so that an electronic product could be more efficiently produced. This particularly applied to the annual project advisory committee (PAC) reports. Concurrent with the library considering the need for process changes, the IPST Research Division was concerned about the style and structure of these research reports as well. They were interested in producing common structure and style elements to provide reports that are easy to follow from one report to another. Eventually, the two parties learned of each other's objectives and began working together to achieve our similar goals.

Library and Knowledge Center staff revamped the traditional writing, editorial review, and printing processes, in conjunction with selected Research Division personnel. During April 1999, the IPST Editorial Services unit was incorporated into the Knowledge Center. Editorial Services is responsible for technical editing and overall publishing of major research reports and other published items. For me, as the library and knowledge center manager, this facilitated easier project planning and allowed for my direct oversight and coordination of related work to the editors. The collaboration among librarians, editors, printing and Web specialists, faculty, and Research Administration personnel resulted in a new process for producing SGML-tagged documents. This new process created an electronic publishing workflow that results in an SGML (TEI) master document from which end user versions such as HTML, PDF, and print can be produced. The SGML-tagged reports are now viewed as the "archival, final document version", while the print version is considered a "work-in-progress," a snapshot of the research, used only to communicate with the project advisory committees during their annual meetings. This is a major change from the previous system where the print version was regarded as the

formal version to be preserved. This shift demonstrates the power of modern digital technology and its potential to reshape our perspectives on documents and information.

The technical tools used to create this workflow are relatively simple. In Microsoft Word, we established report templates that contain some embedded SGML/TEI tags. These templates incorporate the document structure and style desired by the Research Division. The Microsoft Word file is currently used to produce the print version and the PDF version for immediate "work in progress" reporting to committee members. The Microsoft Word file is then edited further, fully tagged, and saved as a TEI file with document-embedded jpeg and gif images of tables, graphs, line drawings, mathematical equations, chemical slides, and other images. The TEI file is loaded in the digital library where it is searchable, and the HTML file is displayed via the Web to people with access rights to these materials.

Beyond the technical details of digital libraries and e-publishing, the communities that interact with IPST are growing into a significant global community of industry and academe. This digital library will become an important new system for sharing research information that directly contributes to IPST's goal of globalizing its research and education activities.

Web Portals

Digital libraries and e-publishing are involved with the formal, structured information generated by an organization. However, importance is now being placed on the informal and momentary kinds of information communicated between people on a daily basis. Web sites are technological portals offering all of these kinds of information, knowledge, and communication methods. They enable the time- and geography-independent transfer of knowledge and facilitate people-to-people communications as well as information-to-people transfers. Not only did IPST need to expand its digital library and electronic publishing, the IPST Web portals, by the beginning of 2000, were proliferating in ad hoc fashion and badly needed modernizing. They needed organization and strategic management if they were to support the global paper industry and scientific community's research, learning, and communications needs.

During December 1999, the Library and Knowledge Center proposed taking over responsibility for the content and design of IPST's Web portals. The proposal was based on the premise that portals are information and knowledge "tools," or "delivery channels," for the transfer of information and knowledge between IPST, its members, other industry-related organizations, and the public. The proposal further stated that the Center possessed the information-based knowledge and skills required. There are three major portals, all with different audiences. There is "Inside IPST," the IPST intranet for personnel and students, the public Web portal at www.ipst.edu, and an extranet called the "IPST Member Channel." Formally opened to personnel of IPST and its member companies in March 2000, the Member Channel delivers IPST's restricted "members only" research information and services.

Many significant management issues for the IPST Web portals are related to information management. For instance, coordinating the publishing of confidential vs. public information between the portals is a major concern. The Library and Knowledge Center was well positioned to be responsible for this aspect of Web content management since it performed this function in

an analog mode to provide access to IPST confidential research reports. It was imperative that someone take on the role of "gatekeeper" to ensure that confidential information did not find its way onto the public Web site. The portals also needed effective and intuitive means of navigation for end users and effective means of information retrieval, both within the site and on the Web in general, so that the public portal could be discovered through popular Web search engines such as Yahoo!, Alta Vista, Northern Light, Google, and others. This latter issue has been a serious problem. Even though IPST leads the world in graduate education and research in papermaking, search engine queries like "pulp and paper," "paper research," "paper science," or "paper education," did not locate the IPST public Web portal among the top 70 results.

Electronic resource management is another major issue. The library's information consultant plays a key role by coordinating the licensing and access of vendor-produced content such as e-journals, databases, commercially available information portals, and other Web-based resources. The information consultant also identifies and reviews Web sites that provide relevant scientific and business information. These Web site reviews comprise the library's "Directory of IPST-Reviewed Links," a Web site screening product that filters out the best Web sites and categorizes them into broad subject areas for recommended use by IPST employees, students, and member company personnel. Through these efforts, the reference librarian/information consultant brings her skills to knowledge and content management.

Other significant issues include developing interfaces that reflect users' information-seeking behaviors and designing a portal layout that is crisp, clear, and attractive to users. The Library and Knowledge Center successfully made the case that it had the requisite knowledge to resolve these challenges since they are all information challenges. For instance, the Center has been developing its knowledge about the emerging information-intensive fields of "content management" and "information architecture." The plan was approved in January 2000, and the Institute's position of Web Sites Specialist became part of the Library and Knowledge Center.

Content management is a broad concept that involves collecting, managing, and publishing content, particularly through Web portals since the concept has grown alongside the development of Web technologies.[3] More specifically, content management deals with content development (i.e., writing and graphics creation), collection, editorial review, version control, content formatting and format conversion, content security, indexing, taxonomies and classification, metadata, and the workflow processes that put all this together in a digital content publishing process. It addresses both structured and unstructured content and intranet-internet content integration as well. Modern content management can be construed as a large digital publishing system. Many librarians are well versed in publishing methods, and, obviously, librarians are well suited to carry out indexing, taxonomy, and metadata functions as well. After all, librarians are without a shadow of a doubt – metadata specialists.

Information architecture is the blueprint upon which all aspects of a Web portal are built. It sets the framework for the structure of the portal, principally focusing on navigation, the user interface, and visual design of the portal.[4] Understanding the information-seeking behavior of end users and meeting their needs to find information is a significant aspect of information architecture. Usability testing is the leading method for achieving this understanding. The concept of information architecture is complimentary to and overlapping with content

management. Library and information science skills mesh very well into information architecture. Many librarians are experienced in organizing information and designing information systems for end users. A Web portal can be interpreted as a system of organized information. Librarians have a rich tradition in studying end users, their use of information and their searching techniques. This background can be applied successfully in usability testing.

After incorporating the editorial services and Web design units and creating the digital library unit, the Library and Knowledge Center now plays a major role in content management. We are integrating traditional workflow processes, examining them, and beginning to create electronic workflows, as in the case of the PAC reports described earlier. New content management flows will also be designed for other types of information. At this point, other Center staff are involved in managing the Web portals. The library cataloger and an editor, who was a former technical information abstractor in paper science, selected keywords for the public Web portal based on a controlled vocabulary, *The Pulp and Paper Thesaurus*. The terms were placed in metatags on the site. Today, when an information seeker performs common Web searches like "paper education" or "paper research," the IPST public Web site regularly appears at the top of the results list. Other staff have contributed as well, including the Digital Library Coordinator, who took on the role of information architect during the design of the current IPST Member Channel. Editorial staff review content to be published on the portals, and we plan to employ them as "portal reviewers," looking for consistency of message and purpose within IPST Web portals. The practical implementation of the new Web portals management scheme, while not finished, has experienced several early successes. The portals are becoming useful for accessing valuable research information, communicating with Institute personnel, and serving a global and increasingly international membership.

Knowledge Sharing

All the activities discussed so far contribute to the management of IPST's knowledge of paper science and engineering and "the paper business." However, these activities involve people-to-information interactions, not people-to-people—where a person's knowledge is shared directly without the intervening step of recording it before transmittal. So, exactly what is "information" as opposed to "knowledge?" Definitions for these two concepts help us to understand the relationship between information and knowledge and why the IPST Library and Knowledge Center has contended that creating a much tighter integration between the management of the two will provide additional value to the Institute.

For author Nancy Dixon, information is "data that is 'in formation' — that is, data that has been sorted, analyzed, and displayed, and is communicated through spoken language, graphics displays, or numeric tables." For Dixon, knowledge goes one step further and is "defined as the meaningful links people make in their minds between information and its application in action in a specific setting."[5] To elaborate further, one of the founding fathers of the concept of intellectual capital, Karl Erik-Sveiby, defines knowledge as "the capacity to act — knowledge is embedded in people and knowledge occurs in the process of social interaction."[6]

From both the Dixon and Sveiby definitions, we can see that information becomes knowledge when it is applied to what we already know. The capacity to acting on what we know

is a major difference between knowledge and information. Information can be an input leading to knowledge, but information does not require action and we may choose to do nothing with it. However, when a person receives inputs, synthesizes them, integrates them, and acts, she is acting on newly formed knowledge. Knowledge begets action. Conversely, knowledge can be "captured" or "recorded" and transmitted as information. It is this "recorded knowledge" or "information" that libraries have had a wealth of experience in managing. Moving forward to managing tacit, or "unrecorded knowledge," is a natural outgrowth of our profession's traditional concern for managing information. In summary, "knowledge" is knowing something that fosters taking action and it is generated and communicated through social interaction. Knowledge and information are inextricably linked, and the philosophy of the IPST Haselton Library and Knowledge Center is to reflect this relationship in our operations.

Since mid-1998, IPST has been engaged in a "knowledge initiative" to accelerate the transfer of knowledge from information generated at or channeled through IPST. The focus has been on developing an information portal, collaboration environments, online learning programs, as well as the digital library. The goal is to improve the business performance of member companies by enhancing the knowledge of their individual personnel. But there is also an "internal knowledge initiative" taking place at IPST. Through a recent strategic planning process, IPST elevated the status of the Haselton Library and Knowledge Center to become one of four major IPST centers, along with the IPST research center, academics center, and a new center for paper business and industry studies. The Library and Knowledge Center is taking responsibility for, and the leadership role in, developing, promoting and facilitating the use of knowledge and information in IPST centers and programs. A new, important part of the Center's mission statement is to "develop and foster knowledge sharing strategies that lead to improved business performance and academic excellence."

What will the Library and Knowledge Center do to improve knowledge growth and sharing? We have a new three-year plan to do just that. We will begin this year by performing knowledge and information needs assessments of the three major IPST centers, profiling their personnel's information needs, and providing a means to update those needs as they change. The most challenging undertaking will be to work with the center directors to design work environments and create human resource policies that encourage information use and knowledge sharing within IPST and with the companies and organizations sponsoring the work of the centers.

Knowledge sharing is viewed as a program of activities that improves Institute knowledge. Techniques will come and go based on their measured usefulness. Certain action steps will be taken based upon the knowledge and information assessment results. Early discussions have included utilizing techniques such as forums and listservs, which are already underway; developing and maintaining lessons learned knowledgebases; and devising restricted access "virtual communities" where communications are fostered and knowledge shared between IPST researchers and personnel from sponsoring organizations. The need for an expert network is being discussed. It will serve as a guide for knowledge seekers to locate the experts who possess the sought after knowledge. The library will act as an intermediary, linking knowledge seekers and knowers, and will use the network toward this end. Another activity included in the three-year plan is to develop an intelligence service to perform business and technical

information research for customers. The use of these techniques will be monitored and measured to determine if they are actually improving knowledge use and sharing.

Learning is a social process. If personnel are to generate and share more knowledge to create a more valuable organization for customers, then social processes, both formal and informal, must be fostered to create the communicative environments that facilitate knowledge growth. Tools and techniques that increase communication, particularly of a spontaneous nature, will best serve the goal of increased knowledge sharing.

The IPST Haselton Library and Knowledge Center is changing on several fronts to create a more valuable parent organization. It is moving toward a mindset that manages information, not just artifacts that contain information. Many libraries have gone through, and are going through, this change, and this change may seem rather academic—but it is not. Information can be found everywhere, in Web pages, listservs, discussion forums, e-mail, data and knowledgebases, unpublished records, papers and notes, audio and video material… and in people. It is produced and communicated in many more ways than the traditional publishing process. The Haselton Library and Knowledge Center is moving toward managing tacit knowledge as well, locating people who possess sought after knowledge, capturing knowledge, and employing techniques to improve the communication and use of tacit knowledge. The primary challenge that lies before us is to understand the skills and activities of the new, emerging information and knowledge management realms. Then, we must merge our new understandings with our existing base of information science and bring it all to bear on our organizations' operations for improved knowledge generation, awareness, communication, use, and preservation. This is the value proposition of the library and information center… now the modern knowledge center.

Endnotes

[1] See "a working definition of digital library." Digital Library Federation, April 21, 1999. http://www.clir.org/diglib/dldefinition.htm.

[2] "IBM DB2 Digital Library: More Information." http://www-3.ibm.com/software/is/dig-lib/about.html.

[3] "Content Management Concepts," Metatorial.com White Paper Archive. (unattributed). February/March, 2000. http://www.metatorial.com/whitepapers/cm_concepts.asp.

[4] Shiple, John, "Information Architecture Tutorial, Lesson I," Webmonkey, The Web Developer's Resource. http://hotwired.lycos.com/webmonkey/98/28/index0a.html?tw=design

[5] Dixon, Nancy M. Common Knowledge: How Companies Thrive by Sharing What They Know. Cambridge: Harvard Business School Press, 2000.

[6] Sveiby, Karl-Erik. Kunskapsledning ("Knowledge Management"). Affärsvärlden 1990. (World's first book on knowledge management. See also www.sveiby.com.au).