Information Resource Management in the Electronic Workplace: A Personal Perspective on "Archives in the Information Society"

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Abstract

This article examines the general direction of information resource management (IRM) and computer technology applications as they influence the workplace. The author briefly explores the environmental characteristics of this new setting, including the influence of the World Wide Web, changes in information network design, and the emergence and widespread use of dynamically created, distributed, and employed information resources. He establishes this frame of reference to assess the implications of these changes for the roles and responsibilities of the archivist, and then considers the skills required on the part of the archivist to service the IRM needs of the highly automated organization and its constituency of so-called "knowledge workers."

Introduction

Over the years, I have been invited by various archival organizations to survey developments in the computerization of the workplace and to consider what impact these changes might have on the responsibilities and professional competencies of the archivist.[1] This essay serves as

[1] My foray into this subject matter began in 1984 with "Automated Information Management: Is There a Role for the Archivist in the Office of the Future?" *Archivaria* 19 (Winter 1984–85): 162–72; followed in 1991 by "The Changing Face of Office Documentation: Electronic/Optical Information Technologies (IT)," in *Information Handling in Offices and Archives*, edited by Angelika Menne-Haritz (Munich: K.G. Saur, 1993), 112–27; and in 1993 and 1994 by two related works, "El paradigma de la gestio dels nous recursos d'informacio i les seves implicacions per als arxivers i els gestors de documents," *Revista Catalana d'Arxivistica LLIGALL* 6 (1993): 27–42; and "Teaching Archivists about Information Technology Concepts: A Needs Assessment," *American Archivist* 56 (Summer 1993): 434–43.

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an extension of past observations. Clearly, less expensive, more broadly available telecommunications and computing capabilities have spurred the rapid transformation of information management and the office itself. These developments in turn have led to the proliferation of automated and "informated" work processes,[2] some with their own trails of electronic documentation and others with only the fading memory of those who try to recall how a particular decision was reached.

The resulting "record" in the emerging World Wide Web-based work environment is a virtual confluence of multimedia information resources. The creation and use of these "records" is nonlinear and hypertext linked, necessitating the reconsideration, if not the revision, of such revered concepts as "respect of original order" and "provenance." Indeed, what one must now manage includes an ever-growing body of digitized information—words, pictures, graphics, sound, animation, and even full-motion video. In their entirety, these information assets may not even reside within the physical confines of the organization but are the property of others located on Web servers throughout the Internet and linked to one another through Internet-based addressing standards.

To begin, this paper describes in the briefest possible terms the characteristics of this automated and informated workplace, an environment focused on: 1) service to the customer, and 2) the reduction of operating costs. Increasingly, all organizations, including those charged with the preservation of national culture, are being held to higher standards of effectiveness and efficiency. This theme should therefore resonate with readers of this article. I will next describe the technological and information resource management underpinnings of this environment, not because I wish to subject my audience to a great deal of technical detail but so that they may gain some insight into the challenges posed by a Web-based information management world. In addition, I draw certain links between these emerging trends and more traditional archives and records management services.

Conference on Archives and its host organization, the Association of Catalonian Archivists, for making his participation possible. The author would also like to thank his own institution, Babson College, and in particular his colleagues, Anne Marie Makarenko, college archivist, and Andrew Martinez, now archivist at the Rhode Island School of Design, for their support and assistance in this effort.

[2] Shoshana Zuboff coined the term "informated" to describe work processes and environments that focus on information-rich content as the means by which tasks are accomplished and value is added to business processes. Typical organizational investments in such efforts as data warehousing, institutional research, and database-driven information systems for recordkeeping and for financial and human resource management are propelled primarily by the need to use the organization's information assets as a lever—that is to make its business processes more informated. The organization's level of commitment to these projects will demonstrate an understanding of the value afforded by better information management. For further insights into the thinking behind the "informated work place," see Shoshana Zuboff, *In the Age of the Smart Machine: The Future of Work and Power* (New York: Basic Books, 1988).

Lastly, I suggest a different role model for the archivist. No doubt a distinct minority of institutionally subsidized archival programs will continue to labor among "documents" as opposed to information. However, to be relevant practitioners today, most archivists must move with the times and deliver valued information resource management (IRM) services.[3] Implicit in this view is a requirement for new ways of thinking about the structure and organization of information assets as well as the need for different core and domain competencies on the part of archivists and other IRM professionals. In the final analysis, my model calls for a greater proactive or "interventionist" role on the part of the archivist, but a role that at times leaves the ultimate responsibility for the retention and disposition of the organization's information in the hands of the end user.

Two Opening Scenarios: (Real Life!)

Creating a New Archives. In conjunction with the opening of its newly endowed Center for Entrepreneurial Studies, Babson College plans to establish an Archives of Entrepreneurship. However, this archives will not have (in the traditional sense) a reading room, collection finding aids, stacks, or even a research staff to assist patrons. The holdings of each entrepreneur, including paper documents, audio recordings, video tapes, and electronic information will be digitized and stored on standard optical disk media. All of these materials will be organized and made available as part of the Entrepreneurial Center's website with each collection's contents linked together through the utility of HyperText Markup Language (HTML). Students and faculty alike will be able to explore the complete holdings of the Archives from anywhere at any time. On-line "Help" screens will assist users of the Archives as they roam its holdings, but since most users will have Web experience, the staff anticipates few customer service problems. As currently envisioned, the overall design of the program provides broad and easy access, flexibility, and rapid turn-around time on the processing of collections. Furthermore, the cost estimates for the program are substantially below those of more traditional archival institutions.

[3] There now exists a vast body of literature around so-called "knowledge management" and "knowledge workers." At its core, information resource management concerns itself with the effective and efficient administration of the organization's information assets. Best IRM practices are proactive, delivering focused information to the end user. This process should not be confused with information systems management which focuses on the delivery vehicles, such as data warehousing, Web-based push technologies, and Internet browsers, that are employed to actually deliver the data to the knowledge worker. For more details, see Thomas A. Stewart, *Intellectual Capital: The New Wealth of Organizations* (New York: Doubleday, 1997); and Jerome Kanter, *Managing with Information*, 4th ed. (Englewood Cliffs, N.J.: Prentice Hall, 1992).

Doing Work and Creating New Information Resources—An Example. Babson College's chief information officer (CIO) is in Barcelona, Spain at a conference. On a regular basis during his stay, the CIO dials into a local Internet service provider (ISP) to access the Internet and the college's website. Once connected, he replicates work in the form of memos, electronic mail messages, database updates, and activity forms (e.g., purchase order and reimbursement requests) to and from the appropriate network servers back on campus. In this way, he quickly receives information and assignments from others while concurrently responding to the last round of work prepared by his colleagues at Babson. The CIO's virtual office space allows him to transact business anywhere and at any time. He does not need to be connected continuously to the college's network. Instead, he links up via the Internet, synchronizes files, and signs off. Beyond the convenience of this arrangement and the efficiencies it affords is the fact that the CIO is drawing upon a wide range of information, some from Babson and some from other sources, with which he will make decisions effecting the college's future information technology investments. The final decision may be recorded in a purchase order or a contract, but the process of decision making is buried in a flurry of electronic mail exchanges, Web browser queries, and Lotus Notes discussion database entries.

Workplace Assumptions

The two brief scenarios outlined above suggest the scope of change sweeping the workplace. Even within not-for-profit organizations, information distribution and sharing is increasingly driven by the need for timeliness, responsiveness, and flexibility. While one's corporate work environment may define the particular information tools and repositories in place, the individual end user must determine how best to mine the organization's information assets. This process is highly personalized, nonlinear, and exploratory, but at its core, it seeks to meet the particular needs of the service provider and his/her customers. As a first step in appreciating how this environment is reshaping IRM requirements, let us consider the drivers of change and their direct impact on the design of information technology (IT) systems and services.

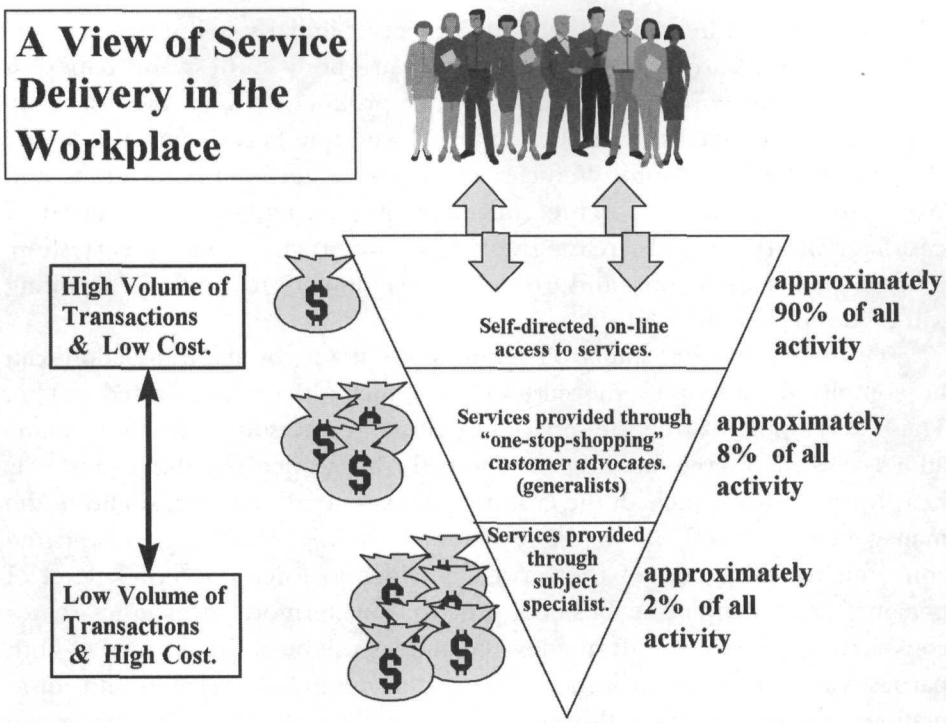
Rising global competition for market share, for satisfied customers, for shrinking resources, and for greater profitability has forced business and governmental leaders alike to search for new ways to make their organizations more effective and efficient. Invariably, their improvement strategies revolve

around the successful deployment of IT.[4] Whatever the particulars of the business being transformed or the employees engaged in the change process, all of these efforts embrace similar objectives for the workplace, namely to:

- simplify the business process and remove unnecessary steps.
- eliminate or reduce the handling of paper-based information.
- reduce the number of handoffs in the process, especially those involving the customer.
- remove barriers (and intermediaries) between the original service provider and the customer.
- eliminate all sources of error, rework, and redundancy within the business process.
- provide easy and ready employee access to accurate information about the customer, the business process, and the status of the product or service, with a focus on meeting the needs of the customer.
- provide easy and direct customer access to information about the status of the product or service and even access to the business processes themselves.
- automate any process component that is repetitive.
- informate any process component that adds value to the customer/service provider relationship.

To achieve these objectives, many organizations will establish change management teams to reengineer their operational areas. In conducting their work, these teams will need to ferret out customer requirements, build consensus around new methods of work, and design critical performance measures for new business processes. The resulting work environment service-delivery model assumes greater individual initiative and responsibility on the part of the customer and on the availability of a wide range of effective and easy-to-use information systems. This paradigm may be represented as follows:

[4] See, for example, Thomas H. Davenport, *Process Innovation: Reengineering Work Through Information Technology* (Boston: Harvard Business School Press, 1993); Don Tapscott and Art Caston, *Paradigm Shift* (New York: McGraw Hill, 1993); James Brian Quinn, *Intelligent Enterprise* (New York: The Free Press, 1992); and Michael Schrage, *Shared Minds: The New Technologies of Collaboration* (New York: Random House, 1990).



This model makes certain assumptions. In the first place, it assumes that the vast majority of customer services will be computer system-mediated, and thus available on-line, any time, and anywhere and that both individuals and organizations will continue to invest in IT as an enabler for their work regardless of the efficacy of the particular IT application.[5] It further assumes that the customer will access and interact with these services as a matter of preferred choice and through self-directed effort. The model also recognizes that a small percentage of related service activities require human intervention. For these needs, the organization will develop a number of cross-functional service delivery roles supported by highly informated systems combining data banks of corporate-wide information with sophisticated communications capabilities. These business process teams will perform as "one-stop-shopping" generalists and will be broadly trained and have access to an array of integrated information about their individual customers. As a last resort, the model accommodates one-on-one customer interaction with a specialist possessing a specific product or service expertise. However, these encounters would be more the exception than the rule in the course of daily business.

Aspects of this service delivery model have been in operation for some time. For example, automated teller machines provide access to a wide range

[5] Indeed, one could argue that an IT infrastructure is a given in any institutional business setting. The effective use of information assets will distinguish one IT implementation from another. Thus, the quality of an organization's IRM practices will, to a large extent, determine whether one's IT budget is well spent or largely wasted.

of automated and informated banking services. Similarly, self-service gas stations employing card readers at the pumps are both staffless and paperless businesses. At a more sophisticated level of product delivery, even such intractable bureaucracies as the U.S. Internal Revenue Service and the Massachusetts Registry of Motor Vehicles now employ telecommunications and Web-based technologies for the collection, processing, and distribution of customer information. Increasingly, almost any process from grocery shopping to stock transactions, and from skill development to medical consulting will be done over the Web.

Through these and similar IT applications, many routine transactions can be completed directly by the customer working with an automated system. These developments free the service organization's personnel for more value-added work. However, in order to succeed, this service paradigm must rely heavily on the willingness of the customer to assume more responsibility in the management of his/her own information, including data integrity, and the concomitant willingness of the service provider to forego a certain level of personal control over the business process. Furthermore, it assumes that a considerable amount of information technology will be at the disposal of both parties. Current trends in information system design—Web-based and information rich—suggest that this view of IT capabilities is a rapidly emerging knowledge management paradigm among most cutting-edge organizations.[6]

When successful, the net result of these efforts is the transformation of both the customer/service provider relationship and the information resources that are at the heart of that association. On-line, real-time data undergird these processes, enabling work through anywhere/any time access to customer and business process information. The data files themselves are far from static. Some are created on demand, based upon customer or service provider requirements. Others are more permanent but are monitored by electronic agents that manage the business processes shaping those records. In short, the IRM implications of the emerging workplace are profound. Let us next consider the nature and IRM attributes of the information technology components that comprise this new work environment.

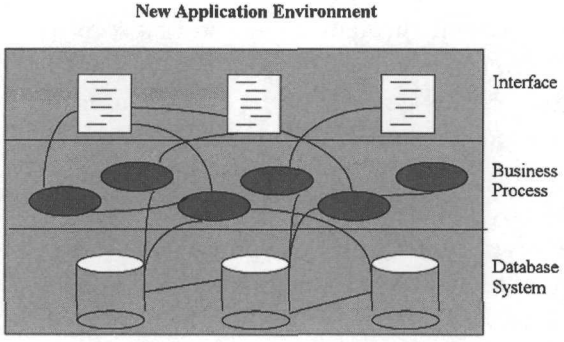
The Electronic Work Environment

To deploy successfully automated and informated work processes, organizations are investing heavily in information technology. These investments encompass the acquisition of local and wide area electronic networks, client/server infrastructures, data warehousing and archiving, replacement transaction systems, and numerous World Wide Web-based, customer applications.

[6] See, for example, "Web Search Solutions: Too Much Information," *Infoworld* (12 May 1997): 72–82 and "Knowledge Management Web Sites," <http://www.computerworld.com/home/features.nsf/all/980608kmlinks>.

The exact nature of these components will depend upon the specific needs of the organization and its customer base, as well as the extent of available resources for investment in IT.[7] In considering these technologies and their implications for organizational recordkeeping, it is perhaps best to begin with a discussion of the most current information networking paradigm—the multitier IT architecture.

Simply put, the multitier model is an electronic network design that separates the sources of data (i.e., electronic databases, corporate data stores/warehouses, or transaction system data), from the business process, and from the interface (i.e., electronic access points) to the end user. In many respects this multilayer model resembles the world of paper record creation as well, where the user creates the document in an operational setting, but according to the "metadata constructs" of a business process, and then passes it on to records storage and/or the archives once the initial administrative purpose for its creation has been addressed.



Since all three component layers will change over time, the organization's information systems implementation must afford the flexibility to swap out components without affecting the remaining pieces. This is a sound practice in that it allows for the best use of each component without marrying the organization to any particular interface, business process, or transaction system for life. In this new environment, the business rules are developed and maintained separately from the transaction system/database layer. The infrastructural separation between layers allows for a more flexible and responsive development environment. Business processes no longer have to be dedicated to one application (i.e., transaction system). Processes that are common throughout the enterprise can be developed as shareable programming objects for many applications.

[7] In the case of Babson College, this strategy is described in my article "Reengineering Babson College," *Journal of Computing in Higher Education* 7 (Fall 1995): 94–117. For a private sector example of IT-enabled systems design, see Peter Palmisano and Richard M. Kesner, "Transforming the Global Organization: Integrating the Business, People, and Information Technology At Camp Dresser & McKee Inc." *Information Strategy* 12 (Winter 1996): 6–15.

The practical implementation of this design may appear simple but is in fact difficult to accomplish. According to the multitier strategy, the organization would create a series of electronic business process entry points that will sit within its World Wide Web home page. These entry points will provide policies, procedures, and general information about all of the organization's major business processes. In envisioning this design, one might consider these entry points functioning like the chapters of an anthology, with each chapter serving as a distinct business process linked to various electronic forms and data views.

Some of these links will be simple electronic forms (e.g., a request for information, an application for services, a purchase order request, phone directory updates) for the end user (either an external customer or an internal service provider) to complete and send to the business process owner. Others will initiate complex automated transactions (e.g., bill payments, selection and purchase of vacation packages, the planning and organization of business meetings). To access these services, the end user will need to identify (authenticate) him/herself to the system through the network's security system. Once the user is authenticated, his/her transaction or data request will pass through for processing. The big challenge here is the coordination of information flows and transaction systems through the use of electronic agents.

The multi-tier information technology architecture is admittedly complex. More than any paper-based or previous electronic networking paradigm, it places even greater end-user dependence on IRM professionals who will develop and maintain the structures affording access to data. And yet, a multitier approach is well suited for the fast changing world of IRM. At the end-user interface layer, the organization might begin by providing access to information through electronic mail or simple forms running entirely within a local electronic network environment. Later, as the organization's need for and competencies with Web commerce evolve, these access points can migrate to the Internet, freeing the end user from location-dependent information retrieval. In all likelihood, the data layer will begin as a series of older, so-called "legacy" information systems and databases, possibly integrated, as we shall see below, in a data warehouse. Over time, this layer will become populated by transaction systems and data repositories more in keeping with Web commerce and anywhere/any time access to data.[8] By contrast, the business process layer is more difficult to define and to build. Much of it is critical to information resource management in that it houses the metadata governing access rights, data formats and presentation standards, information pro-

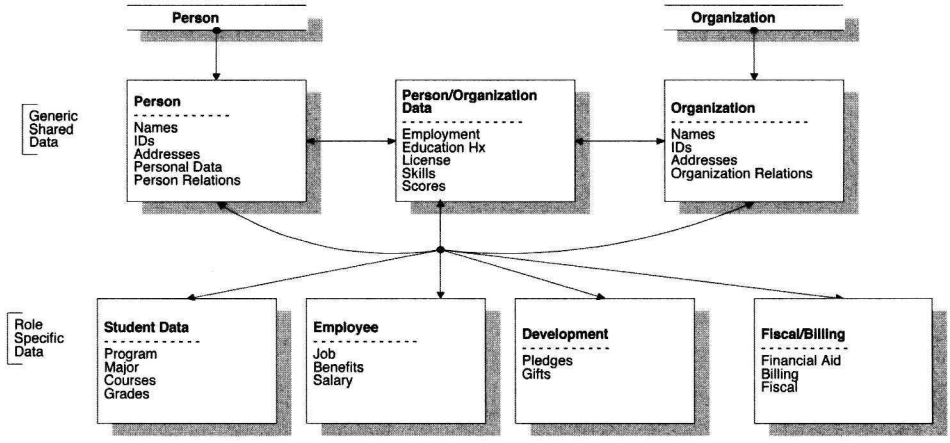
[8] One of the hottest IT topics today concerns the so-called "Year 2000" crisis; that is, the inability of legacy computer systems to properly recognize dates after 1999. Due to this problem, both for-profit and not-for-profit organizations are pouring millions of dollars into either replacing or retrofitting systems. The crisis also raises interesting records management questions and business opportunities for IRM professionals.

cessing rules, and so forth. Indeed, in many critical respects, this layer constitutes the automated archival and records management functions of the IT-enabled work environment.

Within this design, current data might reside in a database referred to as an operational data store (ODS) for fast access, while longitudinal data will reside within a historical data warehouse. In some designs, the ODS and the data warehouse are a single logical information repository. Whatever the specifics of the design, all data warehouses function similarly. Typically, each corporate transaction system is scheduled to periodically download data to a centralized data storage library. A data dictionary governs the so-called "mapping of data" from these systems to the data warehouse and provides a common set of data definitions (i.e., data attributes) for all feeder systems. The creation of these controls is the most difficult step in the development of any data warehousing application. Once it has been accomplished, the process will bring over normalized data for reuse by applications in the business process layer, sending customized information to end users upon request or sharing it among other transaction systems.

To ensure that the data is appropriately matched, some data warehouses will include a person or organization master file that links data attributes. To illustrate what such a master file might look like, consider the design implemented at Babson College. The critical links within this architecture include both personal and organizational links to other data elements within the warehouse. (Please note that in the following diagram the abbreviation Hx stands for history).[9]

IDEAL DATA ARCHITECTURE



[9] This illustration of where Babson is headed in terms of its data warehousing was provided by John Klaas, Babson College's data administrator, the architect of the institution's data warehouse, and a key member of its systems integration team.

In the Babson College data warehouse model, person and organization master files provide single locations within the overall data structure for all of the system-specific identifiers for a given individual or corporation. For example, the person master file includes (as appropriate) the social security number, identification number, telephone pin number, legacy system identification numbers, and so forth, for each person affiliated with Babson information. The master files then link to person or organization-specific data housed in process-specific application systems. This clearinghouse function is essential to efficient and effective information resource management among Babson's various business processes. Without these master files and linkages, college systems could not update and/or associate data fields with the confidence that new information was going into the right location. With this rigorous structure in place, end users can search organization data to address their information needs through the use of an easy-to-use, data access tool.

As critical as data warehousing may be to the overall functionality of a multitier information technology architecture, it is not sufficient to meet the IRM needs of the organization. Most end users will require more than simple data views. They will need access to actual transaction systems—to conduct personal business or to serve others. Here, electronic agents provide the appropriate forms or system applets[10] and then bring the completed forms (i.e., the data) down to the correct transaction system interface. The electronic mail system might also be workflow-enabled,[11] automatically communicating the status of work to the customer and to the service provider alike. Electronic mail, facsimile transmissions, and Web pages might also be employed as delivery vehicles for data views generated from the data warehouse or from the organization's transaction systems.[12]

The beauty of this model resides in its overall effectiveness and efficiency and that end users never need to know anything about or come into direct contact with the organization's transaction system. Instead, the end user enjoys the use of a standard interface, point-and-click technology, and low-cost access to the Web through his/her local network (if an internal user) or an independent information services provider—ISP (if an external user). End users never get access to transaction systems even though they may provide

[10] Applets are small self-contained programs that perform a particular function and because of their focused functionality and design may serve as the reusable building blocks for various software applications.

[11] Workflow refers to the process of delivering information, work, and/or value from one worker to another within a business process. Workflow software tracks roles within a process as well as the status of work flowing through that process. Thus, workflow-enabled systems will typically track the status of work that is in the pipeline, the location of documents within the process, and who has responsibility for the appropriate next step.

[12] See Richard M. Kesner, "Employing Groupware in Business Process Redesign: Action Technology's Action WorkFlow," *Center for Quality Management Journal* 5 (Fall 1996): 11–14. For a discussion of the implications of groupware for the archival community, see also "Group Work, 'Groupware,' and the Transformation of Information Resource Management," *American Archivist* 58 (Spring 1995): 154–69.

much of the data that resides in those systems. Their work is done at the Internet or interface layer, facilitated by workflow-enabled business processes in the intranet or business process layer. This leaves the data layer and its associated transaction systems in the hands of the service providers who own, manage, and are solely responsible for the integrity of these data repositories and specialized systems. Last, but not least, as any single component is upgraded or becomes obsolete, it may be replaced without disturbing the other components within the organization's multitier architecture.

IRM in Practice—Babson College: A Case Study

As a concrete example of how a multitier IRM environment looks and works, here is an illustration drawn from Babson College's View-It and Do-It Online™ (ViDi-O)[13] system. In brief, Babson has committed itself to placing the ability to do business with the college on the World Wide Web. The organizing principle for these transaction processes is the Babson College home page, and, within the home page, a number of customer-focused electronic handbooks.[14]

Each handbook is organized and indexed as a standard HTML document. The handbook index entries indicate if a particular section includes an imbedded ViDi-O object. The accompanying text explains the business process and the respective roles of the customer (student) and the Babson College service provider. The customer then has the option of either immediately clicking on the ViDi-O icon, initiating an IT-enabled business process such as ordering a transcript or viewing one's bill, or selecting a ViDi-O Wizard that will walk the end user through the electronic process one step at a time.

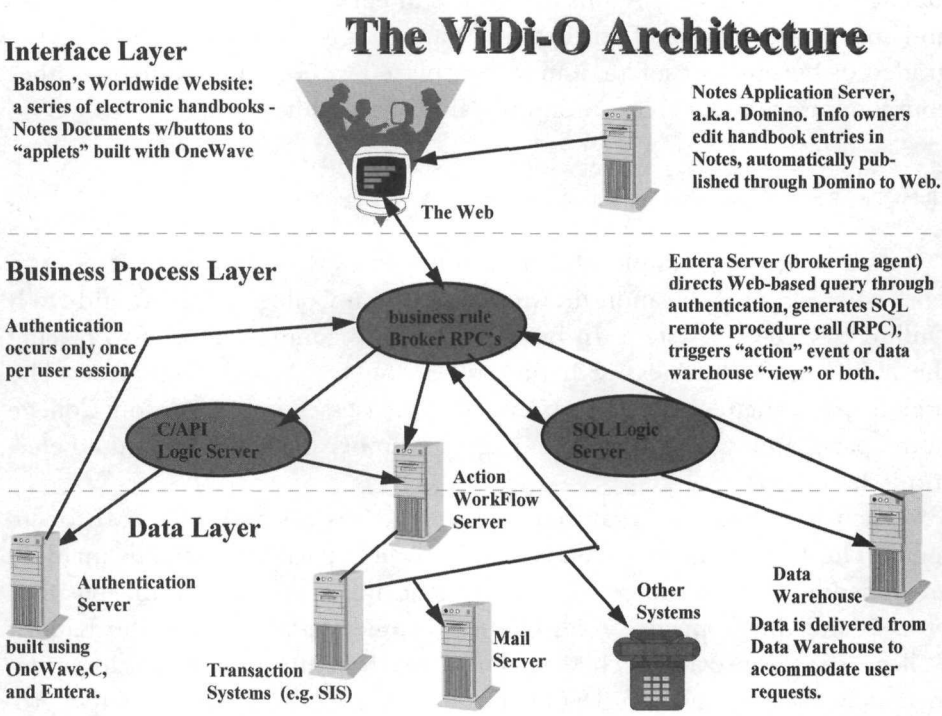
All of Babson's electronic handbooks are created through the use of Lotus Notes templates that serve a three-fold purpose. First, the overall look and feel of the handbook can be easily maintained by a Notes administrator through the use of a consistent interface. Second, through a common Notes client, service providers can maintain handbook content without recourse to technical support personnel. This arrangement adds flexibility while distributing the administrative overhead for the handbooks. Finally, Notes in concert with its Web engine Domino automatically pushes this information, fully indexed and searchable, onto the Web. The end product has all the advantages of a Notes database without the overhead costs of a Notes client on every end user's desktop. Thus, a student, a parent, or an alumnus can access

[13] ViDi-O is a trademark of Babson College. This term refers to the library of Internet-based applications that provide customer access to college information services and systems.

[14] At the present time, Babson has both graduate and undergraduate electronic handbooks up on the Web. Each has a number of linked ViDi-O components. As the IT team produces additional applets, these too will be linked to the handbooks. Eventually, employee, faculty, alumni, and executive education electronic handbooks will join those for graduates and undergraduates.

Babson College business processes from on or off campus simply by employing any Web browser.

If ViDi-O tools are easy for the customer to use, the underlying technology employed is far from trivial:



At the interface layer, Babson employs OneWave software to build Web forms and data views. Lotus Notes (Domino) sends HTML-indexed handbook copy from the Notes databases of college service providers to its website. Within the business process layer, an electronic brokering agent (Entera Server) directs Web-based customer queries through authentication. It then generates SQL remote procedure calls (RPC's) that either trigger events (such as the registration for a class), or the calling of a data view from the data warehouse (such as the presentation of a student bill), or both. Authentication is an essential first step, but it occurs only once each session. Thanks to the person master file in the College's data warehouse, once a customer is authenticated, his/her identity is verified and known to each and every automated business process and transaction system in that browser session.

The brokering agent, in effect, allows the customer into the data/transaction layer. Here, information is sent to and shared with end users via the Internet. For example, billing information, grades, class schedules, housing assignments, and so forth are all data views soon to be available through ViDi-O to Babson students. The same mechanisms will allow students to file for extensions, pay bills, register for classes, and apply for financial aid. A

workflow server will track process activities, queue up work for action by the appropriate service provider, and, when materials or activities are time-sensitive, issue reminders to the appropriate players. While these reminders will most often arrive as electronic mail messages, Babson may eventually employ Edify, its object-oriented voice response development environment, to send voice messages to customers.[15]

At the present time, Babson College has implemented three different types of ViDi-O applets:

- Forms - used primarily by the service provider to act on behalf of the customer by gathering all the relevant data for a particular business process in one working session with the customer.
- Wizards - used primarily by the customer to gather information piece-by-piece through a series of prompts and questions provided by a Wizard program.
- Views - used by both the customer and the service provider to display information for a particular business process.

All of these applet formats possess interactive "Help" screens that display explanatory text as the mouse pointer moves from object to object within the applet. In total, they establish a paperless work environment where most information resources are virtual, where the end user of the service must manage his/her own information assets, and where electronic agents more often than not serve as system records managers. Thus, the Web-enabled workplace is very different than even previous renderings of the "electronic office;" which begs the question, "What is role of archivist?"

The Archivist as Information Resource Manager

In her most recent, well-researched and well-argued article on the subject of electronic archives, Margaret Hedstrom presents a particular view of the issues faced by archivists in managing an information resource environment that is not too dissimilar from the one depicted here.[16] She writes of the need for archivists to introduce themselves to the IRM process early on so that they can effectively influence the creation and handling of electronic records. Hedstrom then goes on to identify IRM issues concerning electronic mail and other document types. While I do not disagree with her findings, I would like to build upon them in redefining archival roles and responsibilities.

[15] Rather than creating information systems from large blocks of continuous computer code, many new systems now employ libraries of reusable, small programming components called objects (hence object-oriented programming). See David A Taylor *Object-Oriented Information Systems* (New York: John Wiley, 1992); and David Chappell *Understanding ActiveX and OLE* (Redmond, Wash.: Microsoft Press, 1997).

[16] See Margaret Hedstrom, "Electronic Archives: Integrity and Access in the Network Environment," *American Archivist* 58 (Summer 1995): 312–24.

The first point to be made is that we now live in an information economy where the producers of value are knowledge workers. Regardless of one's business or job assignment, today's worker needs ready access to information in many different formats. This information must be accurate and timely, it must be tailored to the needs of the end user, and it must be provided on an as-needed, economical basis. Similarly, this same worker will create, reformat, store, and share information on a similar basis and it will take on a more interactive form as a website, a chat room, or a discussion database.

Given the scope and extensiveness of information assets in the emerging work environment, there is little that the archivist can do to interact effectively on an individual basis with all end users. The fact is that the typical organization has too much information changing hands at any one time for the archivist to play an active role. This is not to say that the archivist cannot add value to the organization's information collection, processing, and distribution. But his/her influence will most certainly occur on a different plane of activity.

To begin, consider the data layer. Here one finds the organization's transaction systems, data storage repositories, data warehouse, and so forth. Each one of these electronic repositories contains and maintains a portion of the collective knowledge and information assets of the organization. The typical IT facility methodically backs up the files housed within those systems and may even go so far as to provide for the contingency situations caused by the loss or corruption of data. However, as these bodies of information become large and complex, the mere physical duplication of storage media is totally inadequate for the job. Instead, the design and management of data layer information stores requires more sophisticated IT architecture components.

To this end, the IRM team must develop metadata structures and even a metadata repository that will include: data requirements, data mapping, legacy data formats, data models, data standards, presentation rules, and business views.[17] Whatever its configuration, these metadata structures govern the way information is captured, stored, and shared around the enterprise, and between the enterprise and its customers. Clearly, the archivist or some other IRM professional must serve as liaison between the end-user community, transaction system "owners," and the organization's technology team, translating information needs into formal data structures and system operating rules. Since the needs of users, the information sources themselves, and the systems manipulating the data are in a state of constant flux, the role envisioned here would be part of a continuous improvement process.

Furthermore, someone within the organization must establish retention and disposition standards and processes for electronic records. This responsibility encompasses defining the types of records (e.g., electronic mail mes-

[17] For an intelligent, nontechnical discussion of metadata applications, see Jane Griffin, "Metadata: Capturing the Heart of the Data Warehouse," *Application Development Trends* (January 1997): 70–74.

sages, discussion databases, Web pages) stored on the network, the storage requirements for each type of record and each constituency of end users, the duration of retention, and the frequency of back-up. End user needs will prove to be both varied and dynamic. IRM personnel may manage the overall process, but the individual user will manage his/her own files.

In this setting, the archivist might act as a data collector and process manager concerning end-user electronic storage, back-up, and retention requirements. The archivist might also work on the one hand with the end users to instill records management practices, and on the other hand with the organization's IT team to ensure that storage is properly allocated and that back-up schedules are followed. Though these tasks focus on the management of current electronic records, they are clearly a link to the more traditional role and skills of the archivists, and serve as a bridge between established practices and emerging IRM requirements, easing the transition from paper to electronic media. The archivist's traditional commitment to information integrity and security will serve the institution well in this regard.

At the next level removed from data storage, one finds the business process layer with its own critical metadata. But here the focus is on rules controlling access to and the flow of information rather than the data elements themselves. Historically, this matter may have been addressed by the organization's data security person. However, in a multitier environment operating with Web-applets et al., security firewalls and passwords comprise only one aspect of the overall solution. IRM personnel must ensure that the right information is conveyed to authorized ends users in appropriate formats. If any combination of these three process components fail, the entire system will cease to function. In other words, the business process layer must encompass all of the rules and policy frameworks to ensure the security of the diverse information assets of the organization. This layer also defines the linkages between business processes and information assets.

Here again, a logical connection may be seen between the IRM skills required and the unique perspective that an archivist would bring to this challenge. In brief, the situation calls for someone who can integrate process needs, tools, and resources with the end user's right to know. The archivist must sufficiently understand the mission of the organization, the nature of its information assets, and the knowledge workers employed in its processes to identify and build the links between the work and the data. More often than not, this will involve collaborating in the development of workflow and system interface rules. Once these metadata issues are sorted out, the archivist can turn over the model to other members of the IT team who will be charged with the more technical responsibilities of building 1) the authentication tables and firewalls for access control, 2) the workflow application programming interfaces for IT-enablement of the business process, and

3) other electronic agents and stored procedures for the routing of electronic information products to customers and service providers at the interface layer. Perhaps most importantly, the archivist may not have hands-on exposure to the records and must serve as a specialized consultant to those with access to the data.

Finally, at the interface layer itself, the end user interacts with information forms, query tools, and organizational communiqués mediated by the Web or that user's local network interface. If the IRM team has done its work well, the end user will find all of these capabilities easy to access. However, even in the best of circumstances, navigating the information environment may prove forbidding. At least at the outset, this experience needs to be mediated in two important ways. First, the archivist or some other IRM professional should orient the end user on how to make the best use of the electronic resources now available. As new services are added and as part of educating the end user as a knowledge worker, this process will probably bear repeating on a regular basis. Second, someone—and here the archivist might be the ideal support person—needs to train the end user on how best to manage his/her own electronic files. All too often, the typical knowledge worker is provided with a bevy of office automation tools without any instruction on how best to organize personal data, use the network's storage facilities, and develop a set of individualized rules for day-to-day data management. As a result, information assets go astray and much personal staff time is wasted reinventing flawed or incomplete IRM processes. Here, the archivist should intervene, establishing policies and procedures for the end user and, where possible, generalizing these rules for the corporate work environment.

In short, there is much for the archivist to do in the automated and informated workplace of today. Many of these responsibilities require at least a general understanding of current information technologies and IRM requirements. Moreover, there will need to be a change in orientation away from the actual hands-on management of records to the enablement of others to self-manage their own electronic files. In part, the systems themselves, through their metadata infrastructures, will do this job. But these tools will only succeed if adequate staff training and development are provided by those with a knowledgeable business process/IRM perspective. The rest will come about through the proactive efforts of the IRM team working with end users and business process owners.

To be a contributor to this important work, the archivist must develop a somewhat different portfolio of core competencies,[18] including a knowledge

[18] This essay provides a framework for assessing some of the professional challenges faced by archivists. It is neither the only nor the most complete of such models. Some time ago, a team of archivists developed an automation curriculum for archivists. Its tenets are still highly relevant. See *American Archivist* 56 (Summer 1993). In addition, one should consult the appropriate Society of American Archivists' resource guides and annotated bibliographies as well as the writings of such archival luminaries as Charles Dollar, Margaret Hedstrom, and David Bearman.

and understanding of:

- business process and information resource management consulting,
- business process analysis,
- data mining tools,
- data warehousing and metadata design,
- multimedia document standards and storage requirements, and
- workflow systems design and management.

In addition, the archivist needs to develop a greater familiarity with and general understanding of the following specialized areas:

- data security,
- network support and management issues,
- trends and developments in IRM technologies, and
- World Wide Web services and tools.

Finally, archivists will need to develop domain competencies in the specific work processes and corporate culture of his/her own organization. Furthermore, archivists must be active users of IT and not just witnesses to how others in the organization use technology. In short, their own processes must be automated and informated in keeping with the culture of their organization. Ultimately, the success of information resource management in the workplace will depend upon the ability of knowledge workers to marry how they do work with the information assets at their disposal. Clearly, IRM professionals must focus on developing a role that addresses this need. There may be other attributes as well, but this is a good start if the archivist of today is to become an IRM team member in the emerging electronic office. The traditions and commitments of the archivist towards the integrity of documentation and the quality of face-to-face service to the customer should complement the more recent requirements of the automated and informated workplace.