Technology, Power, and Structure: Developing a Model of the Effects of Automation on Liberal Arts College Libraries

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Based upon theories of organizational structure and power, especially the strategic contingencies theory of intraorganizational power, a model of organizational power and technology within liberal arts colleges is developed, tested, and modified. The model includes measures of subunit (library) power, environment, extent of automation, organizational structure, and bases of power. Data on 487 liberal arts college libraries collected from the 1982 HEGIS survey, the 1990 IPEDS survey, and two mailed questionnaires provided limited support for the proposed model of intraorganizational power. Changes in the amount of library automation caused changes in several of the bases of power of the libraries. Analyses of a modified model of intraorganizational power and technology showed that as automation and the environmental variables increased, subunit bases of power increased, and all of these directly increased library power. Thus, automation can be a change agent within organizations, causing changes in structure, in the bases of power, and in power itself.

The adoption and use of computers and other information technologies have been shown to be associated with multiple organizational effects, including changes in organizational power structures (Hedberg, Edstrom, Müller, & Wilpert, 1975; Pfeffer & Leblebici, 1977), maintenance of power relations (Boeker, 1989; Danziger, 1986), and concentration of power (Robey, 1981). As a result of such findings, many researchers consider power as a dependent variable, influenced by the implementation and use of information systems (Burkhardt & Brass, 1990; Huff, 1991; Kraemer & King, 1986; Lucas, 1984; Markus & Robey, 1988).

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According to the model developed by Saunders (1981) and Saunders and Scamell (1986) in their studies of management information systems (MIS), as MIS usage increases, the power of the subunit which controls the MIS also increases. This is due to the increase in that unit's centrality (called pervasiveness by Saunders), its ability to cope with uncertainty, and its nonsubstitutability. Similarly, Pettigrew (1972) and Pfeffer and Leblebici (1977) argue that information access and the control of information technologies are power resources. Various authors within the library literature have also shown that automation is a change agent within libraries (Cartee, 1990; Gorman, 1987; Moran, 1989; Pungitore, 1986).

Based on the literatures of both organizational power and the social effects of information technologies, this study developed and tested a comprehensive theory of changes within organizational power, structure and technology as a result of the implementation of library automation.

CONCEPTUALIZATIONS AND MODELS OF ORGANIZATIONAL POWER

The word "power" conjures up many definitions and a variety of models to explain it. For example, Pfeffer (1981) states that "power is the capability of one social actor to overcome resistance in achieving a desired objective or result" (p. 2) while Mechanic (1962) defines power as "any force that results in behavior that would not have occurred if the force had not been present" (p. 351). Within the various models of power, concepts such as influence, power, and control are considered synonymous.

Organizational power may arise from many sources. According to Perrow (1970), the most critical functions within the organization tend to have the most power. Pfeffer (1978) lists formal authority, control over resources, information and access, and uncertainty reduction as major sources or determinants of power. Pfeffer (1981) states that power is first and foremost a structural phenomenon, deriving from the division of labor. Ranson, Hinings, and Greenwood (1980) claim that power is "a capacity grounded in a differential access to materials and structural resources" (p. 7). Zald (1970) adds two major sources of organizational power: the contribution and functional importance of a particular group to the work-flow of the organization and a group's position with respect to defining the information flow, rules of the game, and external environment relevant to control and evaluation of the internal economic system. Pettigrew (1972) says that information access and control are power resources, yet he also states that the basic unit of analysis in power relationships should not be individual persons or groups, "but actors operating from one or more structural positions within a specific social system" (p. 188). Thus, power arises in the ongoing relations between actors, often using organizational features as a mediating influence.

A university, for example, is a political organization where decisions are the result of political processes involving interest groups (Baldridge, 1971). In addition, a university or college generally has two hierarchies and two authority systems—the bureaucratic network (administration and support staff) and the professional network (faculty). This leads to four critical power bases in academic politics: bureaucratic (control of budget, personnel appointment and removal, legitimate access, and control of information), professional, coercive (disruption, irrationality, appeal to public opinion), and personal. Wamsley (1970) posits that within the university, power is variable, specific to situations or issues, surrounded by checks and balances, and based on interdependent relationships, often employing negotiation and persuasion and many times found in changing coalitions. In her study of power systems in colleges and universities, Hackman (1985) stresses five concepts: centrality of the subunit to the mission of the institution, resource allocations, resource allocation strategies, environmental power (bringing resources into the institution), and institutional power as measured by size of units and number of students served. In general, power in this context is indicated by the allocation of internal resources to organizational subunits.

The strategic contingencies theory of intraorganizational power states that the control of contingencies needed by other subunits within the organization increases the power of the controlling subunit (Hickson, Hinings, Lee, Schneck, & Pennings, 1971; Lachman, 1989; Salancik & Pfeffer, 1977). Hickson et al. (1971) give the following basic hypotheses of contingency theory (pp. 220-222): (1) The more a subunit copes with uncertainty, the greater its power within the organization; (2) The lower the substitutability of the activities of a subunit, the greater its power within the organization; (3a) The higher the pervasiveness of the workflows of a subunit, the greater its power within the organization; (3b) The higher the immediacy of the workflows of a subunit, the greater its power within the organization; and (4) The more contingencies are controlled by a subunit, the greater its power within the organization. In line with this theoretical model, Hedberg et al. (1975) developed a conceptual framework which included (1) information systems and characteristics of the decision making unit as independent variables, (2) power as observed in resource allocation as the dependent variable, and (3) uncertainty, substitutability, and centrality as intervening variables. Similarly, Saunders (1981) and Saunders and Scamell (1986) proposed that as MIS usage increases, the power of the subunit which controls the MIS also increases. This occurs because of the intervening process whereby the unit increases its centrality (called pervasiveness by Saunders), its ability to cope with uncertainty, and its nonsubstitutability.

Uncertainty is "a lack of information about future events, so that alternatives and their outcomes are unpredictable" (Hickson et al., 1971, p. 219). Coping with uncertainty, therefore, is the extent to which resources are applied to reducing or responding to levels of uncertainty. Substitutability is "the ability of the organization to obtain alternative performance for the activities of a subunit" (p. 221). Dubin (1963) notes that power within a formal organization is based on the importance of the functions performed by the subunit and the exclusiveness with which it performs them. Centrality of a subunit is "the degree to which its activities are

interlinked into the system" (p. 221). Hall (1970) states that from his observations at a number of universities, "the centrality of the operation and the scarcity of personnel are major determinants of the power of a particular organizational unit" (p. 50). In their study of departmental allocations within a university, Pfeffer and Salancik (1974) showed that changes in resource allocations over time are dependent on the centrality of the department as measured by work load and student demand for courses. In her dissertation on centrality and the academic library, Grimes (1993) examined the metaphor of the library as the "heart of the university." Ashar and Shapiro (1988) studied 40 departments from the liberal arts college of a large university and found that centrality is a major departmental characteristic that is considered by decision makers. In times of financial stress, central departments survived better than peripheral ones.

THE CASE OF ACADEMIC LIBRARIES

According to Ortega y Gasset (1961), one of the primary functions of the librarian is to be a filter between people and the torrent of books. For a library to develop and to serve this purpose, it must continue to embrace new technologies of many kinds (Klobas, 1990). Kenner (1986) and Larsen (1991) both note that libraries have often been on the forefront in the acceptance of new technology, from typewriters to indexing systems to computers. This process of adoption and innovation can be traced back to the earliest libraries (Briscoe, Bodtke-Roberts, Douglas, Heinold, Koller & Peirce, 1986). Two major 19th-century innovations, the card catalog and the typewriter, were adopted by libraries with startling success, and continue to co-exist with newer ways of performing similar functions. The electronic descendants of individual library catalogs have often become comprehensive information systems, providing gateways to a variety of information-related services and networks.

These new electronic technologies, however, are having major impacts on academic libraries, causing librarians to rethink their positions on collections, budgets, buildings, staff, and services (Moran, 1989; Potter, 1990). Clausen (1991) argues that library jobs are changing in response to technology. In particular, Veaner (1984) argues that information technologies are shifting work from the professional level to the support staff level. Information technology requires large sums of money to purchase and maintain file servers, terminals, printers, and software licenses. Often, the costs of these technologies must be supplemented with capital funds raised through special campaigns, grants, or gifts. The ongoing costs, however, must usually be absorbed by the library's operating budget, often resulting in a reduction in the budgets for material, staffing, or service.

On college and university campuses, library information functions are in danger of being distributed to other subunits unless university officials and information users are convinced that libraries are well positioned with respect to computer and communication technologies (Segal & Tyson, 1985). According to Hughes (1992)

and O'Neil (1984), most university presidents and chief academic officers put library automation low on their lists of equipment and capital priorities. Munn (1989) claims that the library's budget is considered a fairly modest fixed cost by campus administrators, but it is simultaneously viewed as a potentially bottomless pit. Carrigan (1988) notes that the academic library is constrained within a particular political paradigm (i.e., it relies on its host institution for its own existence). Dilmore (1992), in contrast, reports that faculty members generally rated librarians more highly in their boundary spanning activities than the librarians rated themselves. Such boundary spanning activity has a positive relationship with faculty perceptions of the quality of library service and faculty use of the library, perhaps by decreasing uncertainty and increasing centrality of the library.

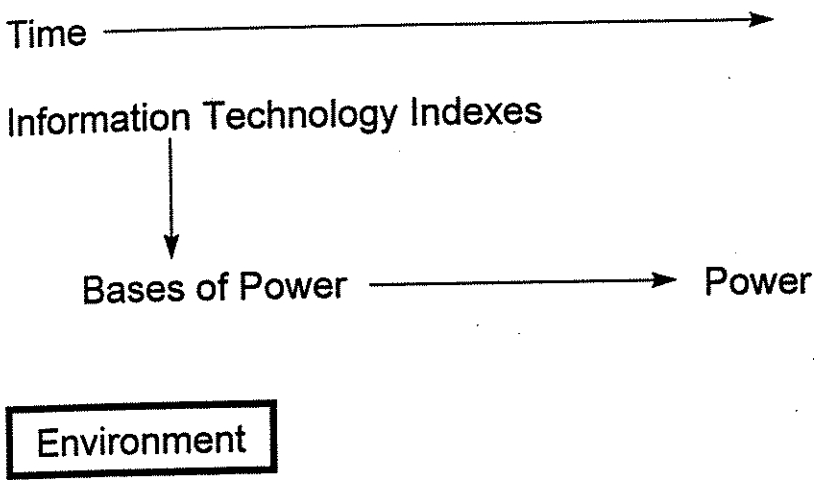
As libraries become more dependent on electronically-based information technologies, they are often drawn into new relationships with other subunits within the college. Gorman (1987), Johnson (1991), Malinconico (1992), and Shaughnessy (1982) discuss how libraries are restructuring in response to library automation.

One of the primary subunits with which the library must deal is the computer center. While the library has traditionally been concerned with the delivery of information-bearing documents, the computer center has concentrated on providing computing cycles, software, and facilities for manipulating and transferring data (Drake, 1989). As libraries acquire and provide access to more computing machinery, computer centers are likewise beginning to provide access to information. Neff (1985) says,

> Similarities between these two organizations should be apparent: the library is a repository of packaged information and the computer center stores and retrieves information; the library lends information and the center displays it; the library acquires and borrows information and the center inputs information. In one form of service or another, storage, retrieval, input, and output of information are common to both. (p. 8)

The computer center is one of the major contenders for funds designated for communication and information technologies. Often the library relies on the computer center for housing library computer hardware, maintenance of hardware and software, and training. In some libraries, the integrated library system may reside on computer center machines. Indeed, Malinconico (1992) argues that information resources are quickly coming under the influence of those who maintain the technological infrastructures, in some cases a chief information officer who oversees the computer center and the library (Kathman, 1989; Woodsworth & Williams, 1988). Thus, information technology and computer centers may be sources of increased uncertainty and substitutability, and decreased centrality, of college libraries.

FIGURE 1
Integrated Model



MODEL AND HYPOTHESES

Based on the prior discussion, Figure 1 presents the proposed integrated conceptual model of intraorganizational power, structure and technology. The strategic contingencies theory of intraorganizational power has been merged with the concept that electronic technology is a change agent in organizations. To this have been added environmental variables. Few studies of organizational power have explicitly considered such factors. These may be important in the study of an organization such as a library, but there is little guidance as to their role in studies of intraorganizational power.

In brief, the model states that as technology within the subunit changes, the bases of power are influenced by or react to those changes in technology. As a result, the manifestations of power also change. Environmental factors may influence some of these components, but perhaps not directly. As Kraemer and Dutton (1982) stress, computing generally supports the status quo, at least in the short run, so some time is necessary before significant changes can take place and be measurable, especially in an academic institution which is bound by tradition.

The following hypotheses were tested in this research:

H1. As the number of information technologies within a subunit of an organization changes, the bases of power of the subunit within the organization change.

H2. As the bases of power within a subunit of an organization change, the power of the subunit within the organization changes.

H3. As environmental variables change, they do not significantly affect the bases of power variables.

H4a. Changes in the amount of information technologies within a unit do not directly affect the power of the subunit.

H4b. Changes in the organizational environment do not directly affect the power of the subunit.

RESEARCH DESIGN

All variables in the study measured change over time, though in different ways. For most variables, the percentage change over time was measured. The technology indexes, however, were measured simply as the number of automated functions that had been added over the time frame studied. In addition, several variables included in the questionnaires were perceptual and were measured by a single score as reported by the respondents.

Two classes of independent variables, technology and bases of power, were included in the study. Since this research was primarily concerned with information technologies used in libraries, the definition of such technologies was by necessity contextually specific. Three technology indices were developed—library functions, networking, and other—from existing library technology measures, where the respondents indicated "currently have" or "currently do not have" (Duval & Main, 1992; Pungitore, 1986; Sitts, 1987). The library functions index include measured of automated acquisitions, automated serials, automated cataloging, automated circulation, and online public access catalog. The networking index included measures of network utility membership (OCLC, RLIN, WLN, etc.), network-based interlibrary loan, local area network within library, node on campus network, and local/regional consortia or networks. The other index included measures of telefacsimile, public computing workstations, CD-ROM indices, reference database searching, and librarian/staff workstations. A principal components analysis resulted in a single factor, with loadings for the library automation index of .76, networking index of .73, and other automation index of .65. Thus, a fourth technology index, total library automation, was calculated simply

by adding together the other three indices. However, Cronbach's alpha reliability of .51 indicated that the three indices measure different aspects of library automation.

The bases of power included both structural and contingency variables. The structural variables included changes in personnel classed as professional and changes in personnel classed as other. "Other" personnel included those individuals not classed as professional, for example, support staff, nonprofessionals, and clerical workers. Student workers were excluded from the analyses due to the difficulty in measuring student employees in terms of full-time equivalent employees.

The contingency variables included two items indicating coping with uncertainty, one item indicating centrality, and three items indicating substitutability. One major way to define coping with uncertainty is through the provision of services or raw materials to the organization. Hackman (1985) looked at two methods of coping with uncertainty in the academic environment: (1) the provision of resources (i.e., money) to the institution, and (2) the number of students served. Both Hills and Mahoney (1978) and Pfeffer and Salancik (1974) included workload of the department, based on the number of students and instructional units, as one factor affecting budget allocations. Workload in libraries is generally stated in terms of the number of circulations and the number of reference transactions (De Prospo, Altman, & Beasley, 1973; Kim & Shin, 1977). Therefore, coping with uncertainty was defined and measured by changes in both the number of items circulated and the number of reference transactions.

Perceived change in centrality was measured by extent of agreement with the statement: "The centrality of the library to the mission and work of the college increased over the period 1982 to 1990 as a result of library automation."

Substitutability refers to the ability of other subunits to perform similar functions as that performed by the subunit of interest. This research followed Hickson et al. (1971) and Saunders (1990) by requesting that respondents rate changes in the substitutability of the library's information functions, of the library's personnel ("It became more difficult to hire professional library staff with skills in automation during the period 1982 to 1990"), and of the collection development responsibility on campus, over the time period 1982 to 1990.

The environmental variables allowed us to control for rival (such as historical) causes of changes in the bases of power and power. Three major categories of environmental variables were included in this research: size, status and funding.

Many researchers have argued that size of the organization is an important variable when studying organizational structure (Khandwalla, 1974; Reimann, 1980). Since students are the largest user group of a library in a liberal arts college, change in the size of the student body was used as an overall measure of institutional size. Kim and Shin (1977) class collection size as one of the organizational characteristics of the library that have a direct effect on the outputs of the library. Change in size of the collection was measured in two ways: change in the overall number of titles in the collection and change in the number of periodical subscriptions.

On many college and university campuses, librarians have been granted faculty status which provides them with the benefits and obligations of such status, such as opportunities to serve on faculty committees (ACRL Academic Status Committee, 1992; Baldridge, 1971; Coughlin & Gertzog, 1992; Lowry, 1993). At some colleges, however, librarians have administrative status and may sit on committees only as *ex officio* members or they may have unspecified academic status which may or may not permit them to become members of academic committees. In many academic libraries, only the director possesses faculty status. Horenstein (1993) reports that librarians with faculty status attend more university meetings than those without such status. Thus, the status of librarians could affect the number of committees on which they serve, the information which is shared by faculty and administration, and, as a result, the overall power of the library. This variable was measured using groupings by change in faculty status (gained, lost, no change).

As with faculty status, tenure for librarians varies between institutions. Tenure was measured by a simple yes/no question as to whether librarians could receive tenure, resulting in three groups of libraries over time: those gaining tenure status, those losing tenure status, and those with no change.

Many colleges have a faculty library committee which serves in an advisory capacity to the library director (Coughlin & Gertzog, 1992). Such a committee may affect the representation of the library's views in decision making and may alter the institutional power of the library. Libraries were grouped into those that gained a faculty library committee, those that lost such a committee, and those that exhibited no change.

Outside funding may also have an effect on the power of a subunit (Hackman, 1985; Pfeffer & Moore, 1980). Groupings of the responding libraries were determined by the source of funding, i.e., operating budget only, grants only, and a combination of grants and operating budget, for retrospective conversion, the acquisition of equipment, and maintenance of hardware and software.

The dependent variable in this study was the power of the library. Power was measured in three ways: change in the share of the budget received by the library, change in the size of the library staff, and perceived power.

According to many researchers, change in the share of the budget received by a subunit indicates the relative change in the power of the subunit (Hackman, 1985; Hills & Mahoney, 1978). For this study, the change in the percent of the educational and general budget allocated to the library was used as one of the three power measures. A second major resource within organizations is personnel (Hackman, 1985; Pfeffer & Salancik, 1974; Pfeffer & Moore, 1980; Schick, Sherr, & Tuggle, 1982). Martin (1988) claims that when libraries adopt new computer-based technologies, they often hire systems librarians and assistants. Thus, change in the personnel resource allocation for the library was the second major power variable. The final measure of power is the perception of the change in the library's power within the organization for the time period studied. Perceptual measures of subunit power have been developed and used by Hackman (1985), Lachman

(1989), Salancik and Pfeffer (1974), Welburn (1991), and others. The present research asked respondents to agree or disagree with the statement, "The power of the library at this college increased over the period 1982 to 1990 as a result of library automation."

Most of the variables included in the study were measured at two times (T1 = 1981-1982 and T2 = 1989-1990 academic years), although a few only measure perceptions, at T2, of change over the period. These periods reflect the data available from the Higher Education General Information Survey (HEGIS) (U.S. Dept. of Education, 1982) and its replacement, the Integrated Post-Secondary Educational Data System (IPEDS) (U.S. Dept. of Education, 1990). This period also witnessed great development in and diffusion of library automation.

Three statistical methods were used for analyses: analysis of variance (ANOVA), path analysis, and canonical correlation. For the categorical variables included in the study (faculty status, tenure status, presence of a library committee, and funding for automation), ANOVAs were used to determine differences between the identified groups. For all continuous variables, simple bivariate path analyses were performed using multiple regression. For all hypotheses, canonical correlation analysis was used to assess the association between the corresponding set(s) of independent and set(s) of dependent variables. Direct and partial canonical correlations were used to provide overall assessments of both the initial and the modified model.

The unit of analysis was the library within the liberal arts college. Due to the size of such institutions, structural changes within the organization and changes in the bases of power as a result of technology should be more readily apparent. The staffs of most liberal arts college libraries are small, so library computing must often be integrated into the work of existing staff members (Crawford, 1991; Martin, 1988).

The sample included 129 colleges classified as Liberal Arts I and 358 as Liberal Arts II by the Carnegie Foundation for the Advancement of Teaching (1987). Only those colleges that completed both the 1982 HEGIS and the 1990 IPEDS surveys and which were not part of a multi-library reporting group are included in the study ($n = 487$).

The HEGIS and the IPEDS databases provided data for the following variables at both T1 and T2: subunit budget as percent of institutional general and educational budget, total number of positions in the library, number of students, collection size (title and subscription counts), classification of personnel (professional and other), and workload/service of the subunit (circulation and reference transactions).

Two mailed questionnaires were used to obtain additional data on the libraries included in the study. The first mailed questionnaire sought data for the following variables: amount of library automation (technology indices), perceived change in power, centrality, substitutability of functions, personnel, and collection development responsibility. A coin flip decided whether each question was worded on the questionnaire as indicating an increase or a decrease. A list of technologies was also presented and respondents indicated whether and when each technology was made available in their libraries. The questionnaire also provided space for the respondents to give open-ended responses to the questions. In addition, the questionnaire asked if the organization would be willing to respond to a more detailed follow-up questionnaire. See the Appendix for a copy of the first questionnaire.

To pretest the questionnaire, the directors of 10 liberal arts college libraries from New Jersey and Pennsylvania were asked to complete the questionnaire and to comment on its content. Eight (80%) returned completed pilot questionnaires and the comments were used to do minor modification of the questionnaire.

The revised questionnaire was sent to the directors of the remaining libraries ($n = 479$). If the questionnaire was not returned within eight weeks of mailing, another copy was sent by mail. All respondents were offered a summary of the completed research and were asked if they would agree to be contacted for additional information. The number of usable responses was 416 (85.4% response rate). When those libraries that completed the survey were compared by t-tests to those libraries that did not complete the survey on variables drawn from the HEGIS and IPEDS data, only one significant difference resulted, for percentage change in circulation per staff member ($t = 2.41$, $p < .05$). This result, however, occurred due to a single outlier. When that institution was removed from the data, no significant difference was found, indicating no bias between respondents and non-respondents.

We also desired more detailed information about several measures, but felt that it was unnecessary, too costly, and too demanding for our respondents, to send the full set of questions to all 479 colleges. So, from the beginning, the research design called for us to select a small group of colleges from these initial questionnaire respondents that would best reflect the extremes of library automation. Therefore, the total automation index was used to calculate z-scores for all the colleges, and to divide the colleges into those with very high z-scores $z >= 1.6$ (i.e., 10 or more items automated, N=30) and those with very low z-scores ($z <= -1.6$, i.e., 0 items automated, N = 33). This group of 66 was then narrowed to only those that had agreed on the first questionnaire to provide additional information (38 of the 66). See the Appendix for a sample of the second questionnaire.

Each of these remaining 38 libraries was then sent a second questionnaire requesting more detailed information about faculty and tenure status of librarians, the existence of a library committee and the funding of library automation. Of these, 31 returned usable forms (82% response rate), with 12 representing low automation and 19 representing high automation.

This study and its analyses, therefore, included both brief and general responses from 416 libraries (85.4%) and detailed and specific responses from 31 libraries explicitly chosen on the basis of their willingness to participate and their extreme (high or low) levels of automation.

DESCRIPTIVE STATISTICS

Table 1 provides descriptive statistics for all the variables included in the study. Of the 416 libraries completing the first survey, the mean increase in library functions

TABLE 1
Summary Descriptive Statistics for Variables

Variable	Mean	SD	Min	Max	N
1. Technology Indexes					
Library automation	1.27	1.48	0	5	416
Network automation	1.09	1.10	0	5	416
Other automation	2.70	1.48	0	5	416
Total automation	5.06	2.91	0	14	416
2. Bases of Power					
Structural:					
Change in professionals	.23	.68	−1.00	9.00	487
Change in other staff	.34	1.31	−1.00	14.00	457
Coping with uncertainty:					
Change in circulation	5.78	129.20	−1.00	2830.4	480
Change in reference transactions	1.61	8.41	−1.00	141.9	444
Centrality:					
Perceived centrality	4.74	1.47	1	7	375
Substitutability of:					
Functions	2.96	1.87	1	7	382
Personnel	3.42	1.65	1	7	378
Collection development	2.32	1.50	1	7	390
3. Power Variables					
Change in budget % for library	−.14	.43	−.81	3.67	482
Change in staff of library	.23	.56	−.80	5.00	482
Perceived change in power	5.12	1.61	1	7	378
4. Environmental Variables					
Change in number of students	.29	.80	−.42	10.40	476
Change in number of titles	.31	2.09	−.85	41.24	405
Change in number of subscriptions	1.59	16.62	−1.00	306.69	463

	Gained	Lost	No Change	N
Faculty status	2 (6.5%)	2 (6.5%)	27 (87%)	31
Tenure status	2 (6.5%)	2 (6.5%)	27 (87%)	31
Library committee	2 (6.5%)	4 (13%)	25 (80.5%)	31

Funding for automation:	Grant(s) Alone	Budget Alone	Grant(s) & Budget	N
Retrospective conversion	7 (26.9%)	13 (50%)	6 (23.1%)	26
Purchase of equipment	6 (32.1%)	9 (34.6%)	11 (42.3%)	26
Maintenance	0 (0%)	24 (92%)	2 (8%)	26

over the time period 1981-1982 to 1989-1990 was 1.3; the mean increase in the number of networking applications reported was 1.1; and the "other" automation category had a mean increase of 2.7. The total library automation index increased 5.1 out of the total of 15 separate items in the three indices.

For the structural variables, over this time span the mean number of professional librarians rose from 3.8 to 4.4 and the mean number of "other" staff rose from 4.9 to 5.4.

Circulation per staff member declined over time, from 3744 to 2484 while the mean number of reference transactions rose from 174 to 192. This mean is misleading due to several outliers; over 50% of the institutions actually showed a decline in the number of reference transactions over the time period of the study. Perceived centrality had a mean of 4.7, indicating a perceived increase of the library's centrality on campus as the result of library automation. For substitutability, the mean score on functional substitutability was 3.0, indicating some disagreement with the statement that other campus units became increasingly able to provide services similar to those provided by the library. The mean of the personnel substitutability measure was 3.4, indicating moderate disagreement with this statement. The mean response to the question about losing responsibility for collection development to faculty was 2.3, indicating strong disagreement with the statement that librarians had lost collection development responsibility.

The mean number of students rose from 1062 to 1230. After removing one outlier, the increase in total number of titles in the collection was from 96,922 to 107,161. When six outliers were removed, the number of periodical subscriptions increased from 685 to 1015.

Faculty status for librarians showed only slight variation over time among the 31 colleges answering this question on the second survey. Two colleges (6.5%) lost faculty status during the time of the study and two (6.5%) gained it, with a total of 18 schools indicating that librarians were considered to be faculty during both time periods. Only one school reported a change in the percentage of librarians with faculty status. Tenure status for librarians also changed little over time: two (6.5%) gained and two (6.5%) lost tenure status, although there were only eight schools at which librarians were eligible for tenure for both the 1981-82 and 1989-90 academic years. Of those schools which reported the percentage of librarians who were tenured, two reported losing tenured librarians and one reported gaining tenured librarians between T1 and T2. Most colleges (25 or 83.3% at T1 and 23 or 75.7% at T2) included in the second survey reported the existence of a faculty library committee. Four schools (13.3%) lost such a committee while two (6.7%) gained one.

Funding for automation came from two major sources for the second survey group: internal budget allocations and grants. Grants for retrospective conversion were received by 13 schools (50% of those answering this question), although six of these also used their operating budgets. Purchasing the automation equipment itself came for both grants and operating budgets. Nine schools (34.6%) report using only the operating budgets for such purchases; six (23.1%) report using only

grants; and 11 (42.3%) report using both sources of funds. Maintenance of automation equipment was overwhelmingly paid for out of operating budgets, with only two schools (8%) reporting the receipt of grants for such purposes.

Overall, the mean budget percentage assigned to the library fell from 4.1% to 3.2%. The total number of positions, excluding student employees, rose from 8.7 to 9.9. Of those libraries completing the first survey, the mean perceived increase in power as a result of library automation was 5.2. Specifically, 31 (8.2%) strongly disagreed (answering a 1 or 2), while 172 (45.5%) strongly agreed (6 or 7) that automation had caused an increase in library power.

TESTS OF HYPOTHESES

Hypothesis 1

According to Hypothesis 1, as library automation changes, the bases of power (structure, coping with uncertainty, centrality, and substitutability) also change.

Simple path analyses provide support for this hypothesis. As the total automation of the library increased, the number of professionals increased (standardized simple regression coefficient of $B = .11$, $p < .05$) and the perceived centrality of the library increased ($B = .23$, $p < .001$), but the substitutability of the library increased (i.e., other units in the college could provide services similar to those provided by the library) ($B = .12$, $p < .05$).

Considering the library automation indices separately, as the number of library functions automated increased, perceived centrality ($B = .17$, $p < .005$) and the belief that other campus units could provide services similar to those provided by the library ($B = .13$, $p < .01$) both increased. As the amount of networking increased in the library, the number of non-professional positions increased ($B = .10$, $p < .05$) and the perceived centrality of the library increased ($B = .11$, $p < .05$). As the number of other automation functions increased, so did the number of personnel classed as other ($B = .11$, $p < .05$), the perceived centrality ($B = .19$, $p < .005$), and the substitutability of library functions by other campus units ($B = .10$, $p < .05$).

Table 2 shows the canonical correlation results for **H1**. Canonical correlation analysis yielded one significant canonical correlation between the technology indices and the bases of power, but explained little variance (7%). The canonical variate for the technology variables was characterized by the following loadings: library automation index (.45); network index (.34); and other index (.64). For the canonical variate of the bases of power variables, the highest loadings were change in the number of professionals (.35), change in circulation (.33), and change in perceived centrality (.78).

H1 received limited support from both the simple path analyses and from the canonical correlation analysis.

Overall, the technology indexes were strong predictors of perceived centrality. Questionnaire comments noted that automation itself has not been the sole determinant of a change in perceived centrality. A few respondents claimed that their libraries had always been central to their colleges and that automation had not affected this situation much. Others said that automation had helped increase the centrality of the library, but that other factors had also helped, for example, resource sharing and interlibrary loan services, new buildings, bibliographic instruction, and especially new library leadership. According to the respondents, the main reason for increased centrality due to automation was that automation gives greater access to materials. One director said, "Our main mission is to provide a liberal education for students. Greater access to materials definitely increases the library's support of this mission." Another replied, "Automation helped us to find and acquire resources to assist teaching, thus helping us to increase our usefulness and 'centrality.'" A third director responded, "Library automation made our campus aware of how far behind we were getting and how important technology was becoming for life-long learning." One of the most common responses to this question, however, was that the libraries were not automated enough—more was needed to provide effective services.

Substitutability of functions was predicted by the three separate technology indices. The substitutability of functions variable, however, was a perceptual measure which may reflect attempts of librarians to justify their expenditures of relatively large sums of money on library automation. Very few respondents felt threatened by computer centers on their campuses, since they either maintained few direct links or both worked together to enhance library automation. A surprising number of directors reported that their institutions, in fact, did not have a computer center or that one had only recently been added to their campuses. A few directors,

TABLE 2
Canonical Correlation Results for H1

Hypothesis 1: Automation Indices and Bases of Power			
Canonical Variate for Independent Variables (Technology Indices)		Canonical Variate for Dependent Variables (Bases of Power Variables)	
Library functions	.45	Change in profs.	.35
Network	.34	Change in other	.21
Other	.64	Change in circ.	.33
Total	.00	Change in ref. trans	-.30
		Perceived centrality	.78
		Subs. of functions	.10
		Subs. of personnel	-.19
		Subs. of col. dev.	.05
Squared Canonical Correlation		.07	
Wilks' Lambda		$F_{24,864.89}=1.66^{*}$	

Notes: $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$

however, did report that there was a threat posed by computer centers because they were increasingly becoming an information center, especially as a result of providing access to the Internet.

Increases in personnel classed as professional was predicted only by the total number of automation functions increased. Only a few directors reported that automation has had a direct impact on the number of staff, although several mentioned that fewer staff members were now needed. One director reported that in his library one professional position was lost while two support staff positions were added in response to automation. The greatest change noted by directors was the change in the job responsibilities of those already working in the library since computing skills are now required as part of most positions. One director underscored this when he said that a cataloging position had been converted into a systems position and that systems responsibilities had also been incorporated into the job descriptions of the circulation supervisor, the serials librarian, and the head of monograph acquisitions and cataloging. The most common thread among the responses was that the workload of the library staff had increased as a result of automation due to the addition of tasks relating to automation and to the need to teach patrons how to use the new technologies. The directors also stressed that training in the new technologies had become increasingly important both for professional librarians and for support staff. One director wrote that nearly every position had changed the means of accomplishing the work required, resulting in stress for some staff members. A few staff had opted to leave the library, but for most automation had been a positive change.

Hypothesis 2

The second research hypothesis states that as the bases of power within a subunit of an organization change, the power of the subunit within the organization changes.

The simple path analyses showed that as the number of personnel classed as professional in the library increased, the percentage of the institutional budget allocated to the library ($B = .33$, $p < .001$), the total number of positions in the library ($B = .34$, $p < .001$), and the perceived power of the library ($B = .13$, $p < .05$), all increased. As the number of personnel classed as other increased, so did the total number of positions in the library ($B = .64$, $p < .001$). Neither the number of committees on which librarians served, nor workload/service were significant predictors of the power variables, but as the number of reference transactions increased, the number of subunit positions increased ($B = .33$, $p < .001$). As the perception of centrality increased, the perception of power also increased ($B = .77$, $p < .001$).

Substitutability of functions predicted only perceived power ($B = .24$, $p < .001$). This result seems counterintuitive since it shows that as the ability of other campus units to perform functions similar to the library increased, the perceived power of the library also increased. In addition, as it became more difficult to hire librarians with automation skills, the perceived power of the library increased ($B = .20$, $p < .005$). Collection development was not significantly associated with any the power variables.

Table 3 shows the canonical correlation results for **H2**. The canonical correlation analysis yielded three significant canonical variates involving the bases of power variables and the power variables. The first canonical correlation explained 76% of the variance; the second canonical correlation explained 58% of the variance; and the third explained only 4%. The highest loadings for the first bases of power variate were change in the number of professionals (.60) and change in the number of other staff members (.92); for the second variate only perceived centrality loaded highly (.95); and for the third variate both change in the number of professionals (-.70) and change in the number of other staff members (.45) loaded highly. Each power variate had only one high loading: variate 1, change in the number of staff (1.02); variate 2, perceived power (.99); and variate 3, change in the budget allocation (-1.05).

These results provide only partial support for **H2**, although each power variable was significantly predicted by at least one bases of power measure: increases in professional personnel, perceived centrality, substitutability of functions, and substitutability of personnel.

A surprisingly large number (94) of respondents to the first questionnaire provided written comments about perceived power. Several provided their own definitions, such as "influence," "ability to carry out its mission," "political power

TABLE 3
Canonical Correlation Results for H2

Hypothesis 2: Bases of Power and Power			
Canonical Variates:	1	2	3
Independent Variables (Bases of Power Variables)			
Change in profs.	.60	.16	−.70
Change in other	.92	.01	.45
Change in circulation	−.01	.02	.25
Change in ref. trans.	.01	-.04	.25
Perceived centrality.	-.07	.95	.22
Subs. of functions	.06	.02	−.05
Subs. of personnel	.01	.08	.01
Subs. of col. dev.	.06	−.01	.27
Dependent Variables (Power Variables)			
Change in budget	−.09	.04	−1.05
Change in staff	1.02	.06	.20
Perceived power	−.02	.99	.21
Squared Canonical Corr	.76	.58	.04
Wilks' Lambda	$F_{24,840.9}$=44.68***	$F_{14,588}$=24.57***	$F_{6,295}$=2.22*

Notes: *$p < .05$; **$p < .01$; *** $p < .001$

and prestige," "power to do things," and "research power." One director wrote, "There are several kinds [of power], including, intellectual, political, etc., for most cases, our various types of power were affirmed in this period."

One of the more tangible results of an increased perception of power on campus has been the addition of librarians to important faculty committees, a fact mentioned by several respondents. Indeed, at one school, a librarian was elected President of the Faculty Senate.

Increases in the number of subunit positions was significantly predicted by increases in the number of professional positions, other personnel, and reference transactions. To some extent, these variables measure similar characteristics of the libraries. Change in the number of reference transactions may actually have been a result of changes in the number of staff members rather than the hypothesized relationship.

Hypothesis 3

Hypothesis 3 states that as the environmental variables change, they do not significantly affect the bases of power variables. The analyses show that this hypothesis must be rejected, as environmental factors seem to affect the bases of power variables.

When the number of students (potential demand for service) increased at a college, so did the number of professional librarians ($B = .09$, $p < .05$), the number of other library staff ($B = .10$, $p < .05$), and the number of reference transactions ($B = .18$, $p < .005$). Collection size measured as the percentage change in number of titles in the library predicted percentage change in reference transactions ($B = .80$, $p < .001$) and change in substitutability of collection development responsibility ($B = .13$, $p < .05$). The directors also reported that as the collection grew, librarians lost some of their collection development responsibilities. Collection size measured as change in the number of subscriptions predicted percentage change in the number of personnel classed as professional ($B = .14$, $p < .01$) and percentage change in the number of personnel classed as other ($B = .13$, $p < .01$).

Only one significant result was obtained for oneway analysis of variance tests using change in the presence of a faculty library committee as the independent variable: change in the number of staff classified as other ($F = 4.02$, $p < .05$). A post-hoc Scheffe' test revealed that at institutions in which a faculty library committee was formed, the library gained more non-professional staff members (mean increase = 2.0) than did those institutions where a faculty library committee was lost (mean = -.1).

Three separate subvariables were used in the analyses of funding for automation: funding for retrospective conversion, funding for automation equipment, and funding for maintenance. Each was categorized into those that used grants exclusively, those that used their operating budgets exclusively, and those that used a combination of grants and operating budgets. No significant differences in any of

the bases of power variables were found across these categories for these three funding measures.

Table 4 shows the canonical correlation results for **H3**. Canonical correlation analysis found only one significant correlation (12% variance explained). The high-loading environmental variables were change in the number of students (.63) and change in the number of titles (.75). The high-loading bases of power variables were change in the number of professionals (.72), change in the number of other staff (.50), change in the number of reference transactions (.36), and substitutability of collection development (.51).

Since the mean growth rate of the colleges included in this study was 28.7%, it seems natural that the number of librarians would need to grow in order to compensate for such growth in the size of the student body. The HEGIS and IPEDS data did show a growth of 23% for professional staff. The data showed that the number of periodicals to which the library subscribed grew over 23% when the outliers were removed. This growth by itself may have caused a need for more staffing. As the student bodies and periodical collections of the libraries grew, so did the need for support staff. As the numbers of students grew, so too did the number of reference questions. The causal relationship between these variables makes intuitive sense since students are the primary user group for most academic libraries. Similarly, as the size of collections grew, the number of reference transactions increased. As the collections of the libraries grew, so did the reported collection development responsibilities of librarians.

In a contradictory result, ANOVA analyses show that as librarians gained faculty status they also reported losing collection development responsibilities.

TABLE 4
Canonical Correlation Results for H3

Hypothesis 3: Environment Variables and Bases of Power			
Canonical Variate for Independent Variables (Environment Variables)		Canonical Variate for Dependent Variables (Bases of Power Variables)	
Change in students	.63	Change in profs.	.72
Change in titles	.75	Change in other	.50
Change in subscriptions	–.10	Change in circ.	.12
		Change in ref. trans	.36
		Perceived centrality	.02
		Subs. of functions	–.29
		Subs. of personnel	–.13
		Subs. of col. dev.	.51
Squared Canonical Correlation		.12	
Wilks' Lambda		$F_{24,711.18}=1.98^{*}$	

Notes: $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$

Echoing the responses of several directors, one director stated that as money for collection development tightened, faculty purchased only books "essential" to the college's curricula. Another responded that collection development has always been done by the teaching faculty. Several directors, however, reported that librarians have gradually begun to have more of a role in collection development. Thus, the contradictory results of the analyses may be a result of the financial situation of the individual institutions, and not the result of changes in either the size of the collection or the faculty status of librarians.

Hypotheses 4a and 4b

The final research hypotheses were used to control for any direct influence of automation and the environment on the power variables. According to the theoretical model, changes in automation (the library indexes) should affect only the bases of power variables, and not power directly, while environmental factors should have no affect on either. The analyses, however, show that there both automation and environment factors have direct effects on the power variables.

As the total amount of library automation increased, the number of positions within the library increased ($B = .11$, $p < .05$) and the perceived power of the library increased ($B = .28$, $p < .001$). As the number of library functions automated grew, the perceived power of the library also grew ($B = .23$, $p < .001$). As networking automation increased, percentage change in the number of subunit positions ($B = .15$, $p < .005$) and perceived power ($B = .16$, $p < .005$) both increased. As other automation increased, perceived power increased ($B = .19$, $p < .005$).

The environment had significant direct effects on the power variables. An increase in the number of students predicted the percentage change in number of library subunit positions ($B = .27$, $p < .001$). As the number of titles increased, the number of positions in the library increased ($B = .37$, $p < .001$). As the number of subscriptions within the library increased, the percentage of institutional budget increased ($B = .39$; $p < .001$), number of subunit positions increased ($B = .32$; $p < .001$), and perceived power increased ($B = -0.16$; $p < .005$).

Table 5 presents the canonical correlation results for **H4a** and **H4b**. The canonical correlation analysis of the automation variables and power showed a significant but weak relationship (7% variance explained). For the technology variate, three automation indices loaded highly: library (.52), network (.50), and other (.40). The high loading variables for the power canonical variate were the percentage change in the staff (.39) and perceived power (.94).

The relationship between the technology indices and the perception of power requires a closer analysis. One of the questions on the first survey requested comments on the statement, "The power of the library at this college increased over the period 1982-1990 as a result of library automation." Pointing out that other factors may be at work, one director wrote, "Difficult to separate effect of automation from the effect of new building (preceded automation by 11 months) and increased budget as a result of a grant. Overall effect has been about 8 on your

TABLE 5
Canonical Correlation Results for H4a and H4B

1. Hypothesis 4a: *Automation Indices and Power Variables*			
Canonical Variate for Independent Variables (Technology indices)		Canonical Variate for Dependent Variables (Power Variables)	
Library functions	.52	Change in budget	–.03
Network	.50	Change in staff	.39
Other	.40	Perceived power	.94
Total	.00		
Squared Canonical Correlation		.07	
Wilks' Lambda		$F_{9,688.5}=4.89^{*}$	

2. Hypothesis 4b: *Environmental Variables and Power Variables*		
Canonical Variates:	1	2
Independent Variables (Environmental Variables)		
Change in students	–.04	.48
Change in titles	–.05	–.75
Change in subscriptions	–.99	.12
Dependent Variables (Power Variables)		
Change in budget	–.89	.57
Change in staff	.22	-1.03
Perceived power	.28	–.01
Squared Canonical Corr.	.40	.28
Wilks' Lambda	$F_{9,691.33}=32.49^{***}$	$F_{4,570}=26.52^{***}$

Notes: $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$

scale of 7." For another, increased power resulted from a greatly improved staff. On several campuses, the library was viewed as a leader in accessing information technology, accounting for its gain in power. A director from the South wrote that automation "definitely changed the influence [of the library] on campus" while one from the Midwest wrote that "it has prevented us from appearing backward." The perception of power as recorded in the answers provided on the survey, however, indicated that library directors believed that their power had definitely increased as a result of increased automation.

The canonical correlation analyses of the environmental variables and power yielded two significant canonical correlations. The first explained 40% of the variance and the second explained 28%. For the first environmental canonical variate, only change in the number of subscriptions loaded highly (-.99), while for the second, change in the number of students (-.48) and change in the number of titles (-.75) loaded highly. For the first power canonical variate, only change in the budget allocated to the library loaded highly (-.89). For the second dependent variate, change in the budget allocated to the library (.57) and change in the number of staff (-1.03) loaded highly.

Thus, **H4a** and **H4b** must be rejected: the direct influence of both automation and the environment on the power of the subunit must be included in models of subunit power.

MODIFIED MODEL OF INTRAORGANIZATIONAL POWER

The results of the preceding analyses were used to develop a modified conceptual and operational integrated model of intraorganizational power, as Figure 2 portrays. All variables whose analyses yielded at least one significant bivariate association, and which were not categorical, are included. Thus, the model includes all four of the technology variables, eight of the bases of power variables with at least one present from each individual base of power, six environmental variables, and three measures of organizational power. Accordingly, the modified model states: as the technology of a library changes, the bases of power within that library change; as the technology of a library changes and as the bases of power within that library changes, the power of the library changes; and as the environment changes, both the bases of power within the library and the power of the library change.

FIGURE 2
Modified Model

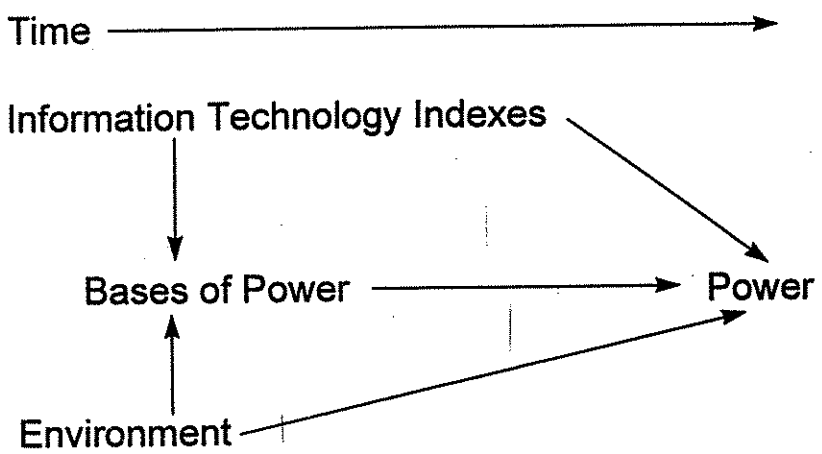


TABLE 6
Canonical Correlation Results for the Modified Integrated Model

1. Step One			
Canonical Variate:	1		
Independent Variables (Technology Indices & Environmental Variables)			
Library automation	−.15		
Network automation	−.39		
Other automation	−.02		
Total automation	.00		
Change in students	.62		
Change in titles	.65		
Change in subscriptions	−.09		
Dependent Variables (Bases of Power Variables)			
Change in professionals	.65		
Change in other	.59		
Change in ref. trans.	.36		
Perceived centrality	.04		
Subs. of functions	−.38		
Subs of personnel	−.02		
Subs. of col. dev.	.43		
Squared Canonical Corr.	.13		
Wilks' Lambda	$F_{42,1143.22}=1.8^{***}$		
2. Step Two			
Canonical Variate:	1	2	3
Independent Variables (Bases of Power Variables)			
Change in professional	.60	.16	−.74
Change in others	.92	.01	.45
Change in ref. trans.	.01	−.04	.15
Perceived centrality	−.07	.95	.24
Subs. of functions	.06	.02	−.05
Subs of personnel	.00	.08	.06
Subs. of col. dev.	.06	−.01	.26
Dependent Variables (Power Variables)			
Change in budget	−.09	.04	−1.05
Change in staff	1.02	.05	.19
Perceived power	−.02	.99	.21
Squared Canonical Corr.	.76	.58	.04
Wilks' Lambda	$F_{21,844.8}=51.4^{***}$	$F_{12,590}=28.6^{***}$	$F_{5,296}=2.5^{***}$
3. Step Three (Bases of Power Partialed Out)			
Canonical Variate:	1		
Independent Variables (Technology Indices & Environmental Variables)			
Library automation	−.10		
Network automation	−.31		
Other automation	.24		

(continued)

TABLE 6
Canonical Correlation Results for the Modified Integrated Model (continued)

Total automation	.00
Change in students	.64
Change in titles	−.56
Change in subscriptions	.23
Dependent Variables (Power Variables)	
Change in budget	−.42
Change in staff	.78
Perceived power	−.56
Squared Canonical Corr.	.12
Wilks' Lambda	$F_{18,668}=2.6^{***}$

Notes: $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$

Table 6 presents the details of the results of the canonical correlation analysis of the modified model. For its first step, the canonical correlation used the technology indices and the environmental variables as independent variables and the bases of power as dependent variables. One significant canonical correlation resulted (13% variance explained). Three of the technology indices and environmental variables loaded highly on the environmental variate: network index, change in the number of students, and change in the number of titles. For the bases of power variate, five variables loaded highly: change in the number of professionals, change in the number of other staff members, change in the number of reference questions, substitutability of functions, and substitutability of collection development.

In the second step of the analysis, the bases of power acted as the independent variables and the power variables were the dependent variables. Three significant canonical correlations resulted (76%, 58% and 4%, respectively). The high loadings for the bases of power variates included: change in the number of professionals and change in the number of other staff members for the first variate; perceived centrality for the second variate; and change in the number of professionals and change in the number of other staff members for the third variate. For the power variates, only one variable loaded highly on each: change in the number of staff for the first variate; perceived power for the second; and change in the budget for the third.

The third step used partial canonical correlation to identify any direct influence of the technology indices and the environmental variables on the power variables by partialling out the influence of the bases of power variables. The results of this analysis showed that the technology indices and the environmental variables together significantly and directly predicted the power variables, explaining 12% of the variance. Two environmental variables, change in the number of students and change in the number of titles, loaded highly on the independent canonical variate, This indicates, however, that the technology indices, by themselves, accounted for little of the variance exhibited by the power variables. This implies

that the influence of technology works through changes in the bases of power, as originally hypothesized (**H4a**), and that technology, *per se*, has little direct effect on power outcomes. All three power variables loaded highly on the dependent canonical variate: change in budget percentage, change in number of staff, and perceived power.

These results showed that the modified model does provide one method of understanding intraorganizational power, structure and technology, using the special case of liberal college libraries over an eight-year period. Technology and environmental factors affected the bases of power; the bases of power affected organizational power; and the environmental factors directly affected power.

LIMITATIONS

The present research has several limitations. First, the findings may not be generalizable to other types of academic libraries or to other libraries in general, much less to other types of organizations, since liberal arts colleges are a distinct group in a number of ways. Liberal arts colleges are usually smaller, take a broader view of knowledge, are less concerned with career training, and place greater emphasis on undergraduate education than many other colleges and universities.

Second, the time span used may not have provided a long enough time for changes caused by automation to have become apparent. However, the decade of the 1980s witnessed great changes in computers, information technology, and library automation. Third, the underlying economic conditions of the institutions included in the study may have affected the results of the study, especially the change in budget percentage and change in staff power variables, as liberal arts colleges are generally tuition-dependent and receive little direct assistance from governmental units. Fourth, the model proposes causality when the relationships between variables may merely be correlational; a repeated measures research design would be needed to provide a more detailed test of causal relations, but such fine-grained temporal data would be hard to obtain. Still, many of the measures were measured nearly a decade apart, increasing the validity of causal interpretations.

Fifth, much of the research upon which the tested model was developed came from the management information systems literature. The organizational politics surrounding MIS systems may differ significantly from the politics of a liberal arts college and the adoption and use of automation within a library. MIS seeks to support and control an organization's internal financial functions such as payroll, purchasing, invoicing, and inventory. Library automation, in contrast, is used to provide greater access to the wealth of published information used in the pursuit of knowledge, and is thus notoriously resistant to notions of "efficiency" or "financial criteria".

Finally, other exogenous variables not included in the model may have caused some of the identified changes. These include economic conditions of the colleges,

such as endowments and financial stability, which could have an impact on the institution's ability to purchase and maintain information technologies. Leadership styles of the college administrators and head librarians will also affect the ability of the institution to attract donations and grants and the ability of the library to receive funding from its host institution. More complex influences on changes in structure and power relationships may come from the colleges' institutional networks. Kraatz (1995), for example, shows that linkages to other liberal arts colleges (derived from their joint memberships in over 50 national associations from 1971 through 1986, and controlling for other factors measured from the same HEGIS databases as used in the present research) significantly influenced colleges' adoption of professional programs in their curricula through a process of learning from other, similar but higher-performing colleges.

Additional limitations are inherent in the strategic contingencies model of power itself. As Huff (1991) says, "there is a fundamental difference between being perceived as having power, and using power" (1991, p. 52). For this reason, the present study included power measures for both actual power and perceived power. Mechanic (1962) pointed out that power relationships in organizations are likely to be molded by the type of organization being considered, the nature of organizational goals, the ideology of organizational decision making, the kind of commitment participants have to the organization, the formal structure of the organization, and so on. The model proposed in this research could be adapted to add micro-analytic variables which examine the roles of individuals in the power structure of the organization instead of focusing on the subunit itself (Zanzi, 1989).

CONCLUSION

To understand better how library automation has affected the academic library and its power relations on college campuses, the present study developed and tested an integrated model of intraorganizational power based largely upon the strategic contingencies theory, adding organizational structure, information technology, and environmental variables, and measuring three different aspects of power.

The analyses of the initial model provided mixed results. The analyses of the revised provided better support for the overall theory proposed. The technology indices and the environmental variables accounted for 13% of the variance of the bases of power, but only the network technology index, change in the number of students, and change in the number of titles in the library displayed high loadings on the independent canonical variate. Three of the bases of power exerted the most influence on power: change in the number of professionals, the number of staff classified as other, and perceived centrality. The test of the direct influence of the technology indices and the environmental variables on the power variables showed that most of the influence came from two environmental variables—change in the number of students and change in the number of titles—and little directly from changes in technology.

Taken together, these results provide only limited support for the major proposition tested in this research, namely, that automation through information technology is a direct agent of change in library power relations. In most of the analyses, the direct effect of the technology indices, while at times significant, was weak. The primary influence of information technology on the power of a library is through changes in that library's bases of power. These bases, however, are influenced, though weakly, by changes in technology.

One of the significant aspects of this study lies in its use of power to help understand the role of information technology in college libraries, which contrasts with the classical bureaucratic paradigm so heavily used to study libraries. Power needs to be studied to a greater extent so that librarians and library directors may be able to acquire the resources needed for their organizations to better meet the information needs of the populations they serve.

When compared to other studies of intraorganizational power, the present research provides several contributions. First and foremost, time is important. Static studies provide only limited information on the relationships of the variables under consideration. The additional variables included in this study, especially the coupling of structural and bases of power variables, also increase the explanatory power of the model. In addition, the different measures of power proved useful in assessing additional dimensions of this crucial concept. For example, the two allocation variables were highly correlated with each other, but not with the perception of power. Thus, these seem to reflect different dimensions of power.

Finally, the present study adds the concept of information technology as a change agent to the strategic contingencies model (as did Burkhardt & Brass, 1990), contextualized within the specific organization of the liberal arts college and its library subunit. Many anecdotal articles have been written on how automation has caused changes in the structure and function of academic libraries, but few have been soundly based on theoretical and empirical grounds.

This research has provided some contradictory results. As technology has increased in libraries, the percentage of the institutional budget allocated to the library has actually declined by an astounding 14%, while staff has increased by 23%. Such changes, when coupled with the ongoing costs of information technologies and the continuing expansion of the types of information technology and the information services available through them, have had and will continue to have dramatic effects on the traditional role of the library (i.e., buying books and periodicals—although the data presented in this study show that library collections are still growing). The pressures on the library director to balance such countervailing trends are enormous. Nonetheless, the directors in this study state somewhat contradictorily that their libraries have grown both in power and in centrality to the mission of their institutions, while slipping in the share of they institutional budget they receive. Understanding such trends and obtaining a better view of the nature of power, from a theoretically-generated and empirically-tested approach, should prove to be beneficial to the directors of liberal arts college libraries, and to researchers of organizational power and information systems.

APPENDIX

First Questionnaire

For each of the following items, please indicate the approximate year when your library first installed, joined, or provided the indicated function or service. If your library is planning for an individual function or service but has not yet provided it, please indicate the stage in which the function is currently (planned, seeking funding, ordered). If your library is not currently planning to automate in a particular area, please indicate "not planned."

		Stage			
	Year	Planned	Seeking Funding	Ordered	Not Planned
Automated Cataloging	_____	_____	_____	_____	_____
Automated Circulation	_____	_____	_____	_____	_____
Online Public Access Catalog	_____	_____	_____	_____	_____
Automated Acquisitions	_____	_____	_____	_____	_____
Automated Serials	_____	_____	_____	_____	_____
Network Utility Membership (OCLC, RLIN, WLN, etc.)	_____	_____	_____	_____	_____
Network-based Interlibrary Loan	_____	_____	_____	_____	_____
Local area network within library	_____	_____	_____	_____	_____
Library accessible by campus network	_____	_____	_____	_____	_____
Local/regional consortia or networks	_____	_____	_____	_____	_____
Telefacsimile	_____	_____	_____	_____	_____
Public computing workstations	_____	_____	_____	_____	_____

CD-ROM indexes	_____	_____	_____	_____	_____
Reference database searching	_____	_____	_____	_____	_____
Librarian/staff computer workstations	_____	_____	_____	_____	_____

Part B.

Using the scales beneath each statement, please indicate your perceptions for each of the items below.

1. The power of the library at this college increased over the period 1982 to 1990 as a result of library automation.

Strongly Disagree			Neutral			Strongly Agree
1	2	3	4	5	6	7

Comments:

2. The centrality of the library to the mission and work of this college increased over the period 1982 to 1990 as a result of library automation.

Strongly Disagree			Neutral			Strongly Agree
1	2	3	4	5	6	7

Comments:

3. Other units on campus, such as the computer center, became increasingly able to provide services similar to those provided by the library during the period 1982 to 1990.

Strongly Disagree			Neutral			Strongly Agree
1	2	3	4	5	6	7

Comments:

4. It became more difficult to hire professional library staff with skills in automation during the period 1982 to 1990.

Strongly Disagree			Neutral			Strongly Agree
1	2	3	4	5	6	7

Comments:

5. Librarians, in comparison to faculty, lost responsibility for the selection of library materials during the period 1982 to 1990.

Strongly Disagree			Neutral			Strongly Agree
1	2	3	4	5	6	7

Comments:

Second Questionnaire
[Parts I and II identical except for time period covered]

Part I.

For this section, use the 1981-1982 school year for answering the following questions.

1. What percent of librarians in your library had full faculty status? _____%

   (Full faculty status means that librarians are considered faculty, are permitted to sit on faculty committees, and are eligible for research assistance, sabbaticals, and other faculty benefits.)

2. Were librarians eligible for tenure? yes no

3. Was there a faculty library committee? yes no

   (A faculty library committee is defined as a committee of the teaching faculty which serves in an advisory or oversight capacity to the library directory.)

4. To whom did the library director report?

   _____
   (Title of position)

5. Counting the president of the college as number 1, how many levels down from the president is the position of library director? _____

   (example, if the director reports directly to the president, the position is one level down from the president)

6. How many committees of the college did librarians serve on? _____ (enter the number)

7. If available, please attach a list of all college committees and their members, with departments noted, for the school year 1981-1982.

   (For example, Honors Committee: A. Jones, History; B. Smith, Library; etc.)

Part III.

1. How do you feel library automation has changed the power or influence of the library on campus?

2. How has library automation affected the library's budget?

3. How has library automation affected the library's personnel?

4. How was retrospective conversion funded?

5. How was library automation funded?

6. How is continuing maintenance of library automation funded?

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