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# A Framework for a Comparative Analysis of Library Work

*A measure of organizational technology was developed to compare the work of fifteen functional departments in three academic libraries. The study suggests that work performed in various departments of academic libraries is similar regardless of the department and that, in general, predictable events, routine operations, and relatively low knowledge requirements constitute the technologies or work of the departments.*

ALTHOUGH MANY ASSUMPTIONS HAVE BEEN MADE about the comparative nature of library work,[1] few investigators have analyzed library work systematically and empirically so that the work of one library department can be compared with that of another. Recent analyses have been made at the task level, not at the job or departmental level, with the purpose of determining which tasks, assumed to be routine, can be assigned to a clerical employee and which tasks, assumed to be discretionary, must be performed by a professional librarian.[2] The investigation reported in this paper makes no assumptions about the nature of library tasks.[3] It studies the characteristics of library work and develops a measure of the work of library departments that, though administered to individuals, permits the aggregation of individual scores in order to produce a single departmental score that can be compared to other departmental scores.

The framework for the study is derived from the work of Charles Perrow, who defines organizational technology as

> the actions that an individual performs on an object, with or without the aid of tools or mechanical devices, in order to make some change in that object. The object, or "raw material" may be a living being, human or otherwise, a symbol or an inanimate object.[4]

For the purposes of the study three dimensions of the nature of work, that is, technology, are considered: materials technology, the nature of the raw materials entering a department; operations technology, the nature of the techniques used to convert the raw materials into finished products; and knowledge technology, what the organization's members must know in order to convert the materials into the finished product or service.

Perrow's theory of technology makes possible a comparison of library departments by an analysis of their work into three measurable and common elements: the materials or events that are the cause or subject of the work; the methods or search strategies that are used to do the work; and the knowledge that the workers must have to complete the work. If these elements are demon-

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strably common ones and can be measured, then library departments can be compared systematically and empirically.

## Theory of Organizational Technology and Methodological Issues

Perrow's theory has influenced many recent investigations in complex organizations.[5] However, current studies on technology have remained exploratory because the boundaries of the construct, technology, still are not clear, and the operational variables drawn upon to measure it, that is the "domain of observables,"[6] are so large that it is difficult to decide which variables to include. Investigators might agree on some of the prominent observables related to technology, but they dispute the inclusion of others.

The differences among the studies of Woodward, the Aston group, Hage and Aiken, and Perrow reflect the current disagreements on the definition of technology and methods of measurement.[7–10] Woodward and the Aston group define and measure technology at the system level, using methods of observation and interviews with top administrators. Woodward defines technology according to the technical complexity of the production processes. The Aston group considers the level of automated machinery and other techniques the organization uses in its workflow. Both concepts of technology are suitable primarily in the study of large industrial organizations and are concepts easily measured by observation or by information obtained from key informants.

Woodward pioneered in classifying industrial production, in terms not of its organization but of its technology and according to the technical complexity of the overall productive process. She achieved this rationale by a reanalysis of her data after a fruitless attempt to understand the conduct of one hundred businesses using classical principles of management. Woodward's insight directed subsequent investigators to view technology as a crucial variable. The definitions of Zwerman, Fullan, Meissner, and Grimes, Klein, and Shull largely embody her viewpoint that technology is to be measured by the complexity of the whole system of production.[11–14]

To Woodward's understanding of technology as an entire production system, the Aston group added analysis and measurement of the characteristics of such a system, largely in terms of the concept workflow. As one of its five measures, the group employed the degree of automation of production equipment. Although the idea of workflow serves as a valuable generalizing concept for systems of industrial production, it appears inadequate to explain the technology of certain other organizations. The Aston group, measuring technology in terms of workflow characteristics, was unable to distinguish among service organizations on the basis of technology.

Woodward's important contribution in bringing a new variable, technology, into the study of organizations was limited in its conception to industrial producers. Perrow, by extending the theoretical perspective, freed investigators from this limitation. By identifying materials, operations, and knowledge as aspects of technology, Perrow extended the boundaries of organizational technology beyond the confines of production systems.

Perrow and the team of Hage and Aiken define and measure technology at the individual level; thus procedures and work characteristics at the system level are excluded from their measures. Instead, they ask many individuals in the organization about their work and aggregate the responses for an organizational score. Hage and Aiken base their study on Perrow's theory but de-

fine technology as overall routineness in the work. They measure the technologies of social welfare and health agencies by means of structured interviews with professional staff members selected from various levels in the organization. Perrow measures the technology of industrial firms through questionnaires submitted to all salaried-exempt employees, that is, foremen and above. The results of the Hage and Aiken study and the Perrow study suggest that Perrow's theory of technology can produce a comparable measure of the work done in a variety of organizational settings.

It is not a simple matter to separate the conceptual or theoretical issues from the empirical issues or issues of method. The attempt to apply Perrow's theory of technology to library work in this study had important consequences for the research design. The method used to investigate library technologies followed that used by Perrow and Hage and Aiken. Individuals in various library departments were asked questions about their work. The answers to the questions then were aggregated to get departmental scores. Although this method can be criticized for reflecting only attitudes about work and not the work itself, it was an assumption of this study, as it was in the other studies, that the characteristics of work itself are being measured.

Organizational research has not yet determined which individuals to ask in order to get an organizational score and how to aggregate individual scores. Some investigators base their scores on the responses of managers or a few top administrators in each organization. Others select their respondents according to social position, weighting positions to reflect their differential importance. Perrow asks all salaried-exempt employees, but he suggests that in the study of some organizations it would be important to survey all personnel.[15]

Each of these methods has its problems. Some research suggests that the participant's perception of the organization is a function of his location in the organization.[16] By relying upon the responses of one or several respondents, the investigator assumes that the perceptions of his respondents are the same as those of other participants in the organization and that the variable under study is observable on all dimensions. By sampling respondents in various social positions, the investigator encounters complex problems concerning the selection of positions, the weighting of positions to reflect their differential importance, and the treatment of individuals having multiple roles. If he weights the responses from all full-time people equally, he might bias the departmental score in favor of those positions most frequently occurring and neglect the important characteristic of differentiation in social structure.

## Research Design and Measurement

Departments assigned the functions of book selection, acquisitions, cataloging, circulation, and reference in the main library of three large academic libraries were selected for study. These departments perform the central core of library activities and can be found in most large academic libraries. Although these five operational functions were studied in all three libraries, the organizational patterns so varied that six departments were studied in one library, five in the second, and only four in the third.

An effort was made to match the libraries according to size of budget, size of staff, and number of doctoral programs maintained by the universities in which the libraries are located. As the libraries were guaranteed anonymity, their exact size, location, and historical development cannot be disclosed.

### *Measuring of Technology*

The major instrument used to gather the data was a precoded, forced-choice

questionnaire.[17] The respondents were able to answer a majority of the questions on a one-to-seven Likert-type scale which specified extreme values, for example, "definitely true" to "definitely false."

The questionnaire items were designed to measure the theoretical categories that correspond to the Perrow model and to previous research on technology. The purpose was to draw up an inclusive list of content ideas and items under each category. The literature on technology and work, the descriptive case studies of organizations, and the library literature provided the basis for the questions. In order to control for questions on routineness that might reflect an individual's satisfaction with his job rather than the nature of his job, measures of satisfaction used by other investigators were included in the questionnaire. The questionnaires were distributed to all full-time staff members, both professional and clerical, in each of the departments being studied. It was assumed that the reality of departmental technology would be reflected more closely in the aggregation of scores of all full-time staff members than in the aggregation of any other group.

Factor analysis and item analysis techniques were used in the scale construction.[18] Eighty-eight variables from the questionnaire were analyzed in the first factor analysis. The questionnaires returned from the respondents in the fifteen departments were merged into one data set ($N = 384$) in order to have a ratio of four cases to one variable. Before the data were merged, the distribution on the responses to the questions from each library was compared. The distributions were similar on nearly all questions. The risk of distortion from merging appeared minimal.

Ten major factors emerged in the first analysis. These factors are reported in Table 1. The questionnaire items forming the factors are listed in the Appendix.

Scales then were constructed for each factor from questionnaire items that loaded .4 or above on that factor. Scores

TABLE 1

FACTOR LOADINGS: FACTOR ANALYSIS OF QUESTIONNAIRE ITEMS*

| Item Number† | Factors† | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | VII | VIII | IX | X |
| 1 | .756 | .039 | .086 | .195 | −.001 | .086 | .023 | −.035 | .027 | .017 |
| 2 | .574 | .254 | −.086 | .253 | −.091 | .088 | .028 | .235 | .052 | −.145 |
| 3 | .030 | .762 | −.037 | .197 | −.033 | .055 | .064 | −.058 | .016 | .025 |
| 4 | .061 | .731 | .040 | .307 | .031 | −.005 | −.052 | .010 | −.081 | .101 |
| 5 | .015 | .018 | −.692 | .103 | −.022 | −.016 | −.049 | .219 | −.035 | .049 |
| 6 | .117 | .149 | .422 | .387 | −.002 | −.125 | −.149 | −.032 | .002 | −.049 |
| 7 | .186 | −.009 | .400 | .285 | −.082 | .157 | −.098 | −.046 | −.028 | −.009 |
| 8 | .034 | .051 | −.045 | .794 | .072 | .006 | .130 | .181 | .012 | .103 |
| 9 | .038 | .034 | .061 | .783 | .042 | −.048 | .457 | .386 | .079 | .013 |
| 10 | .059 | .009 | −.064 | .758 | −.028 | −.012 | .116 | .273 | −.018 | .158 |
| 11 | .017 | .067 | .064 | .758 | −.034 | .031 | .078 | .117 | −.053 | .156 |
| 12 | .065 | −.046 | −.153 | .716 | −.018 | .038 | .101 | .083 | −.003 | .094 |
| 13 | −.027 | .118 | −.041 | .692 | .102 | .103 | .091 | .143 | .026 | .071 |
| 14 | .030 | .189 | .110 | .669 | .039 | .106 | −.044 | .102 | .052 | .118 |
| 15 | .178 | −.029 | .061 | .501 | .083 | −.242 | .125 | .114 | −.027 | −.039 |
| 16 | −.064 | .076 | .024 | .570 | −.014 | −.027 | −.116 | −.020 | −.062 | .100 |

* Varimax orthogonal rotation; principal component analysis. Loadings ≥ .4 are underlined.
† See Appendix for listing of forty-six items and ten factors.

*TABLE 1—Continued*

| Item Number† | Factors† I | II | III | IV | V | VI | VII | VIII | IX | X |
|---|---|---|---|---|---|---|---|---|---|---|
| 17 | .163 | .158 | .060 | .604 | −.064 | .086 | .054 | −.050 | .073 | .077 |
| 18 | .010 | .222 | −.063 | .548 | .169 | .160 | .074 | .036 | .005 | .007 |
| 19 | .212 | .165 | −.039 | .532 | .080 | .127 | −.030 | .105 | .083 | .035 |
| 20 | −.169 | .032 | .030 | .018 | .740 | .232 | .007 | .072 | .266 | .051 |
| 21 | .084 | −.043 | .047 | .090 | .651 | .162 | .037 | −.092 | .084 | .112 |
| 22 | −.034 | .064 | −.056 | .121 | .639 | −.020 | −.048 | .134 | .145 | −.043 |
| 23 | .067 | .154 | .012 | .136 | .054 | .654 | .081 | −.069 | .058 | −.061 |
| 24 | .091 | .032 | .027 | .018 | .219 | .726 | .007 | .072 | .266 | .051 |
| 25 | −.007 | .034 | −.074 | .350 | −.028 | −.057 | .457 | .386 | .079 | .013 |
| 26 | .035 | −.028 | .041 | .144 | −.018 | .085 | .747 | .174 | .005 | .072 |
| 27 | −.038 | .001 | −.032 | .425 | .015 | −.038 | .652 | .227 | .036 | .023 |
| 28 | .136 | .006 | −.080 | .577 | .079 | −.136 | .463 | .210 | −.006 | .116 |
| 29 | −.015 | .059 | −.015 | .319 | .093 | −.047 | .180 | .697 | −.058 | .120 |
| 30 | .112 | .051 | −.048 | .184 | .069 | −.014 | .070 | .662 | .085 | .254 |
| 31 | −.053 | −.063 | −.157 | .192 | −.021 | .038 | −.034 | .619 | −.141 | −.051 |
| 32 | .002 | .048 | −.068 | .486 | .035 | −.050 | .310 | .595 | −.082 | .113 |
| 33 | .070 | .030 | −.192 | .126 | .032 | −.042 | .133 | .589 | −.175 | −.007 |
| 34 | .015 | −.117 | .125 | .124 | −.020 | −.081 | .083 | .589 | −.051 | −.151 |
| 35 | .076 | .032 | −.086 | .220 | −.057 | .028 | .005 | .444 | −.127 | .231 |
| 36 | −.087 | −.087 | −.044 | .008 | −.131 | .066 | .185 | .416 | −.112 | .176 |
| 37 | −.003 | −.004 | .086 | .127 | .062 | −.022 | .076 | .093 | .803 | .027 |
| 38 | .060 | .113 | −.026 | .107 | .129 | .002 | .075 | −.103 | .675 | −.002 |
| 39 | −.107 | −.161 | −.090 | −.199 | −.037 | .151 | −.105 | −.110 | .659 | .037 |
| 40 | −.083 | −.128 | −.011 | .004 | −.143 | .070 | −.059 | .105 | .625 | −.218 |
| 41 | .040 | .193 | −.012 | −.188 | .174 | .146 | −.114 | .021 | .483 | −.035 |
| 42 | −.080 | .042 | −.051 | .315 | .038 | .125 | .061 | .093 | −.010 | .710 |
| 43 | .044 | .060 | −.050 | .316 | .022 | −.057 | −.013 | .177 | .048 | .703 |
| 44 | −.063 | .091 | .016 | .327 | .005 | .053 | .037 | .029 | .154 | .691 |
| 45 | .089 | −.072 | −.144 | .139 | .094 | −.057 | .145 | −.223 | .075 | .462 |
| 46 | −.021 | .092 | .203 | .166 | .052 | −.054 | .129 | .222 | .172 | .423 |

representing each factor scale were constructed by first coding the items in the appropriate direction and then adding them together. The simple procedure of adding item scores in order to get a factor score produces results almost identical with the more elaborate procedures necessary to compute scores from the item factor loadings.[19] A correlation matrix of these scores then was computed and a principal components factor analysis was calculated on the matrix using the varimax rotation. Three major factors reported in Table 2 emerged in this second factor analysis.

The three factors reflect those aspects of work that have been interpreted as technology by recent investigators. The first factor, combining the overall routineness, morale, and job satisfaction scales, resembles Hage and Aiken's measure of technology. The Hage and Aiken measure of technology consists of five items: "Would you describe your work as being very routine, somewhat routine, somewhat non-routine, or very non-routine? People do the same job in the same way every day. One thing peo-

TABLE 2

FACTOR LOADINGS OF SCALES DEVELOPED FROM THE FIRST FACTOR ANALYSIS*

| | Scales Based on First Factor Analysis | Reliability Coefficient† | Factors 1 Overall Routineness | 2 Library Technology | 3 Task Interdependence | $h^2$ |
|---|---|---|---|---|---|---|
| I. | Predictability | (.5) | .227 | .693 | −.039 | .558 |
| II. | Routineness of Operations | (.7) | .075 | .654 | .162 | .516 |
| III. | Insufficient Knowledge | (.3) | −.186 | .657 | .135 | .498 |
| IV. | Overall Routineness | (.9) | .621 | .448 | .057 | .762 |
| V. | Interdepartmental Task Interdependence | (.5) | .061 | −.006 | .758 | .602 |
| VI. | Internal Task Interdependence | (.5) | .092 | .173 | .488 | .303 |
| VII. | Satisfaction | (.8) | .762 | .138 | −.022 | .608 |
| VIII. | Morale | (.8) | .808 | −.031 | −.144 | .720 |
| IX. | Discretion (Rules) | (.7) | −.128 | .117 | .688 | .606 |
| X. | Discretion (Job Autonomy) | (.7) | .531 | .054 | .265 | .622 |
| | Percent of Total Factor Variance | | 29.2% | 20.8% | 19.4% | |
| | Percent of Total Variance | | 16.9% | 12.0% | 11.3% | |

* Principal components analysis; Varimax rotation. Loadings ≥ .6 are underlined.
† Cronbach's alpha coefficient of internal consistency.

ple like around here is the variety of work. Most jobs have something new happening every day. There is something different to do every day."[20] Factor 1, however, also includes the morale and job satisfaction scales and suggests that a major confounding of routineness with satisfaction may exist as these variables are measured in the present study.

The second factor, labeled library technology, reflects the essential variables of Perrow's concept of technology. Seven questions form the three scales that loaded together on this factor:

1. Think of all the kinds of events that cause your work. How often would you say you are able to anticipate and predict the nature of these events?
2. How often do you encounter the same kinds of problems in your work?
3. To what extent are the work decisions you make dissimilar from one day to the next?
4. Many library jobs require the use of searching procedures of one kind or another. To what extent are the searching procedures you use dissimilar from one day to the next?
5. Are the events that cause your work easy to handle?
6. There are parts of my job that could be eliminated without really affecting the work of the library.
7. It is impossible to learn enough about this job to handle all of the problems that come up.

Questions one and two measure the perceived nature of the raw materials, that is, the "presence or absence of exceptional cases" of Perrow's model. The search behaviors required to deal with the cases, the second major aspect of Perrow's technology variable, are measured by questions three and four, which ask about the similarity of library search procedures and work decisions. The knowledge dimension of Perrow's theory is tapped by questions five to seven, which ask whether the events causing the work are easy to handle and whether it is easy to learn enough about the job to handle all of the problems that come up.

Overall routineness loaded on this second factor at .448. The loading suggests that routineness of work may be

related to Perrow's technology. The loading however could be a fluke due to error in the measures. Overall routineness was excluded from the description of factor 2 for several reasons: overall routineness loaded heavily on factor 1 with morale and satisfaction; predictability, routineness of operations, and insufficient knowledge loaded above .6 on factor 2; and these three dimensions reflect Perrow's theoretical definition of technology.

The third factor combines the scales that measure task interdependence and rules. Lawrence and Lorsch have used task interdependence as a measure of organizational technology, although they measure task interdependence differently.[21] The loading of internal task interdependence on this third factor, although not as high as the other two factors, is consistent with the factor and lends support to the interpretation.

The seven-item scale, reflecting Perrow's definition of technology, becomes the tool of analysis and the evaluation of the technology of library departments that is discussed below. Unfortunately, there are no independent measures of technology that can be used to validate the scale.[22] Theoretical disagreement on the definition of technology and variations in the measures of technology will continue while the study of organizational technology still is in its early stages. In the present study the scale measuring library technology begins the empirical investigation of a theoretical perspective of library work. The reliability of the scale, measured by Cronbach's alpha coefficient,[23] was .55.

## Comparative Analysis of Library Work

The data reported in Table 3 support the expectation that the functional departments in the three libraries would have similar technologies and would cluster together on the technology scale. The result resembles those in studies of

TABLE 3

Departmental Mean Scores on Technology

| Rank | Score | Department | Library |
|---|---|---|---|
| 1 | 20.125 | reference | C |
| 2 | 23.462 | reference | B |
| 3 | 24.500 | reference* | A |
| 4 | 25.797 | catalog | B |
| 5 | 26.290 | catalog | C |
| 6 | 26.513 | catalog | A |
| 7 | 26.636 | serials† | A |
| 8 | 27.212 | acquisitions* | B |
| 9 | 27.632 | acquisitions | A |
| 10 | 27.886 | serials‡ | C |
| 11 | 27.958 | acquisitions§ | C |
| 12 | 28.500 | circulation | C |
| 13 | 28.775 | circulation | A |
| 14 | 29.550 | circulation | B |
| 15 | 29.666 | searching | A |

* Includes book selection function.
† Combines serials acquisitions and record keeping.
‡ Combines serials acquisitions, cataloging, and record keeping.
§ Faculty members and departmental libraries do the book selection.

functional units in industrial organizations in which departments of sales, production, finance, and research and development clustered together.[24]

Because the functional groups cluster together, it is possible to consider the characteristics of the departments in terms of the nature of the work they do without taking into account the specific organizational settings in which the departments operate. Similarities among the same functional departments have been assumed by librarians before. Now the data provide some evidence to support that assumption. Based on the rank ordering of the fifteen departments, a functional department in an academic library resembles the same functional group in another academic library with regard to the nature of its materials, operations, and knowledge more closely than it does different functional departments within its own library.

The measure of technology developed in this study discriminates among the various departments whether the department deals primarily with clients or materials. The reference departments (dealing primarily with clients) and the

TABLE 4

ONE-WAY ANALYSIS OF VARIANCE OF TECHNOLOGY BY LIBRARY DEPARTMENT (FIFTEEN CATEGORIES)

| Source | Sum of Squares | Degrees of Freedom | Mean Square | F Ratio | Level of Significance |
|---|---|---|---|---|---|
| Between groups | 1224.4375 | 14 | 87.4598 | 2.262 | $p < .001$ |
| Within groups | 12337.8021 | 369 | 33.4358 | | |
| Total | 13562.2396 | 383 | | | |

catalog departments (dealing primarily with materials) score higher on the technology scale than do the serials (materials), acquisitions (materials), and circulation (clients and materials) departments. Perrow's model is important because it provides a means by which different types of organizations can be compared. The instrument developed in this study is important because it shows that Perrow's theoretical construct can be measured in a variety of organizational settings.

The scores indicate that differences exist among departmental technologies. To test this hypothesis, that is, that the fifteen library departments differ with respect to their technologies [$H_o$:$m_1 = m_2 = m_3 \ldots = m_{15}$], a one-way analysis of variance was applied to the data. The results, presented in Table 4, are significant at the .001 level. The evidence supports the conclusion that departments do differ with respect to their technologies.

Although Table 4 shows that the library departments participating in this study differ with respect to their technologies, it does not disclose which departments are making the difference. The ranking of departments in Table 3 shows that the functional groups cluster together despite differences that might exist regarding specific departmental assignments or responsibilities. That table, however, offers no information about whether the functional groups differ significantly on their technologies. In order to provide some evidence on these matters, the catalog department in library B was used as a reference group and a multiple regression analysis using dummy variable coding was applied to the data. Using multiple regression, the library departments are the independent variables and technology is the dependent variable. The partial correlations in Table 5 show what relevance technology has in differentiating between each department and the catalog department in library B. The correlations are tested for significance by means of the F test.[25] The catalog department in library B was selected as the reference group because it was the largest department in terms of full-time staff, and it contained a serials-cataloging and record-keeping unit and a searching unit that were separate departments in other libraries.

The results, presented in Table 5, show that the reference department in library C, the circulation departments in libraries A and B, and the searching department in library A differ significantly from the catalog department on their technologies. The departments in the functional groups of cataloging and acquisitions do not differ significantly from the catalog department selected as the reference group.

These comparisons suggest that, despite the clustering of functional groups and the differences in departmental scores, the work of functional departments in academic libraries is not as different as is assumed. In terms of the predictability of the material, the routineness of operations, and the knowledge necessary for performance, there might be relatively little difference in the work performed in the function-

TABLE 5

COMPARISONS OF PARTIAL CORRELATIONS BETWEEN TECHNOLOGY AND THE CATALOG DEPARTMENT, LIBRARY B, VERSUS THE OTHER LIBRARY DEPARTMENTS

| Department and Library | | Partial Correlation Coefficients | Partial F Value with 1 and 369 Degrees of Freedom | Level of Significance |
|---|---|---|---|---|
| reference | C | −.136 | 6.94727 | $p < .01$ |
| reference | B | −.070 | 1.89427 | n.s. |
| reference | A | −.046 | .79250 | n.s. |
| catalog | B | | referent | |
| catalog | C | .021 | .15883 | n.s. |
| catalog | A | .033 | .39107 | n.s. |
| serials | A | .023 | .20164 | n.s. |
| acquisitions | B | .049 | .90306 | n.s. |
| acquisitions | A | .064 | 1.52133 | n.s. |
| serials | C | .098 | 3.60160 | n.s. |
| acquisitions | C | .083 | 2.53122 | n.s. |
| circulation | C | .072 | 1.92459 | n.s. |
| circulation | A | .135 | 6.88554 | $p < .01$ |
| circulation | B | .133 | 6.63148 | $p < .01$ |
| searching | A | .111 | 4.62363 | $p < .03$ |

al departments of these academic libraries. Although there are differences among the departments, the differences are small. This finding suggests that in future studies it may be possible to generalize about the work of the academic library as a whole and to compare library technology with the technologies of other types of organizations. However, the data also suggest that when the measure of technology is refined and more items are written that measure the technology construct, stronger departmental differences will be discovered. The measure as it now exists may be too gross to identify the differences in the technologies that distinguish the work of one library department from that of another.

## SUMMARY AND DISCUSSION

This study attempts to develop a measure that would enable comparisons of the work of various library departments. The study identified underlying characteristics of work, or what is called library technology; measured these characteristics in each department; and then compared the departments on the characteristics.

The characteristics of work that formed the concept technology are related to three major aspects:

1. The raw materials or the events that are the cause or the subject of the work. The essential characteristic of the department's raw materials is whether the material is perceived to be predictable or unpredictable.
2. The methods or search strategies that are used to convert the materials into finished products. The essential characteristic is whether the department's operation is routine or not.
3. The knowledge required of the worker in order to complete the work. The essential characteristic is whether the knowledge of the department's work is sufficient or not.

The results suggest that the three characteristics of technology are interrelated. When the department's raw materials are basically predictable, its operations are routine and the level of knowledge required is low and quite sufficient for completion of the work. Conversely, when the department's raw materials are basically unpredictable, its operations are basically nonroutine and the level of knowledge required is high and relatively insufficient for completion of the work.

Data were gathered by questionnaire from a sizable number of participants in each department and then aggregated in order to get an organizational score. Equal weighting was used in gathering the data from the organizational participants, although the complex problems posed by weighting could not be solved in this study.

By adopting a research design that depends upon aggregation, the study as-

sumes that the perceptions of work at the individual level can be aggregated to measure the work at the departmental level. Although the results of the aggregations reflect the reality of the departmental technologies as observed by the investigator, little is known about how greatly the aggregation biases the results.

Although the scale developed in the study was successful in discriminating among the fifteen departments as to technology, the differences are small. Generally, predictable events, routine operations, and relatively low knowledge requirements constitute the technologies of all of the library departments participating in this study.

This outcome indicates that the nature of the work performed in the functional departments of academic libraries is similar regardless of the department in which the work is performed. This conclusion is tentative, however, for the instrument, as it now exists, is less refined than ultimately desirable. It is a useful tool in exploring departmental technologies, but it cannot identify those subtle technological differences that might exist among the library departments.

This study also attempted to link Perrow's model of technology to its empirical domain. In the continuous interaction between theory and research, the next step is to refine the instrument, demonstrate its validity, and then to test the propositions suggested by Perrow's model. If the variables are measured carefully and reliably, it is expected that the application of the technology theory of organizations will extend the knowledge and understanding of organizational differences in libraries and provide a method by which library departments and libraries can be compared in an objective and systematic fashion.

## Appendix

### Questionnaire Items That Form the Factors and the Scales

*Factor I. Predictability of Events*

1. Think of all the kinds of events that cause your work. How often would you say you are able to anticipate and predict the nature of these events?
2. How often do you encounter the same kinds of problems in your work?

*Factor II. Routineness of Operations*

3. Many library jobs require the use of searching procedures of one kind or another. To what extent are the searching procedures you use dissimilar from one day to the next?
4. To what extent are the work decisions you make dissimilar from one day to the next?

*Factor III. Insufficient Knowledge*

5. There are parts of my job that could be eliminated without really affecting the work of the library.
6. It is impossible to learn enough about this job to handle all of the problems that come up.
7. Are the events that cause your work easy to handle?

*Factor IV. Overall Routineness*

8. My job is monotonous; the work itself provides no basic interest.
9. To what extent is your present job a real challenge to what you think you can do?
10. The longer I hold my job the more boring it becomes.

11. In my job there is something new happening every day.
12. My job gives me the chance to do the things I do best.
13. Are the events that cause your work interesting?
14. How would you describe your work? All of it is routine . . . All of it is non-routine.
15. Regarding your training and skills, would you say you now have . . . much more than needed for your present job . . .
16. My job is frustrating, but it is never dull.
17. The work I do keeps changing and I have to change to keep up with it.
18. How much variety is there in the events that cause your work?
19. Do the events that cause your work seem repetitious?

*Factor V. Interdepartmental Task Interdependence*

20. What percent of the tasks you do must be done before someone else in another department can do his work?
21. What percent [of the tasks connected with your job] depends upon someone else in another department doing his job first?
22. In my job there is emphasis on the actual production records.

*Factor VI. Internal Task Interdependence*

23. What percent [of the tasks connected with your job] depends on someone else in your department doing his job first?
24. What percent of the tasks you do must be done before someone else in your department can do his work?

*Factor VII. Satisfaction*

25. How satisfied are you with your present job when you compare it with similar positions in other departments or in other libraries?
26. How satisfied are you with the progress you are making toward the goals that you set for yourself in your present position?
27. How satisfied are you with your present job when you consider the expectations you had when you took the job?
28. How satisfied are you with your present job in light of your career expectations?

*Factor VIII. Morale*

29. In general, how is the morale of the staff in this department?
30. It is difficult for new and original ideas to receive consideration in this department.
31. This department is organized in such a way that the supervisors can let us know when we are doing well.
32. How about your own morale?
33. Are the people in your department kept informed about the library's policies and long-range objectives?
34. How helpful is your supervisor in enabling you to carry out your work?
35. Unnecessary procedures are kept to a minimum in this department.
36. Most of the people in this department are uncertain about the way they should do their jobs.

*Factor IX. Rules*

37. About what proportion of your normal daily activities are guided by written manuals or directives that set forth the way in which you are to perform your job?
38. How often does a rules manual cover what you are working on?
39. How often do you refer to written manuals or directives?
40. With regard to those tasks that are guided by written rules and manuals, how strict is your supervisor in requiring you to follow these rules?
41. There are a lot of rules, policies, procedures and standard practices one has to know in order to do his work well in this department.

*Factor X. Job Autonomy*

42. How much responsibility do you have in deciding how your job is to be carried out?
43. I have little control and final say over how I do my job.
44. How much freedom do you have in deciding exactly how you do your own work?
45. Generally speaking, how frequently does your supervisor check your work?
46. In this department people are often permitted to use their own judgment as to how to handle various problems.

## References


1. Mary Lee Bundy and Paul Wasserman, "Professionalism Reconsidered," *College & Research Libraries* 29:5–26 (Jan. 1968); Raynard C. Swank, "The Catalog Department in the Library Organization," *Library Quarterly* 18:24–32 (Jan. 1948).
2. Leslie Beth Rothenberg et al., "A Job-Task Index for Evaluating Professional Utilization in Libraries," *Library Quarterly* 41: 320–28 (Oct. 1971); Social, Educational Research and Development, Inc., *A Task Analysis of Library Jobs in the State of Illinois* (Silver Spring, Md.: 1970).
3. For a more complete report of this study see Beverly P. Lynch, "Library Technology: A Comparison of the Work of Functional Departments in Academic Libraries" (Ph.D. dissertation, Univ. of Wisconsin-Madison, 1972).
4. Charles Perrow, "A Framework for the Comparative Analysis of Organizations," *American Sociological Review* 32:195–96 (April 1967).
5. A. J. Grimes, S. M. Klein, and F. A. Shull, "Matrix Model: A Selective Empirical Test," *Academy of Management Journal* 15:9–31 (March 1972); Jerald Hage and Michael Aiken, "Routine Technology, Social Structure and Organizational Goals," *Administrative Science Quarterly* 14:366–76 (Sept. 1969).
6. Jum C. Nunnally, *Psychometric Theory* (New York: McGraw-Hill, 1967), p.85.
7. Joan Woodward, *Industrial Organization: Theory and Practice* (London: Oxford Univ. Pr., 1965).
8. David J. Hickson, D. S. Pugh, and Diana C. Pheysey, "Operations Technology and Organization Structure: An Empirical Reappraisal," *Administrative Science Quarterly* 14:378–97 (Sept. 1969).
9. Hage and Aiken, "Routine Technology."
10. Charles Perrow, "Working Paper on Technology and Structure," mimeographed (Madison: Univ. of Wisconsin, 1970).
11. William L. Zwerman, *New Perspectives on Organization Theory* (Westport, Conn.: Greenwood Pub. Corp., 1970).
12. Michael Fullan, "Industrial Technology and Worker Integration in the Organization," *American Sociological Review* 25: 1028–39 (Dec. 1970).
13. Martin Meissner, *Technology and the Worker* (San Francisco: Chandler Pub. Co., 1969).
14. Grimes, Klein, and Shull, "Matrix Model."
15. Perrow, "Working Paper on Technology and Structure."
16. W. Richard Scott, "Professionals in Hospitals: Technology and the Organization of Work," in Basil S. Georgopoulous, ed., *Organization Research on Health Institutions* (Ann Arbor: Institute for Social Research, Univ. of Michigan, 1972), p.139–58.
17. Lynch, "Library Technology," p.114–35.
18. R. J. Rummel, *Applied Factor Analysis* (Evanston: Northwestern Univ. Pr., 1970); George W. Bohrnstedt, "Reliability and Validity Assessment in Attitude Measurement," in Gene F. Summers, ed., *Attitude Measurement* (Chicago: Rand McNally, 1970), p.80–99.
19. David L. Featherman, "Achievement Orientations and Socio-economic Career Attainments," *American Sociological Review* 37:131–43 (April 1972).
20. Hage and Aiken, "Routine Technology," p.368.
21. Paul R. Lawrence and Jay W. Lorsch, *Organization and Environment* (Boston: Graduate School of Business Administration, Harvard Univ., 1967).
22. Lynch, "Library Technology," p.32–37.
23. Lee J. Cronbach, "Coefficient Alpha and the Internal Structure of Tests," *Psychometrika* 16:297–334 (1951).
24. Raymond G. Hunt, "Technology and Organization," *Academy of Management Journal* 13:235–52 (Sept. 1970); Arthur M. McAnally, "Departments in University Libraries," *Library Trends* 7:448–519 (Jan. 1959).
25. Jacob Cohen, "Multiple Regression as a General Data-Analytic System," *Psychological Bulletin* 70:426–43 (1968).