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Digital Shift or Digital Drift? Dilemmas of Managing Digital Library Resources in North American Universities

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The Research Problem

Many IT specialists take for granted the shift from paper to electronic documents as part of a digital revolution. National indicators of the growth of network usage support shifts to digital documents such as exponential increases in the number of Internet hosts, the number of electronic mail addresses and the number of World Wide Web sites. However, in our empirical studies we have found that academic administrators base their decisions on

local indicators of demand such as the number of people who depend upon World Wide Web for their work, the demand for electronic mail accounts and number of information retrieval requests from bibliographic databases. Because university budgets are flat relative to inflation and the university management of information resources is dispersed at many levels, they are investing in a way that indicates a drift toward use of digital materials.

Can whole industries drift into major IS investments without coherent strategies? Such a pattern is anathema in the literature about information systems as purposive strategic investments (Morton, 1991). Even those who criticize the ways that organizations computerize tend to assume managerial rationality -- albeit around values that they criticize (see, for example, Zuboff (1988) on automating versus informing). There has been an interesting set of studies of the ways that managerial rationality may backfire, and information systems may not be developed or used as intended (i.e., Zuboff, 1988; Kling and Iacono, 1989; Orlikowski, 1993). One interesting alternative to managerial rationality is bureaucratic drift, in which organizations (or clusters of them) develop tacit large- scale policies through balkanized management and managers playing semi-

coordinated short-term games in their "organizational turf" (See Allison, 1971; Kling and Iacono, 1984).

We know of no industry-scale studies that examine alternatives to managerial rationalism as the dominant logic behind IS developments. This study examines the organizational processes that are driving a specific form of computerization in a specific industry: the increasing investments in digital libraries in North American research universities. Our research questions include: How are university administrators making budgeting and policy decisions about information technology access for research? What are their choices? How do they pose outcomes? We do not claim that this industry or family of information systems typifies other industries. But the major research universities are highly competitive in some key terms: in attracting and retaining productive faculty and promising students, in justifying fees (tuition) to parents and state legislatures, and in attracting research grants and gifts from public agencies, corporate donors, foundations, and individuals.

Methods and Data

We are currently engaged in empirical studies of the use and management of paper and digital libraries in eight major US research universities. These universities vary in their library investments (per faculty member) and in their levels of library centralization. In each university, we interview the University Librarian, the Director of Academic Computing, and other senior academic administrators such as a Provost. We also interview three faculty and some Ph.D. students in each of four fields: lab science (molecular biology); artifactual discipline (computer science); social science (sociology); and a humanities discipline (literary theory). We seek data about ways that scholars use paper and digital research materials, patterns within the disciplines (ie, roles of paper and electronic preprints), and data about university investments in library and computer support.

The main form of data analysis is to examine the ways that demand for digital and paper materials is reflected in university decision-making, and to theorize these patterns in terms of analytical models of organizational change (see for example, Allison, 1971; Kling and Iacono, 1984; Kling and Iacono, 1989). The study is empirically anchored and we are reaching the end of our data collection phase. The results here are primarily descriptive and characteristic of our preliminary analysis.

Paper and Digital Libraries in Research Universities

Paper libraries are rarely the glamour centers of university life: they store books in musty stacks, attempt to maintain tight control over the collections, and are often well posted with signs for visitors to remain quiet and leave food and drink outside. They sometimes offer quiet places for reflective reading, but are often used as warehouses in which faculty and students seek specific kinds of books or articles but read them elsewhere.

Academic libraries are also major expenditures for colleges and universities. In 1992-93, thirty-eight U.S. universities each spent between \$15M/yr and \$58M/yr on academic libraries, and twenty-two of these universities each spent over \$20M/yr (ARL, 1995). These investments get relatively little attention from professors and students. In the last 5 years libraries have been faced with rapidly rising prices for books and journals. In the face of rising costs and relatively flat (and sometimes declining) university budgets, university librarians have usually slowed the rate at which they buy books, and have sometimes canceled large numbers of journals subscriptions.

The exciting elements in recent stories of academic publication have focused on digital libraries in various forms. There are two common approaches to defining digital libraries, one based on Internet services and the other based on library automation. Computer scientists often identify digital libraries with collections of whole text documents and images that are available via Internet services, such as ftp, gopher, and World Wide Web (WWW). These corpuses are growing at a relatively rapid rate, and include some standard versions of classical texts, preprints of academic articles, technical reports, published papers, diverse but incomplete sets of government reports, electronic journals, and a few new books. Library and Information Scientists cast a different net, and include on-line card catalogs, searchable citation collections (i.e. Medline, Current Contents), abstracting services (i.e. Chem Abstracts, Inspec), and agglomerations that offer whole text (Dialog, Lexis, Nexis) (Arms, 1990; Buckland, 1992). Buckland refers to this latter group of as "automated library services." They are offered independently of the Internet (although they are sometimes available through it) and are usually purchased by university libraries. Automated library services identify books and articles that may be in a library's holdings or available through interlibrary loan arrangements.

Many direct costs of automated library services show up in university library budgets, and their costs and usage are, in principle, controllable by academic administrators such as University Librarians (chief administrators of university libraries) and chief academic administrators (such as Provosts and Academic Vice Chancellors). The contracts for automated library services and parts of the human and technological infrastructure to support them can be traded off against other parts of academic library budgets. For example, one University Librarian claims to be investing in automated library support with a growth rate of 10%, while the rest of his much larger overall budget remains flat. This budgeting process resembles disjointed incremental analysis (Lindbloom 1979) which includes several strategies and focuses on areas for remediation rather than specific broad ambitions. Despite optimistic plans for improving research with information technology campus-wide, administrators are careful to align their projects with other incremental goals such as serving more students, lowering costs and improving the education process. We do not take a particular position about desirable investment rates for library automation; we simply observe that this segment of digital library budgets can be made relatively visible, controllable, and tradable against other inputs for library services (i.e. holdings, hours, and staffing).

The control over access to networked digital library resources is much more decentralized in North American universities. Universities primarily provide access to the Internet, but

the nature of such access and the ways that academic schools, departments, and institutes pay for services varies from one university to another. In extreme cases, some "leading edge" universities have provided two ethernet connections to every campus office and classroom, while other universities have wired only a fraction of offices (often in the sciences) with twisted pair and don't offer SLIP or PPP. All of the universities that we have studied so far rely upon academic units to find funding for relatively "up-to-date" high performance PCs or Macs and printers if they want such equipment for all faculty and Ph.D. students. Universities vary in the extent to which they centralize or decentralize the purchase of file servers, support for computer training, network consulting, and other "human infrastructure." A local collection of computers, networks, software, and technical staff does not constitute a digital library. It provides a basis for scholars to search for and try to read, possibly print, and use documents that are stored in digital form elsewhere

The creation of networked resources and services, instead of comprising "big-step" computing policies (Lindbloom 1979), engage decentralized decision-making processes (i.e. what types of contributions count for tenure and promotion) that fragment centralized efforts to promote use of both paper and digital resources. For example, a decision to catalog a special collection of rare prints is more of a mutual process between faculty member (and a cadre of students who will find it easier to work with this material) and librarian who needs a constituency to justify budgeting for a formerly little-used resource.

We have not yet located any university libraries (or other academic units) that help manage these Internet-based electronic archives for students and scholars. Libraries may provide workstations with some Internet tools, such as web browsers. But the digital archives, including their integrity, permanence, indexing (if any), and manipulability is outside the domain that librarians define for themselves. The Computer Scientist who obtains preprints in postscript from the (electronic) Journal of AI Research via a Web server does so at his or her own discretion and with his or her own trust in the authenticity of the documents. The high energy physicist who seeks preprints from HEPnet (maintained by Stanford Linear Accelerator (Okerson, 1991)) does so by himself, or with help from his graduate students. The literary scholar who seeks articles in the (electronic) Bryn Mawr Journal of Medieval Studies or the (electronic) journal, PostModern Culture, usually searches, downloads, prints, and reads by himself or herself. These electronic journals, as well as preprint servers, mailing list servers and diverse archives provide a cornucopia of materials whose marginal cost of acquisition often seems small to scholars.

Scholars who use Internet services have a delightful freedom from the collection control policies of campus librarians. Moreover, their preferences seem to be strongly influenced by shifting standards in their own subspecialties, to which university libraries do not usually respond very rapidly. It is easy to find enthusiasts for digital library services that are mediated by the Internet (i.e., Odlyzko, in press; Drabenscott, 1993; Okerson 1991). But we have not found coherent accounts that situate the use of digital and paper materials in the context of specific scholarly projects, or of coherent university policies.

The costs of acquiring and storing materials from the Internet is also hidden from organizational accounting. Standards vary for what constitutes "cheap storage": many humanities scholars still use computers with 80MB disk drives while a few computer scientists have 40GB disk farms. We have had difficulty in finding university officials who have budgetary control over the diverse computing support that supports effective Internet access and also paper resources acquired by university libraries. While most research universities are incrementally increasing their support for Internet access by faculty and students, it does not seem to be managed in some visible way as a direct tradeoff with paper library investments. Moreover, faculty maintain their own copies of (or pointers to) Internet-based materials, universities do not purchase sharable resources with their Internet investments. In contrast with the journals or books that libraries acquire, catalog, shelve, and make available to all, the materials on a faculty or students' hard drives are a form of private property and are not visible to others.

Which models of organizational choice and change best describe these shifting investments in new (digital library) information systems? Overall, universities are making steady increases in their investments in digital library resources. While some universities have made large investments in digital resources and a few universities have tried to have coherent strategic digital library plans, most IT investments are not massive and focused. The bulk of choices seem to be driven by disjointed incrementalism in academic departments

There might seem to be a big digital shift from paper to electronic materials taking place in universities. There certainly is technological momentum behind this move (Smith & Marx, 1994). But, simultaneously, paper materials remain supreme in most fields. Faculty outside the humanities prefer to publish in paper journals and often subscribe to 4-8 journals personally. Aside from computer science, faculty exchange preprints in paper by mail. And even Computer Scientists prefer to print preprints and tech reports for reading. Paper does not disappear, when faculty use digital materials. Our early observations suggest that universities appear to be steadily drifting into more intensive digital investments with little managerial oversight about the extent to which their investments are effective or efficient, adequate or frugal.

Quantifiable indicators such as the number of Web sites, electronic mail addresses or even bits carried across research networks impress administrators to consider large shifts in resource allocation. After all, how can they attract research funding, capable students and support the best scholarly work without giving all of their faculty and students to diverse digital libraries? Nevertheless we have seen how drift and disjointed incremental decision-making figure prominently in campus IT policies. The necessity of basing decisions on decentralized use makes us think that drift will continue to figure more prominently in the management of digital documents.

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