Enhancing the Quality of Computing Service: Technology, Structure, and People

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What factors determine the quality of end-user computing services in local governments? In a survey of 1,869 end users in 46 U.S. cities, the authors examine three major "controllable" factors that the literature indicates might influence the quality of computing services: (1) the structure of service provision, (2) the level of technological problems, and (3) the service orientation of computing service specialists. The survey results do not support the popular argument that structural factors (e.g., whether computing services are centralized or decentralized within an organization) are most important; both the level of operational problems and the attitudes of the service providers were more significant. The findings were especially supportive of explanations that focus on service-orientation factors, leading the authors to stress strategies for service improvement that concentrate on the "sociotechnical interface" (STI) between end users and computing service providers.

Every public and private organization faces puzzles regarding computing. One of the most important puzzles is how to maximize the quality of its computing services. This issue is increasingly crucial as organizations continue to expand their investments in computing and as they move beyond the straightforward provision of computing by a traditional data processing shop toward a complex computing environment, with a computer on nearly every desktop and with diverse points of provision and control. Ideally, an organization should adjust those factors under its control which will enhance the quality of computing services. But there is considerable uncertainty about which factor(s) will actually have the greatest intended impacts on quality.

Organization theory identifies three sets of factors that might be especially important for the level of computing quality: technology, structure and people (Leavitt, 1964). Our purpose in this article is to ask: which (if any) of the controllable elements of these factors account for variations in the quality of computing services provided to end users? This article provides important evidence regarding this question, based on an extensive recent study of 1,869 end users in 46 American local governments (see grey box). The major dependent variable is end users' evaluations of the quality of the computing services they receive.[1]

There are many elements of the three factors that might affect the quality of computing services experienced by end users. In this analysis, we focus only on those elements that seem especially amenable to policy intervention. These are particularly interesting because they indicate whether there are feasible actions that senior managers might take in order to enhance computing service quality. Apart from a brief treatment of end users' role type, this analysis does not explicitly consider other key elements of the organization's structure, technology, and people which might affect quality, but which are difficult or impossible to alter by means of policy interventions. These other elements include, for example, organizational function and end users' personal characteristics.

Research Design

We examine how three sets of factors (technology, structure, and people) affect the quality of computer services by empirical analysis of the recent experience of 1,869 end users in 46 American municipal governments. Empirical studies of this type of issue typically specify a model which includes many elements of structure, technology and people, and then use multivariate techniques to analyze the contributions of each element to a single equation accounting for variance in the dependent variable. We employ an analytic strategy that differs in two ways.

First, we examine the three factors as, in philosopher Gilbert Ryle's terms, competing explanations as well as alternative explanations. As alternative explanations, we assess whether the factors are complementary components in accounting for variance in the dependent variable. To specify the effect of each element, we use multivariate techniques which examine all the elements together within a single-equation model. But as competing explanations, we evaluate each factor as a separate, exclusive influence on the dependent variable. For the competing explanations analysis, we employ statistical techniques which indicate the explanatory power of a particular element, controlling for the effects of the other factors.

Second, as we noted above, we are interested in those elements of the three factors that are particularly amenable to control within the organization. These elements are crucial because organizational actors can target them for alteration in the attempt to enhance performance. Thus, within the structural element, we examine the structure of provision of computing services. Among the aspects of technology, we focus on major types of operational problems that might arise in the provision of computing service. And in terms of the people element, our emphasis is on the service relationships between the computer specialists and the end users. Our analytic approach facilitates a specification of the policy interventions that seem to have the most positive effects on computing service quality.

The Variables

The dependent variable in the analysis is a measure of the *quality of computing services.* The indicator is the end user's response to this question: How would you rate the *quality* of data processing services provided to your department? The end user could respond: poor, fair, good, or excellent (poor = 0; excellent = 3). The individual end user is the unit of analysis in this article. The data for all other variables are matched with each specific end user.

The *structure of computing service provision* for each end user was determined by the end user's response to the question: Please indicate the location of the mainframe or minicomputer you use most often. Response options included: computer in central data processing, computer in this department, computer in another department, or an outside computer (e.g., regional computer or a time-sharing service). About 50.5 percent of the end users receive most or all computing services from a central installation (which is defined here not only as a central DP computer, but also a computer in another department or an outside computer). The remaining 49.5 percent report primarily using decentralized, departmental installations. There are end users served by each type of installation in all of the 46 cities in our analysis. It is an unresolved empirical question how evolving technological and organizational changes will affect the structures through which computing is provided. Technological developments such as area networks (e.g., local: LANs, metropolitan: MANS, and wide: WANS) might provide new intermediate options for computing provision, between centralization and decentralization. Regarding organizational changes, one reviewer noted that in the for-profit sector there are increasing instances of matrix, project teams and of flatter, wider, looser hierarchies which allow such intermediate structures of computing provision (see also, Drucker, 1988; Hammond, 1982); but others argue that such changes will ultimately produce greater consolidation of authority over computing service provision (Mowshowitz, forthcoming). While we recognize that intermediate structures of computing provision can be established, to this point such structures are uncommon for end users in local governments. Thus our operational measure of centralization/decentralization is a direct measure of the end user's primary source of data processing services. This insures greater precision in establishing the correct analytic linkage between the structure of computing provision and the quality of computing service for each individual end user.

Level of operational problems with computing services is measured by two indicators. The first is a *technical problems index* combining the end user's ratings (from "not a problem" to "very often a problem") of four possible computing problems: (1) slow machine response time; (2) computer down time; (3) foul-ups in day-to-day computer operations; and (4) frequent technical changes in computing services. The technical problems index ranges from 0 (no technical problems) to 12 (frequent problems across all dimensions). A second indicator, *service problems,* is the user's rating of the speed with which the data processing staff responds to requests for computer service. The service problems indicator ranges from 0 (not a problem) to 3 (very often a problem).

There are two measures of the *orientation of computing specialists* serving the end user (that is, aspects of the STI). *Service orientation* is a scale measured by the end user's evaluations of four components of his or her interactions with the computing specialists: (1) are the specialists generally not user oriented; (2) do they confuse conversations with technical language; (3) are they more intrigued with what computers can do than with solving the user department's problems; (4) are they more interested in working on new computer uses than on improving existing ones? A "technically-oriented" unit of computing specialists has a low mean score on these measures, a "service-oriented" unit has a high score (scores range from 0 to 3). *Service promotion* is measured by the users' assessment of the willingness of computer specialists to propose new computer applications that explicitly serve the department's needs. Scores on this indicator range from 0 (low) to 3 (high).The descriptives for the measures used are: technical problems index mean = 2.91, s.d. = 2.2; service problems index mean = .88, s.d. = .85; service orientation scale mean = 1.88 s.d. = .82, Cronbach's alpha = .88; service promotion mean = 2.27, s.d. = .91.

The Respondents

Detailed self-administered questionnaires were completed by 4,834 end users in 46 American municipal governments in 1988. These municipalities are broadly representative of American cities with greater than 50,000 population (Kraemer *et al.*, 1988). The respondents were selected randomly to obtain representation of local government employees in a broad spectrum of white collar organizational roles, spanning four broad role types: managers (e.g., city managers, chief administrative officers, mayors, department and division heads), staff professionals (e.g., planners, management analysts, accountants), desk-top workers (e.g., bookkeepers, administrative assistants), and counter-top workers (e.g., clerks, librarian assistants, customer service representatives) Municipalities were selected from an initial set of more than 400 cities with greater than 50,000 population. Individual cities were selected on the basis of a stratified, purposive sample whose stratifying variables were a set of theoretically interesting computing policy dimensions (e.g., extensiveness of computing applications, centralization of the computer package, and sophistication of computer hardware). Data were first gathered in these municipalities in 1976, and the 1988 questionnaires were distributed during field research and interviews in the large majority of the 1976 cities, with replacement cities from the original sample only where necessary (due to non-participation) and with some additional cities added to increase variation on microcomputer penetration. Since this analysis does not involve longitudinal comparison, the precise relationship of the two samples is not relevant.

Individual respondents were identified within a sampling framework specifying 40 specific role-types representative of the full-time employees of American municipalities. To enhance cross-city comparability, the same roles within each role-type and the same departments were sampled in each municipality. Within a role, individual respondents were selected randomly from a list of those city personnel within that role-and-department subset. Details of this sampling framework are in Danziger and Kraemer, 1991 and Kraemer, Dutton and Northrop, 1981, and elaboration of the four broad role types is in Danziger and Kraemer, 1986.

Each respondent provided answers to more than 150 questions regarding personal background, levels and uses of computing, and the impacts of computing on his or her work. Depending upon the size and functional responsibilities of the city, the questionnaire was distributed to between 60 and 110 end users. The overall response rate was 74 percent for those who received the questionnaire, and was more than 60 percent in each of the 46 cities.

For this analysis, we consider only those white collar respondents who actually use a mainframe or minicomputer or obtain computer-based products (in the form of reports or other computer based information) on a regular basis (at least a few times a month), and thus have a sound basis for informed opinions about the quality of computer services they receive. As shown in Table 1, our sample consists of 1,869 end users, composed of 31 percent mainframe users, 27 percent using mainframes and microcomputers in about equal amounts, 25 percent who are indirect users, and the remaining 17 percent who are split between those who use either the mainframe or the microcomputer proportionately more. Of the full sample of 4,940 end users in our overall research framework, 38 percent (1,869) are appropriate for this analysis. Those who are not relevant for the current analysis include (as a percentage of all respondents): 7.3 percent who never use computer-based information; 8.3 percent whose frequency of computer use is several times per year or less; 2.1 percent who are personnel of a county government and 24.5 percent who are police patrol officers, both groups sampled for other purposes in our research but not appropriate for this analysis of personnel in office-based municipal government functions; 1.8 percent who use stand alone microcomputers exclusively; and 18.2 percent who did not provide responses indicating their type of computer use or their assessments of the quality of computing provision or the nature of their relationships with computing service providers. On the measures employed in the analysis, this last group did not differ from those studied.

Analytic Methods

The analysis initially assesses the relationship between quality of computing service and each of the explanatory factors that might account for variations in quality. In this paper, "factor" denotes an element that contributes to the nature of a phenomenon of interest; it is not a mathematical component from a factor analysis.

Then the relative importance of each explanatory factor is determined by analyzing that factor controlling for the other factors. In each mode of analysis, we first consider the full sample of end users and then partition those users receiving computing services from a centralized unit from those receiving services from a decentralized, departmental unit.

In this article we operationalize technology, structure and people with a set of independent variables that seem especially likely to affect computing service quality *and* that can be controlled by policy interventions. *Technology* refers to operational performance in the provision of computing, and is measured as the level of technical and service problems. *Structure* refers to the organization of computing services, and is measured as the centralization or decentralization of provision. Given the intense, ongoing debate regarding decentralization of computing, we are particularly interested in whether there is a systematic variation in the quality of computing services provided in centralized versus decentralized settings. And *people* refers to the sociotechnical interface (STI) between the end users and the computing service providers (that is, the computer experts) and is measured by the service orientation of the computer experts toward those end users.

In general, the data analyzed below reveal that, among the three factors under investigation, the orientation of computing staff has the greatest explanatory power in accounting for variations in computing service quality. The level of operational performance for the technology also has a significant impact on service quality. Surprisingly, there is no discernible relationship between the quality of computing services and whether those services are provided through centralized or decentralized arrangements. The basis and implications of these findings are elaborated below.

Explaining the Quality of Computing Service

As suggested above, the literature on information technology in organizations and on MIS identifies three controllable factors that might affect the quality of computing services experienced by end users: (1) the structure of service provision; (2) the level of operational problems with the technology; and (3) the service orientation of the computer specialists.

The Structure of Service Provision

Greatest attention and the fiercest controversies about the organization of computing have concerned whether the computer package should be centralized or decentralized.[2] By computer package, we mean the hardware, software, personnel and organizational arrangements for providing computing services (Danziger *et al.*, 1982). The case for *centralization* has traditionally been based on notions of efficiency. Centralization, it is argued, increases economies of scale in the acquisition of expensive hardware and facilities, provides for greater diversity, skills, and career opportunities among technical staff, enhances interagency coordination in the uses of software and data, and, most broadly, provides managers with greater ability to guide computing toward organization-wide goals (Andersen and Dawes, 1991; George and King, 1991; King, 1983; von Simson, 1990).

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Table 1
Distribution of Types of Computer Users

	N[a]	Percent
Indirect users[b]	459	25
Mainframe computer use only	573	31
About equal mainframe and microcomputer use	504	27
More mainframe than microcomputer use	159	8
More microcomputer than mainframe use	174	9
Total	1869	100

[a] This includes a random sample of end users in forty specific role types in 46 American municipal governments.
[b] Indirect users request and/or receive computer-based data/information/reports from others, but do no "hands-on" computing.

With the decreasing cost of hardware, the increasing capabilities of smaller computers, and the availability of standardized software, *decentralization* of computing has become a favored prescription for improvements in effectiveness, especially among department managers and users. It is argued that decentralized computing, in the form of so-called "departmental computing,"[3] is more effective because it brings the computer package under the direct control of end users, who gain greater mastery of the technology and are best able to shape it to meet their department's needs and functional responsibilities (King, 1983; King and Kraemer, 1981; Griesemer, 1984). It also reduces the dominance of a central unit of computing specialists who, it is assumed, have greater interest in their own technical-professional concerns than in understanding and responding to end users' needs.

Studies in both business and government note a steady trend toward decentralization of the computer package since the mid-seventies (Keen and Woodman, 1984; Laudon, 1986; Kraemer *et al.*, 1986, 1989). In some cases, decentralization has been quite extreme, with major departments abandoning the central computing unit for a bevy of microcomputers in standalone or networked configurations. As the trend has accelerated, there has been some concern that decentralization has gone too far. First, no one within the organization seems able to control the proliferation of the computer package. Few central managers have been effective at asserting such control, and many managers and central data processing units have yielded to the strong pressure from the user agencies that those agencies be allowed to select, implement and even operate their own computing. Second, decentralization reduces the likelihood that organizational needs will be met with respect to a common technical infrastructure, integrated data bases, and coordination among the information processing activities of various units.

The number of departmental installations has risen steadily since the mid-seventies (Kraemer *et al.*, 1989). However, despite the trend towards decentralization and the wide distribution of some computing resources, most organizations continue to have a central computing unit. For example, in local governments generally (Kraemer *et al.*, 1986), and in all of the

Table 2
Assessments of Quality of Computing Service Provided to End Users

	N	Percent
Poor	112	6
Fair	467	25
Good	916	49
Excellent	374	20
Total	1869	100

cities in our study, there is still a single, "central" computer installation serving multiple user departments. And in recent years, the pendulum appears to be swinging back toward centralization, at least in large government and business organizations. In characterizing this type of partial recentralization, one observer states: "Organizations are consolidating data centers, beefing up the authority of their central IS staffs, and establishing company-wide technical standards and work procedures" (von Simson, 1990, p. 158). Thus, the key research question regarding structure is whether the quality of computing service provision is systematically associated with more decentralized or more centralized computing. And the underlying policy issue for managers is whether there are compelling reasons to push for more centralized or decentralized computing in their organization.

The Level of Operational Problems with the Technology

One alternative explanation for the quality of computing service experienced by end users is that users are particularly affected by their level of operational problems with the technology. This assumes that end users perceive service quality in terms of the presence (or absence) of problems in their day-to-day instrumental use of computing (Kling and Scacchi, 1979, 1982). If this operational performance hypothesis is correct, end users will report low service quality when they experience significant computing service problems such as down time, slow computer response, disruptions due to frequent changes in systems, and delays in the provision of service. And high computing service quality will be associated with the absence of these operational problems. We also might find that only some of these problems are particularly important to end users' assessments of service quality.

The Orientation of Computer Specialists

Finally, variations in computing quality might be most closely associated with the working relationships between the end users and those providing computing services. This aspect of the sociotechnical interface (STI)—the subjective linkages between users and the computer package—has received considerable attention in both empirical research and in policy prescriptions regarding the management and provision of computing (Danziger and Kraemer, 1986; Hedberg *et al.*, 1977; Lucas, 1975). Particular attention has been placed on the extent to which the computer specialists are user oriented. It has been suggested that there can be "two cultures"—that of computer specialists and that of end users—and that the disjunction between these cultures results in poor computing service to the users (Danziger, 1979; Kraemer *et al.*, 1989).

From this perspective, we hypothesize that the quality of computing is likely to be relatively low when the computer specialists are *technically oriented*—that is, when they operate as a "skill bureaucracy" whose members are more motivated by what is technically interesting than by the needs of end users, are not communicative with end users, and are more interested in new developments than in improving existing applications (Danziger, 1979). In contrast, quality will be higher when computer specialists are generally *service oriented*—that is, when they make an effort to learn the end users' "basic business" and are responsive to the end users' needs, attempt to communicate in the language of the user, work to improve existing systems, and promote new applications whose primary purpose is to help end users.

Findings

Quality of Computing Service

About one-fifth of the end users enjoy excellent computing services and an additional 49 percent report that the quality of service is good (Table 2). One-quarter of the end users report that service is only fair, and 6 percent experience poor quality service. Overall, this suggests that there is considerable room for improvement in the quality of computing services provided to end users in public organizations, although service quality is at least good for about two-thirds of the end users.

Factors Explaining Quality of Service

While our central interest is to analyze the elements of structure, technology and people specified above, we do wish to consider briefly the effects on computing service quality of one important, but uncontrollable element—the end user's role type. For this purpose, Table 3 classifies the end users into the four broad role types noted above. Table 3 reveals that differences in the quality ratings among end users in the four role types are not statistically significant. The mean assessment of computing quality varies from a low of 1.78 (staff professionals) to a high of 1.89 (desk-top workers). Thus it seems reasonable in our analyses of computing service quality to treat all end users as a single set of respondents irrespective of role.

We can now turn to our essential question: do controllable aspects of structure, technology and people seem to account for variations in service quality? Table 4 directly tests the impacts of centralization versus decentralization on computing quality. The most striking finding in Table 4 is that these data take much of the fire out of the debate over centralized versus decentralized provision of computing services. The distribution of ratings on the quality of computing services is virtually identical for those with centralized and decentralized provision. For each of the four quality levels, the difference between centralized and decentralized end users is 4 percent or less. The Chi square statistic reinforces the conclusion that the location of computing provision has no direct, systematic association with service quality to individual end users.

Do any of the other explanatory factors account for variations in quality of computing service? To assess this, Table 5 displays the (Pearson's r) correlations between quality of ser-

Table 3
Assessments of Quality of Computing Service Provided to End Users Partitioned by Role Type

	N (=1869)	Quality of Service Mean	Standard Deviation
Role Type			
Managers	721	1.84	.84
Staff Professionals	510	1.78	.80
Desk-Top Workers	361	1.89	.81
Counter-Top Workers	277	1.87	.75
		F-Ratio	F-Prob
		1.42	.23

vice and the selected explanatory variables for the technology and the people elements. All are significantly associated with computing service quality in the hypothesized direction, and all have quite substantial correlation coefficients. Higher quality computing service is particularly associated with a computer staff that is more user oriented. It is also linked with less extensive service problems, the promotion of useful applications, and fewer technical problems with computing. Conversely, poor computing service is more likely where the computer specialists operate as a skill bureaucracy and where there are more extensive service and technical problems in the provision of computing.

The alternative explanations approach—that is, the relative importance of the various explanatory variables—can be evaluated more precisely by the multiple regression analysis in Table 6.[4] These data reinforce the findings above, and they also reveal that each variable, *except centralization /decentralization,* has a substantial independent effect on computing service quality. Overall, these variables account for nearly 40 percent of the variance in the quality of computing service experienced by end users. As in Table 5, the service orientation of the computing staff has the greatest effect on quality. But the level of service problems and of service promotion also contribute importantly to the regression equation. These three, as well as the level of technical problems with computing, are all statistically significant (probability less than .001) in accounting for the variation in computing service quality reported by end users.

Table 7 is guided by the competing explanations framework, which assesses the exclusive explanatory power of one factor controlling for other key factors. Based on a "methods" test, the data indicate the combined explanatory power of the two variables reflecting the service style of the computer specialists (that is, the measures of service orientation and service promotion), controlling for the effects of the two variables measuring computing problems. And the table also indicates the explanatory power of the two problems variables, controlling for the computing style variables.

The most striking finding is that the service style of the providers of computing has substantially more explanatory power than the extent of computing problems. This finding is evident whether one analyzes all end users, or just those receiving computing from either a centralized or a decentralized source. For the entire sample of end users, service style

Table 4
Assessments of Quality of Computing Service Provided to End Users, Partitioned by Centralized and Departmental Facilities (by percent)

		Structure	
	All End Users (n=1869)	Central Facility (n=943)	Department Facility (n=926)
Poor	6	6	6
Fair	25	23	26
Good	49	51	47
Excellent	20	20	21

$X^2(p) = .31$

is nearly four times as powerful as a competing explanation than is the level of computing problems. And for the departmental facility users alone, service style has five times the explanatory power of computing problems. Table 4 supported our inference that the structure of service provision (centralization/decentralization) has no independent effect on service quality ratings. The limited effect of structure of provision is reinforced by the first equation in Table 7, which again indicates its minimal effect on service quality, relative to the other explanatory variables in the analysis.

Discussion

Structure

In both public and private organizations, many users have persistently argued that decentralization is the antidote for poor performance in the provision of computing services by central computing units. The technical developments associated with small and powerful minicomputers, local networks, and personal computers have added force to this argument (Andersen and Dawes, 1991; Griesemer, 1984). However, as we noted above, the considerable decentralization in many organizations has now provoked counter-arguments that distributed computing has gone too far and that there is a need to recentralize computing under a single management structure (von Simson, 1990).

Our analysis bears directly on this debate. The empirical data indicate that *the quality of computing services experienced by end users is independent of whether computing is centralized or decentralized.* While we do not conclude that the

Table 5
Correlations Between Quality of Computing Service and Explanatory Factors[a]

	Quality of Service
People	
Service orientation: computing staff are user oriented	.52
Service promotion: computing staff propose new applications	.37
Technology	
More technical problems with computing	-.32
More service problems with computing	-.42

[a] N = 1869 end users in 46 municipal governments.
Pearson's r Correlations: $p < .001$

> **The** *quality of computing services experienced by end users is independent of whether computing is centralized or decentralized*

structure of computing provision has no effect on quality, the data suggest that computing service quality is not directly and systematically associated with centralized versus decentralized computing.

What are the implications of these findings for the continuing debates about decentralization and distributed computing? At least, the arguments for distributed computing must be examined more closely. The intraorganizational debate regarding decentralization of computing (and for recentralization as well) has typically been couched in issues of effectiveness and efficiency. But the data here reveal that, contrary to the efficiency perspective, end users in centralized computing contexts are no less likely to report significant operational and technical problems with computing than users of decentralized computing. And, contrary to the effectiveness perspective, end users in decentralized computing contexts are no more likely than those with centralized provision to deal with computing specialists who have a strong end user orientation and who promote applications useful to the users. In short, while many advocates of centralization or decentralization maintain that there are efficiency or effectiveness payoffs from their preferred alternative, computing service quality does not seem to be systematically associated with a straightforward measure of this element of structure.

It should be recognized, however, that the end users are not the only actors whose judgments about the payoffs from computing are important. It might be that top managers, middle managers and information systems managers apply different criteria for assessing computing benefits, and thus quality. Perhaps centralized computing is better able to provide for large-scale data processing needs, does increase the integration and interunit sharing of data, and does make better use of available technical expertise. And, from the end users' perspective, perhaps decentralized computing does produce empowered and satisfied end users who utilize computing services more extensively because they believe they are able to shape the technology to serve their needs more fully.

These points are suggestive that political-ideological concerns about control over computing technology, software and staff might be an important factor in the continuing debate over decentralized computing. From this viewpoint, some advocates of decentralization might be guided more by considerations of sub-unit (usually department) power and interests than of computing service quality (King and Kraemer, 1981). And some advocates of centralized computing might be primarily concerned with the critical points of control over the organizational information system. Our analysis supports the interesting finding that end users with local control of computing do not consistently report higher computing quality, even if they harbor a bureaucratic politics perspective favoring local autonomy and control.

If the manager's objective is to enhance the quality of computing service in a direct and effective manner, the evidence in this article is that improvements in technology and especially in the attitudes and behaviors of people are more important than structural shifts toward centralization, decentralization, or recentralization. Based on our quantitative analyses and our extensive interviews and observations during more than 200 weeks of field work studying computing in American local governments, we believe that the quality of computing services to end users can be enhanced in ways that are clearly within the control of senior managers and do not require fundamental restructuring of the organizational arrangements for providing computing.[5]

Technology

To reduce operational and technical problems in the provision of computing services, senior managers should allocate rewards (or sanctions) to computing units, managers and staff on the basis of explicit, measurable performance criteria such as the timeliness of response to users' requests for computing products, the reduction of down time, and the minimization of disruptions due to technical changes in systems and procedures. These operational performance criteria can be applied

Table 6
Predictors of Quality of Computing Service Provided[a]

Independent Variables	Beta	Standard Error	F	Significance
Structure				
Centralized provision	-.03	.02	1.940	.164
People				
Service promotion	.19	.02	97.719	.000
Service orientation	.37	.02	325.658	.000
Technology				
Technical problems	-.08	.02	14.588	.000
Service problems	-.19	.02	74.029	.000

[a] N=1869 end users in 46 municipalities. Based on a multiple regression analysis:
Adjusted R^2 =.37; F = 221.59; sig. = .00

Table 7
Relative Contribution of Explanators of Quality of Service[a]

	R^2 Change	F	Significance
All End Users			
Service style of computing specialists	.178	263.80	.00
Computing problems	.048	71.42	.00
Centralized provision	.001	1.94	.16
Central Facility Users			
Service style of computing specialists	.160	121.60	.00
Computing problems	.059	44.55	.00
Department Facility Users			
Service style of computing specialists	.195	141.95	.00
Computing problems	.039	28.23	.00

[a] Based on a methods test, which indicates the level of explanatory power (R^2) for one set of independent variables, controlling for the other set. N=1869 end users in 46 municipal governments.

to any provider of computing services, whether external (e.g., a service bureau or facilities management contractor) or in-house, and whether a central computing unit, a departmental unit, or a sub-unit provider.

People

Regardless of their organizational location, computer specialists who are clearly user oriented—who are communicative and responsive to user needs and who are committed to improving existing applications and proposing appropriate new ones—seem best able to satisfy end users' criteria for higher quality computing services. Thus senior managers should allocate specific rewards to those computing staff who are responsive to users. This should encourage technical staff to understand and to be influenced substantially by the end users' perspective during the development and application of computing technology to those users' activities.

In short, our analysis here is consistent with a major finding in our earlier empirical research on end users in the late 1970's (Danziger and Kraemer, 1986): the relationships between the end user and the providers of computing services (that is, elements of STI) are crucial to the differential impacts of computing on the end user. The gap between the end users' culture and the computing specialists' culture can be spanned through both increasing the computer competence of users and also the socialization of the technical specialists providing services. Bridging this gap seems especially dependent upon the capacity of the specialists to comprehend the tasks for which the users are responsible, to employ the language of the users, and to provide computing services which meet users' needs.

At the same time they increase their end user orientation, the computing specialists still can and should serve as custodians of the organization's information technology interests, which include both the integration of systems across the organization and the setting of computer, communications and data standards for all users. To achieve these dual purposes, one key for top managers and information systems managers is to promote an orientation among information system specialists in which they are at least as loyal to their organization, clients and central managers as they are to their profession and colleagues.[6]

Our current analyses are also consistent with our observations during the more recent field research conducted in conjunction with the survey generating the data for this article. We found that computing service quality to end users is excellent (or quite poor) in some public organizations where computing provision is highly centralized and in others where departmental computing is dominant. There were cases in which problems with computing provision have been minimized and cases in which senior managers have been very successful in instilling a strong end user orientation among the providers of computing services, regardless of whether the technical staff is centralized or decentralized.

Neither the data presented here nor our field research suggest that there is an optimal, one-size-fits-all solution regarding the structure of computing provision. Each organization must search for its own appropriate balance between centralization and decentralization of computing, depending upon elements of both the organization's computer package (e.g., existing technological infrastructure, availability and skills of technical staff, computer resource allocation) and its political ecology (e.g., local computing history, organizational functions and end user tasks served by computing, service priorities, and the distribution of power and responsibility within the organization). But our research does underline the importance of a positive sociotechnical interface and the value of solid operational performance. Our findings should help senior managers in both general management and in information systems departments to focus their attention on the issues and policies that seem most likely to enhance computing service quality to end users.

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Notes

The authors are listed randomly to denote equal contribution. The authors are grateful for the very helpful comments of anonymous reviewers.

1. In this analysis, we employ the end users' perspective on computing service quality. From an alternative perspective, we could assess service quality for the organization as a whole. This could be done by aggregating end users' assessments, by relying on the evaluations of top managers, or by creating external measures of department-level or organization-level service quality. Another useful perspective would be the analysis of objective, "benchmark" measures of service performance.
2. There have been two major movements towards decentralization of computing. The first, in the middle to late seventies and early eighties, centered around minicomputers and involved location of the entire computer package in the user departments. The second, which began in the mid-eighties, centered around microcomputers and mainly involved location of computer hardware and software in the user departments, with expertise and control retained by the central computing unit. In some of these cases, user departments acquired their own technical expertise with microcomputers and reduced their reliance on the central computing unit. Analytically, both the minicomputer and the microcomputer movements are similar; but we focus on the former because it is more tractable empirically.
3. "Departmental computing" has traditionally referred to the location of a medium-sized computer, or minicomputer, along with the necessary software, staff and managerial control, in one or more user departments. These departmental installations are usually independent of the "central" computing unit and, therefore, decentralized both physically and managerially. In recent years, with the advent of microcomputers, the phrase departmental computing has broadened to include the location of microcomputers in the user departments. In this article, our concern is the more traditional meaning of the term.
4. The intercorrelation matrix of the independent variables is the following:

	Service Orientation	Service Promotion	Technical Problems	Service Problems	Decentralization
Service Orientation	1.00	.30	-.31	-.37	.01
Service Promotion		1.00	-.16	-.26	.02
Technical Problems			1.00	.52	-.03
Service Problems				1.00	-.01

   Interaction terms for people x technology variables are not statistically significant; consequently, they are not included in the multiple regression analysis presented in Table 6.
5. We spent one to two person-weeks in each of the 46 cities in our study. During this field work, we conducted detailed interviews with managers, end users in diverse roles, and computer service providers. These interviews were semi-structured, and grounded in a case coding system to insure greater comparability of data across sites. While this paper draws explicitly on the surveys returned by end users, our discussion is also informed by our rich field interviews and observations.
6. These points were emphasized by one reviewer, who recalled the comments of the late Franz Edelman (1981) during a panel symposium of the Decision Sciences Institute in the early 1980s.

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