Cooperation, Autonomy, and Control in Corporate Information Management

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ABSTRACT

Past research on users of information systems (IS) and on IS professionals was dominated by discussions of tension between control by the IS organization, i.e., centralization, and autonomy by the user organization, i.e., decentralization. The purpose of this paper is to find evidence of such tension as well as to see whether organizations explicitly pay attention to cooperation between user and IS organizations. The subjects of the study were users and IS professionals who were asked about the goals of corporate information management and the impact of microcomputer use. As expected, respondents implied concern with centralization and decentralization. However, their responses also implied awareness of cooperation. Thus, the study confirmed that, in the context of corporate information processing, cooperation is considered in addition to control and autonomy. This paper also offers suggestions to IS practitioners and researchers with respect to unresolved questions about the optimal blend of cooperation, autonomy, and control and the dynamic nature of IS organizational design.

INTRODUCTION

In the 1990s, two distinct organizational units interact with information systems (IS). The larger group is that of IS customers, i.e., users who rely on information systems and software productivity tools to carry out their professional jobs. The smaller group is that of IS providers, i.e., managers and IS professionals (e.g., analysts and programmers) who are in charge of facilitating the use of information technology by users. The IS literature which deals specifically with the relationship between users and IS professionals includes discussions about the tension between the two groups [5,15]. Furthermore, based on theses discussions many writers consider notions of centralization and decentralization and the balance between them [3,20,26].

It was this tension between users and IS professionals and the dilemma between IS centralization and decentralization that originally triggered the study described in this paper. Following a review of the IS literature, we interviewed both IS professionals and users in the process of designing a questionnaire concerning the tension between IS professionals and users as well as the balance between centralization and decentralization. Preliminary data analysis provided information about the balance between centralization and decentralization and also revealed an awareness of tension between users and IS professionals. However, a third element emerged — a genuine interest, on both sides, in effective cooperation between their respective organizations.

These preliminary findings led us to identify, in the general management literature, an article by Keidel [13] suggesting that in organizational design, in addition to the notions of centralization and decentralization, it is imperative to consider the notion of teamwork. According to Keidel, the challenge is to strike the right balance among cooperation (teamwork), autonomy (decentralization), and control (centralization). Intuitively, this framework seemed applicable to corporate information management. Originally, information systems management was a fundamentally centralized phenomenon. Later, the emergence of microcomputers seemed to pull in the direction of a fundamentally decentralized phenomenon. Practitioners became concerned with how to structure information management so as to get the best from both: the consistency and quality from centralized informa-

tion management and the relevance and timeliness of decentralized information management.

Thus, work on this study was two-phased. First, we focused on centralization versus decentralization. Then, after preliminary results were obtained, the notion of cooperation emerged and pulled the study more toward Keidel's framework. In addition to our original focus on the tension between the IS and user organizations and the balance between control and autonomy, we wanted to find whether data collected for this study revealed instances of cooperation between the two groups and movement toward an effective blend of cooperation, autonomy, and control.

In the next section we review the IS literature on this subject, elaborate on the relevance of Keidel's framework, and phrase two key research questions. In the third section we discuss the methodology, including details about the questionnaire design, about the statistical tools used, about the sample, and background data. The fourth section, where results are presented, exposes the reader to our interpretation of the results in relation to the research questions. Finally, the conclusion offers pertinent advice to IS practitioners and researchers.

RESEARCH QUESTIONS

The emergence of microcomputers, in the late 1970s, brought with it the direct use of computing technology by users who are not IS professionals [10,21,22,23,24]. Whereas previously users had to rely only on mainframe applications, now the scope of computer use includes office automation applications, decision support and expert systems, data sharing and communication, and database access in client-server environments [9]. In many cases [2], adoption of microcomputer technology evolved as a grass roots effort by functional areas to increase knowledge worker productivity, and respond to the data processing backlog. The proliferation of microcomputers, over the 1980s, combined with the widespread availability of telecommunications technology, have resulted in a significant change in the corporate computing environment [14,16]. Due to these technological advances, computer-based information processing has become accessible to all members of an organization and is no longer merely a "back room" function which supports transaction processing. Microcomputer-aided information processing is now a pervasive and high profile corporate activity intended to increase productivity and give competitive advantage to a firm. With these developments taking place, corporate information management policy had to look beyond issues concerning mainframes and minicomputers to the challenge of comprehensive corporate information management [1,5]. There is some evidence in the literature that this is already happening. In a study of the evolution of corporate information management, Trauth [26] found that organizations recognized information as a valuable organizational resource, which should be managed in much the same way as people, machines, and capital, and established formal information policies in many organizations.

The literature makes it clear that corporate information management is undergoing a major transition. IS executives are confronted with several important issues. One is determining how to manage and control in this versatile environment while encouraging effective individual and departmental use of computing. A second issue is that given the large investment in computing and communications technology, there is a need to demonstrate and assess the value-added benefits from the present computing environment. A third issue is that of expanding the policy-making process to include all personnel involved in information processing activities, including users. The final issue is user accountability; that is, along with increased autonomy in information processing, it is important to delegate management responsibility and to give users control over hardware, software, data, and processing. All these transitional issues, by being related to notions of control and autonomy, motivate the first research question addressed in this paper. This research question concerns the tension between user and IS organizations within the corporate information environment and the balance between the centralization, desired by IS organizations, and the decentralization, desired by user organizations.

The second research question we address in this study is motivated by framing the first research question in the context of Keidel's approach to organizational design. As mentioned in the introduction, he advocates a triangular geometry that includes teamwork. He also contends that the challenge is to strike an effective balance among the three variables:

a. cooperation (teamwork)
b. autonomy (decentralization)
c. control (centralization).

In other words, Keidel proposes that in designing organizations cooperation be given as much attention as control and autonomy. He then asserts that it is important to include teamwork as explicitly a component of organizational design rather than assume that teamwork will occur automatically. Keidel also maintains that every organization must make explicit tradeoffs between these three variables.

According to Keidel's framework, every organization and organizational unit must blend autonomy, control, and cooperation; no two organizations are ever identical nor are any two units within an organization. Furthermore, in the organizational triangle autonomy, control, and cooperation represent dilemmas:

1. autonomy/control: local responsiveness versus global perspective
2. control/cooperation: consistency versus flexibility

3. autonomy/cooperation: accountability versus synergy.

Keidel warns that not all blends are viable. More specifically, organizations trying to maximize all three variables at the same time in equal measures, or organizations overemphasizing a single variable to a point that the other two are neglected are bound to fail. Viable blends are either dominated by a single lead variable or are characterized by a near symmetrical balance between two of the three variables. Finally, he indicates that change must be characterized by a transitional evolution whereby an organization evolves through a series of transitions.

We could not find in the IS literature direct application of Keidel's framework. However, his framework made us wonder about the role of cooperation in IS organizational design. Thus, in this paper we are concerned with the relevance of Keidel's triangular geometry framework, and our second research question concerns the incorporation of cooperation in the context of corporate computing.

To summarize, the research questions investigated by this study concern:

1. The balance between control by IS organizations and autonomy by user organizations.
2. The incorporation of cooperation between the IS and user organizations into the control/autonomy blend.

METHODOLOGY

Questionnaire Design. A field study was conducted, using a questionnaire designed to address the above research agenda. The questions included in the questionnaire were based upon the authors' knowledge and experience, as well as on an extensive literature review [2,3,4,6,7,8,9,11,12,17, 18,19,23,25,27,28,29]. The questionnaire was tested during preliminary interviews with users and IS professionals. The final questionnaire contained two types of questions. The first type aimed at collecting background data about the respondents, their organizations, and their utilization of information technology (see the Appendix for sample questions). The second type aimed at collecting data pertaining to the research agenda, namely about corporate IS management and planning and about the interaction between the user and IS organizations (see the Appendix for sample questions).

Statistical Tools. To cope with the above research agenda various statistical tools were used. In addition to obtaining summary descriptive statistics, such as means, standard deviations, and discrete distributions, we also used t-tests, one-way analysis of variance, contingency tables (chi-square), factor analysis, and the critical incident technique. Results were considered significant when the level of significance (p) was below 0.1. Thus, $p < 0.1$ can be assumed for significant results reported below, unless a lower level of significance is indicated.

Sample. Two hundred and fifty questionnaires were distributed using mailing lists of two professional associations who requested anonymity. One association was primarily composed of users and the other was primarily composed of IS professionals. To encourage participation, follow-up notices were included in respective newsletters, and announcements were made at professional meetings. Ninety-nine responses were mailed back. Late response bias was examined by comparing early and later returns. First, the data was analyzed when the number of respondents reached 73; subsequently, the data analysis was repeated when the number of respondents reached 99. The differences between the results were not significant. Thus, there was no apparent evidence of late response bias in the results. To check for non-response bias, we compared characteristics of responding and non-responding organizations. Thus, the industrial range of responding organizations (manufacturing, government, public utilities, education, and consulting) was similar to the range across the whole sample, indicating that there was no non-response bias. Also, the size distribution of responding organizations (small, medium, large, and very large) was similar to that of the whole sample, indicating that there was no non-response bias. It is also noteworthy that the 40% response rate is almost double the rate expected from questionnaires distributed by mail [6].

Background data. Descriptive data from the questionnaire revealed background details such as respondents' roles within their information processing environments, the size of their companies, and the industries in which they worked. Fifty-one respondents (51.6%) were users while forty-eight (48.4%) were IS professionals. As can be seen in Figure 1, the respondents worked in a wide range of industries, including manufacturing, government, public utilities, education, and consulting. The size of their companies (indicated by annual revenues) was evenly distributed across small, medium, large, and very large companies (See Figure 2).

In order to study the maturity of microcomputer use among respondents, we inquired about when and why microcomputers were introduced into their organizations. Most respondents' organizations introduced microcomputers and their applications around 1983 with some introductions as early as 1980 and as late as 1987. In one-way analysis of variance, no significant relationships existed between the organization's size or industry and how long microcomputers had been in use. As for why microcomputers were introduced, dissatisfaction with the IS organization was not a key reason cited for using microcomputers tools. Less than half of the sample cited dissatisfaction with the IS function as the reason for using microcomputers. Instead, the desire for increased productivity, and the availability of technology were the

Figure 1
Industry Affiliation of Respondents

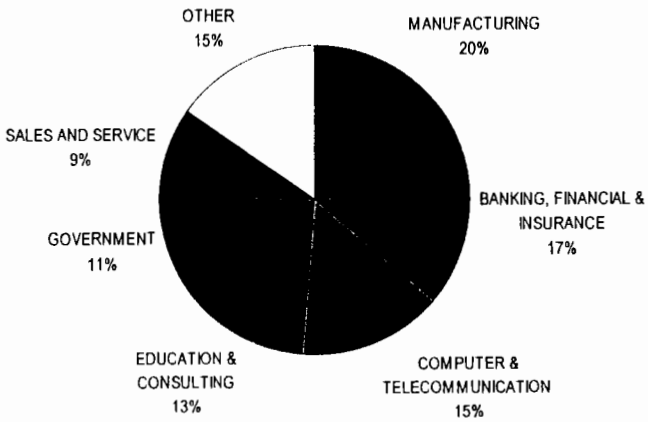
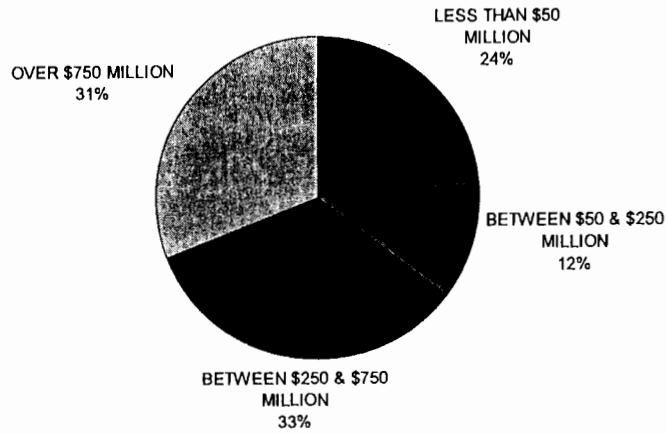


Figure 2
Profile of Respondents' Corporate Revenue



main motivating factors. Because users' dissatisfaction with the systems development backlog and with systems themselves was no longer the primary motivation for using microcomputer applications, and instead, the motivation was users' expectation of achieving improved productivity from an enabling technology (e.g., microcomputers and user-friendly software), it is possible to say that respondents were mature in the way they used microcomputers.

Respondents were also asked to evaluate a set of typical microcomputer applications by indicating, for each application, whether it was part of their computing environments, and the level of importance that their corporations attached to each application. A seven-point Likert scale, with values of 1 denoting very important and 7 very unimportant, was used. Table 1 shows the applications considered important (mean < 3 and at least 50% of the responses = 1 / very important or 2 / important). The results show that the most important applications were word processing, spreadsheet, database management (DBMS), and fourth generation languages (4GL). We also found out that almost all organizations (97.5%) had word processing, spreadsheet, and graphics software, and slightly fewer (88%) have DBMS and 4GL applications. It is noteworthy that applications such as electronic mail, data downloading and uploading, and local area networks (LANs), which require connectivity, were considered to be less important and were less prevalent (availability was about 60%) than the first set of applications mentioned above.

Chi-square analysis was conducted to determine whether organizational characteristics account for any variations in use of applications. The use of DBMSs and 4GLs and the practice of data transfer between computers were found to be dependent on industry group and on whether the respondent was a user or an IS professional. Companies in the sales and

Table 1
Importance of Microcomputer Applications

Activity	Mean Activity Importance to Organization	Mean Activity Importance to Respondent
Word Processing, Graphics	1.77	1.87
Spreadsheet Applications	1.82	2.49
DBMS & 4GL Applications	2.63	2.57
Downloading Data	2.94	3.00
Electronic Mail	3.28	3.17

service industries used these applications less than those in other industry groups. Also, users considered DBMSs and 4GLs to be more important elements of the computing environment than did IS professionals. Applications such as downloading or uploading data and data sharing between PCs turned out to be related to organization size; these were more prevalent in larger firms.

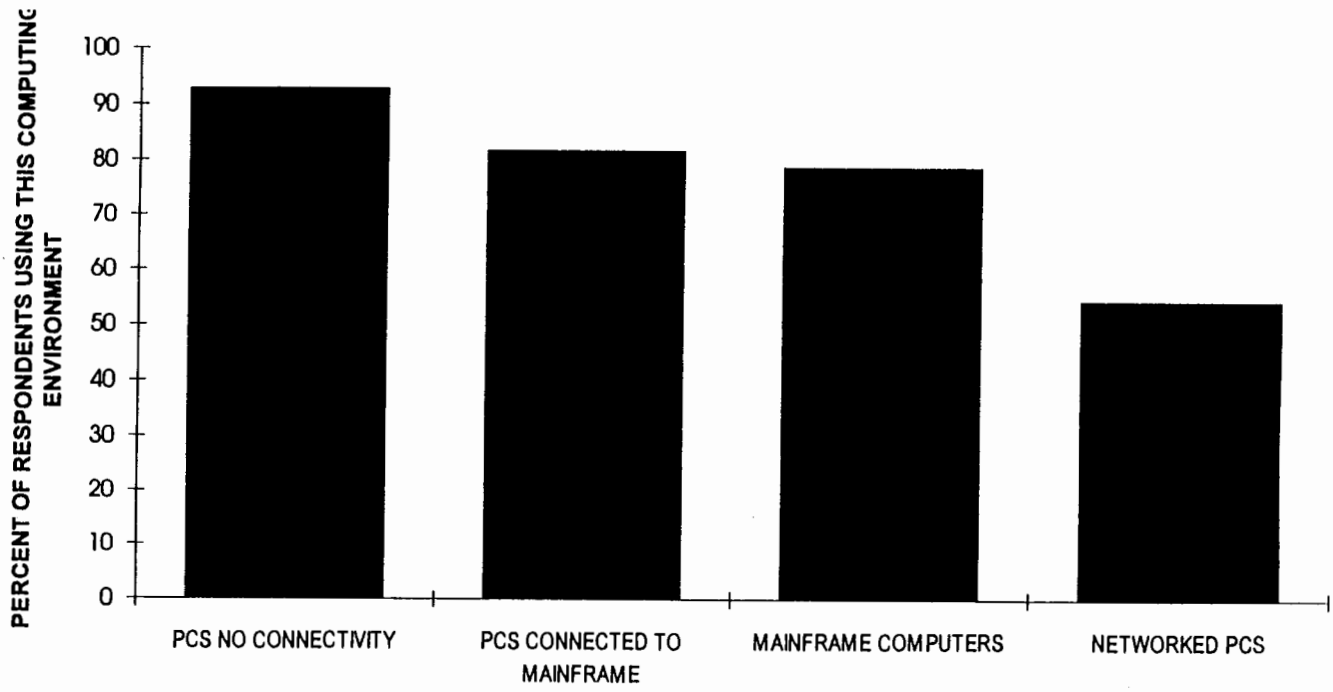
Although in the majority of the respondents' organizations (92.9%), personal computers were used as stand alone work stations in one's office for purposes of increasing productivity, connectivity was possible to a great extent. Figure 3 shows that about 80% of respondents reported that they had microcomputer or terminal access to mainframes or minicomputers, and almost 55% indicated that their personal computers were networked. In 62% of organizations, the IS department was responsible for managing microcomputer technology.

We were also looking in the data collected for signs of maturity of the IS organization. In particular, we looked into the status of the top IS manager as a reflection of recognition of information as a resource. In most of the respondents' organizations (80%), the most senior IS executive was positioned at a high level in the organization: either one (54%) or two (26%) levels below the president. This finding suggests that the sampled organizations were veteran users of information technology. However, only in 24% of the cases was the title of that person Chief Information Officer. With significance under .05 Chi-square analysis revealed that this phenomenon varied among industries: while there were no CIOs in the computer and electronic companies, CIOs most often existed in financial, government, or service organizations. Without the benefit of further research it is unclear how to interpret the finding that only a few organizations actually employed the term CIO and the finding of variance according to industry. Another finding that suggests maturity of the IS organization was found in responses regarding the extent to which IS planning was integrated into the overall corporate planning process. Roughly half of the respondents (53%) reported partial integration and 34% reported full integration.

RESULTS AND DISCUSSION

This section presents and interprets study results that shed light on the balance between control by IS organizations and autonomy by user organizations and on the explicit incorporation of cooperation between the two organizations

Figure 3
Respondents' Computing Environment



into IS organizational design. Essentially, within the IS context, we look in the data collected for answers to questions like: Is cooperation given as much attention as control and autonomy? Do organizations make explicit tradeoffs between these three variables? and Do they deal with two-way dilemmas (autonomy/control: local responsiveness versus global perspective; control/cooperation: consistency versus flexibility; autonomy/cooperation: accountability versus synergy)?

According to Keidel, no two organizations are ever identical in blending control, autonomy, and cooperation. Indeed, according to our data, sampled organizations were diverse in IS organizational design. In particular, they varied in the way they blended centralization and decentralization. The information processing environment described by respondents was primarily a centralized operation in almost two-thirds of the organizations (65.6%). However, the trend seemed to be toward less centralized environments. Five percent of the respondents reported that their organizations had no centralized or corporate IS group. Accompanying this trend toward decentralized computing was the existence of IS groups in functional areas in 41% of the respondents' organizations. Of those organizations, the corporate IS group had direct control over the functional area IS groups in 42% of the cases. These findings were consistent with Keidel's framework, since creation of functional-area IS groups under the control of corporate IS may have reflected not only a recognition that cooperation was a third element in IS organizational design but also a way of coping with the control/cooperation dilemma. At least one organizational unit, formally assigned with the responsibility for managing information as a corporate resource, existed in 58% of cases (in 17% there existed more than one such unit). Fourteen percent of the respondents said their organizations employed an informal group (i.e., a group that accomplished these tasks without being formally assigned the corresponding responsibility). The rest, 28%, indicated that their organizations had no such group. This finding might be a further reflection of diversity among respondents' organizations in terms of the blending of autonomy, control, and cooperation.

The questionnaire listed twenty-seven goals characteristic of corporate information management. Respondents were asked to indicate the importance of these goals in their organizations, using a seven-point Likert scale with values 1

Table 2
Importance of Information Systems Goals

Goal	Mean Level of Importance
VERY IMPORTANT	
• Productivity Improvement	1.908
• Improved timeliness and reliability of corporate information	1.939
• Security and privacy of corporate information	1.965
• Improved quality and integrity of corporate information	1.978
• User involvement is critical	2.124
IMPORTANT	
• Quality user training	2.325
• Information system decision making influenced by corporate goals	2.490
• Systems Integration	2.490
• Location dependent data quality	2.505
• Information system decision making influenced by corporate goals	2.537
• Corporate-wide communications standards	2.629
• IS planning covering all technological platforms	2.736
• Corporate-wide integration of technology, functions and information	2.842
• Corporate-wide information processing standard	2.814

denoting very important and 7 very unimportant. Table 2 lists those goals considered important (mean < 3 and at least 50% of the responses = 1 / very important or 2 / important). The most important goals were productivity improvement; improved timeliness, reliability, security, privacy, quality and integrity of corporate information; and user involvement.

It is noteworthy that all goals classified as important or very important by respondents, user involvement in particular, were necessary conditions for cooperation between the user and IS organization. Productivity improvement and user involvement are usually related to the autonomy/cooperation dilemma of accountability versus synergy. Also, the goal of improved timeliness, reliability, security, privacy, quality and integrity of corporate information is usually related to the control/cooperation dilemma of consistency versus flexibility. Thus, in addition to the conventional control/autonomy dilemma, our data seems to reflect the two additional dilemmas involving cooperation.

Further analysis was conducted to determine which variables might influence perceptions about goals. The results of t-tests suggest that whether the respondent was a user or an IS professional made a significant difference with respect to their view of the importance of the goals ($p < 0.05$). Users attached a lower level of importance to maintaining a global view of data than did IS professionals. This finding may suggest with respect to the autonomy/control dilemma that users, when compared to IS professionals, were oriented more toward responsiveness through autonomy and less toward global perspective through control. Additionally, while for users ensuring that information systems mirror actual information flows was an important goal, IS professionals were neutral on this issue. This result seems to suggest that users and IS professionals varied in their views on the dilemma of control and cooperation. By attaching more importance, users seemed more oriented toward flexibility through cooperation, while IS professionals, by being neutral, seemed inclined toward consistency through control by the IS organization.

Organization size was found significant with respect to several goals in one-way analysis of variance with four groups (small, medium, large, and very large organizations). The importance of treating information as a corporate asset and a strategic weapon varied widely with organization size ($p < 0.01$). Small companies rated it as very important or important, medium companies rated it unimportant, while the large and very large organizations considered it somewhat important. This goal mainly implies control. However, without collecting more data in future research, it is difficult to logically interpret why the level of importance neither increased nor decreased as a function of company size.

The goals of maintaining the security and privacy of corporate data on microcomputers, using corporate goals to influence the choice of technology, and encouraging data sharing were found to be significantly related to organization size ($p < .01$). Respondents in medium-sized companies considered these particular goals to be significantly less important than other respondents. The main implications of these goals are related to cooperation. Once again, however, it is difficult to logically interpret the observed relation to company size without collecting more data in future research.

As for industry affiliation, the goal of establishing and enforcing information processing standards was considered very important in financial organizations and less so in electronics, computer and data processing companies ($p < .05$). Since the goal of enforcing standards is usually oriented toward control, this finding may suggest that financial organizations, whose use of information technology is more strategic and interorganizational, tended more toward control because they valued a global perspective and consistency.

In a further one-way analysis of variance (with three groups) regarding corporate information management goals, respondents were classified according to whether their organizations formally managed information as a corporate resource (Group 1), informally managed information as a corporate resource (Group 2), or were not involved at all (formally or informally) in managing information as a corporate resource (Group 3). For most goals, respondents in organizations in either Group 1 or 2 agreed on the level of importance. For example, the goal of improving the timeliness, quality, reliability, consistency, and accuracy of corporate information was very important to Group 1 and Group 2 organizations and somewhat important in Group 3 organizations. Likewise, Groups 1 and 2 organizations considered the goal of reducing data redundancy important, while Group 3 organizations were neutral about this goal. Note that all the goals thus differentiated are related to the blend between control, autonomy, and cooperation in corporate information management and in particular to dilemmas involving cooperation. Therefore, these findings seem to suggest that Group 3 responding organizations did not place as much value on incorporating cooperation into IS organizational design as did Group 1 and Group 2 organizations. This might be a reflection of a lesser dependence on IT or a lesser maturity in terms of IT use within Group 3 organizations.

Factor analysis was conducted with respect to respondents' ratings of goals and five factors representing them emerged. Based on the mean level of importance of constituent goals, the factors were divided into a primary category (two factors) and a secondary category (3 factors). Table 3 lists constituent goals for the primary factors and only reports the number of goals (items) allocated to each of the three secondary factors. The first primary factor involved productivity improvement, IS planning across all technological plat-

Table 3
Factors Representing the Goals of Information Management

Primary Goals of Corporate Information Management:

1. Ensure Data Systems Support of the Organization
   - Productivity improvement
   - IS planning covers all technological platforms
   - Systems integration
   - User involvement is critical
   - Information systems priorities integrated with corporate goals
   - Coordinating the use of shared data
2. Maintain High Quality Corporate Data
   - Improved quality and integrity of corporate information
   - Security and privacy of corporate information

Secondary Goals of Corporate Information Management:

1. Achieve Corporate-wide High Quality of Data (6 goals)
2. Establish and Enforce Policies (5 goals)
3. Make Data a Strategic Weapon (3 goals)

forms, systems integration, user involvement, integration of IS priorities and corporate goals, and coordinating the use of shared data. It is quite possible that these goals constitute the first primary factor because of their cooperation orientation. In other words, respondents seemed to have implicitly acknowledged the importance of cooperation in their goal ratings.

The second primary factor was concerned with maintaining corporate information for better quality, integrity, security, and privacy. It is noteworthy that while attaining the second primary factor usually implies a certain emphasis on control by the IS organization, some degree of cooperation between the IS and user organizations is usually also warranted. The three secondary factors deal with viewing corporate information globally, enforcing policies, and approaching information processing strategically. All these factors are closely related to the control and autonomy dilemma. For example, strategic information processing has often been associated with user innovation which presumes autonomy. The somewhat lesser rating of the secondary factors may suggest that the respondents placed higher value on cooperation-oriented factors and at the same time acknowledged the need to balance autonomy and control.

In addition to IS goals, the questionnaire also included a set of 20 statements, drawn from the literature [3,4,6,9, 23], about the potential impact of microcomputers. Respondents were asked to indicate their level of agreement with each statement using a seven-point Likert scale with values of 1 denoting strong agreement and 7 strong disagreement. Table 4 lists those impact statements the respondents agreed upon (mean < 3 and at least 50% of the responses = 1 / strong agreement or 2 / agreement). The three statements that ranked the highest in agreement were: microcomputer technology increases the complexity of the IS environment; distinction between personal and corporate information is important; and enforcement of standards becomes difficult when IS personnel have no clear line of authority over users. Not surprisingly, all three statements about which respondents tended to agree upon were autonomy oriented. However, usually these statements are also related to cooperation. Cooperation may help simplify the IS environment, it may facilitate the distinction between personal and corporate information, and may enable the enforcement of standards.

There was only slight agreement regarding the following impact statements: microcomputer use results in a decentralized information processing environment for the organization; the IS department should support any hardware and software that users use; users should only use the hardware and software on an organizationally approved list; personal data is outside the domain of corporate control; microcomputer use complicates the task of maintaining links between information systems and the overall corporate plan. This slight agreement would have been surprising for organizational design with emphasis on either control or autonomy. For example, control-inclined organizations might ignore cooperation and tend to force users to use only hardware and software on an organizationally approved list. On the other hand, autonomy-inclined organizations might ignore cooperation and require the IS department to support any hardware and software that users choose to use. However, the incorporation of cooperation into organizational design can help explain the slight agreement observed. For example, when organizations pay attention to cooperation between the user and IS organizations, exceptions to an organizationally approved list of hardware and software might be tolerated and even encouraged under special (e.g., innovative) circumstances but, at the same time, the IS department would not be expected to support all hardware or software on a users' wish list.

Disagreement was observed regarding the statement: centralized data storage as a mechanism for coordination and control is not viable in today's information processing environment. This disagreement might be interpreted as supportive of Keidel's assertion that overemphasizing a single variable (in this case, control) to a point that the other variables (in this case autonomy and cooperation) are neglected, is bound to fail. The respondents might have realized that control

Table 4
Impact Statements that Rated a High Level of Importance

Impact Statement	Mean Level of Importance
STRONG AGREEMENT	
• Microcomputer technology increases the complexity of the IS environment	2.263
• Distinguishing between personal and corporate information is important	2.429
• Enforcement of standards and achieving user adherence to standards is difficult when IS personnel have no line management control of users	2.495
• Users are knowledgeable about information processing	2.545
• Users take responsibility for data quality assurance	2.566
• Users are accountable for compliance with data quality standards	2.694
AGREEMENT	
• Adherence to corporate information processing policies improves the ability of users to communicate	2.814
• Motivation for microcomputers use facilitates information processing autonomy	2.899
• Adherence to corporate information processing policies improves user productivity	3.010

alone is not viable and therefore disagreed with this statement.

In one-way analysis of variance with respect to the impact statements, a relationship with industry classification was observed ($p < .05$). More respondents from service organizations, as distinct from respondents in other industries, thought that users should not be restricted to an organizationally approved list of technology and that the IS department should support all hardware and software. This finding may suggest that service organizations are more autonomy oriented. However, it is difficult to logically interpret the exceptional importance rating given by respondents from service organizations without collecting more data in future research.

Another significant variable was organization size. Respondents in medium-sized organizations had a perspective on impact statements that differed from the rest of the sample ($p < .01$). While the majority of the respondents expected users to become more accountable for adherence to standards, those from medium-sized firms held no such expectation. They also attached more importance to centralized data storage as a mechanism for coordination than did other respondents. Again, however, it is difficult to interpret the exceptional importance rating by respondents from medium-sized companies without collecting more data in future research.

Factor analysis on the twenty impact statements yielded eight factors. These are listed in Table 5 with an indication of how many items loaded on each factor. Several items loaded on more than one factor. The eight factors could be interpreted as closely associated with Keidel's organizational geometry. Factors that could be viewed as inducing an autonomy emphasis were: the second — the greater autonomy that users have in information processing; the fourth — user accountability; and the seventh — user greater responsibility. Factors that could be viewed as inducers of a control emphasis were: the third — the need for corporate information systems standards; the fifth — the need for control and coordination in the presence of microcomputers; and the last — improved productivity and communication by adherence to standards. Factors that could be viewed as inducers of a cooperation emphasis were: the first — the increased complexity of the information processing environment and the sixth — enforcement of standards.

Finally, the critical incident technique [4] was employed. Respondents were asked to describe incidents associated with microcomputer use that had a significant effect on the information processing environment. Thirty-three of the subjects described critical incidents, but, of these, eight were rejected because respondents did not recall a specific incident. The findings were consistent with the results of the factor analysis on impact statements. Thus, despite the low response rate, it is safe to assume that the responses to the critical incident portion of the questionnaire were representative. The two most prevalent incidents (see Table 6) were closely related to Keidel's two-way dilemma between cooperation and control. The first incident, concerning user demand for greater computing flexibility, was related to the flexibility

Table 5
Results of Factor Analysis on Impact Statements

Factor 1:	
• The information processing environment is more complicated.	(4 Impact Statements)
Factor 2:	
• Users have greater autonomy in information processing.	(3 Impact Statements)
Factor 3:	
• Corporate information processing standards are needed for sound application of microcomputers.	(2 Impact Statements)
Factor 4:	
• User accountability must accompany microcomputer use.	(3 Impact Statements)
Factor 5:	
• Control and coordination are needed in the presence of microcomputers.	(2 Impact Statements)
Factor 6:	
• Enforcement of information processing standards is complex in the presence of microcomputers.	(3 Impact Statements)
Factor 7:	
• Users assume greater responsibility for their computing environments.	(3 Impact Statements)
Factor 8:	
• Adherence to corporate information processing standards improves user productivity and communication.	(3 Impact Statements)

that is inherent in the cooperation. The second incident, concerning standards and control issues that arise regarding use of hardware, software, and data, was related to the consistency that is inherent in control. The remaining three incidents, concerning the more complex information processing environment that must be managed by IS professionals, the improper use of corporate information and resistance to microcomputer technology, provided further support for the need to explicitly account for cooperation in today's IS environment.

CONCLUSION

Our results are predicated by the fact that the use of information technology by responding organizations was fairly mature at the time of this study. Whereas in studies conducted during the introduction and initiation of microcomputers, a key reason cited for using microcomputer tools was dissatisfaction with the IS function in an organization, that did not appear to be the case in this study. Instead, the desire for increased productivity, and the availability of technology were the main motivating factors. Thus, our data

Table 6
Results of Critical Incident Analysis

1. Users demand greater computing flexibility	(6 Incidents)
2. Standards and control issues arise regarding use of hardware, software and data	(6 Incidents)
3. IS personnel must manage a more complicated information processing environment	(4 Incidents)
4. Improper use of corporate data	(4 Incidents)
5. Resistance to microcomputer technology	(3 Incidents)

reflects mature application of microcomputer technology by users, and also finds the IS function at a relatively mature phase. One indicator of maturity was the relatively high placement of the most senior IS person in most respondents' organizations. This finding suggests that the sampled organizations were veteran users of information technology. Other indicators of maturity were the IS planning process and the extent to which it was integrated into overall corporate planning. In nearly all of the organizations studied, comprehensive IS planning was incorporated to some extent into corporate planning. The data also shows evidence of maturity in the interaction between users and IS professionals. Whereas in the past, control of the information resource had been totally in the hands of IS professionals, the study showed that with the adoption of microcomputer technology users began to exercise more autonomy in information processing. Both types of respondents, users and IS professionals alike, seemed to be aware of the increased complexity of the IS environment and its impact on the tension between autonomy and control. Their responses also implied an awareness of the need for cooperation between the IS and user organizations. Cooperation was evident in the importance placed on joint planning and joint establishment of policies and procedures regarding hardware, software, and data quality.

Thus, consistent with the Keidel Framework, the organizations that responded to our questionnaires were beginning to look at cooperation as a way of relieving the tension between control and autonomy. However, the data also suggests that, at best, attention paid to cooperation was informal and implicit and that in most cases explicit attention focused more on control and autonomy. Examples of explicit attention to control could be found in the high importance attached to the goals of maintaining mainframe data and broadening the structure for IS management to increase control and to incorporate all information technologies in use in the firm. Similarly, examples of an explicit focus on autonomy could be found in the high importance attached to the goal of redesigning the IS management structure to incorporate greater user autonomy and accountability. However, several goals that were related to cooperation received a lesser rating of importance: maintaining a global view of corporate data, reducing redundancy, coordinating sharing, assigning and measuring the value of information, and extending privacy and security controls to the personal computing environment. Thus, although the need for cooperation was acknowledged by the respondents, it appears as if specific explicit mechanisms for achieving cooperation were still lacking.

We searched the literature and were unable to find formal applications of Keidel's design triangle framework in the IS context. However, the data suggests that IS practitioners seemed to be moving in the right direction. First, most of the responding organizations had a group responsible for the management of information as a corporate resource, thereby encouraging cooperation. Since slightly less than half of these organizations created such a group before the introduction of microcomputers, user autonomy was neither a trigger for cooperation nor a deterrent. Second, whether the respondent was a user or an IS professional was uncorrelated with the level of agreement with impact statements. Thus, perceptions about IS management seemed to be consistently held. In particular, respondents of both types seemed to be in favor of cooperation on the comprehensive management of all corporate data. Both these observations indicate readiness for cooperation.

This study provided preliminary confirmation that the Keidel's framework is applicable in the IS context. Based on the study it is possible to offer suggestions for further implementation of the framework by IS practitioners. Of top importance is awareness that in today's computing environment control of data can no longer be achieved only through control of the corporate databases stored on mainframe computers and used by IS personnel. The emergence of microcomputers and their users presents a fundamental challenge, not so much to the goals of corporate information management but to their scope and the means by which these goals could be achieved. The question is not only how to effectively balance centralized management of corporate data. In light of our findings, the scope of this question should be broadened to consider, as suggested by Keidel, the formal incorporation of cooperation into IS organizational design. Three specific management initiatives could help organizations to explicitly pay attention to cooperation:

1. Promote greater use of data sharing and communication-based applications through incentives and policies that are jointly developed and sponsored by users and IS professionals.
2. Map responsibilities with respect to systems and data, while distinguishing between personal, functional-area, and corporate data.
3. Encourage users' increasing involvement in IS planning by formulating joint planning forums, and educate users for greater accountability and adherence to standards and controls.

Since our study is rather preliminary, it is possible to offer suggestions for further work on Keidel's framework by IS researchers. Future studies could research in more depth Keidel's assertions that autonomy, control, and cooperation represent three different dilemmas involving tradeoffs between:

1. local responsiveness and global perspective
2. consistency and flexibility
3. accountability and synergy.

Future studies might also help determine whether, in the IS context, some blends are more likely to succeed (e.g.,

blends that are dominated by a single lead variable or are characterized by a near symmetrical balance between two of the three variables) while others are doomed to fail (e.g., trying to maximize all three variables at the same time in equal measures or overemphasizing a single variable to a point that the other two are neglected). Finally, such research effort should also recommend ways for organizations to make a transitional evolution through a series of transitions until the target effective blend is reached.

Last but not least is paying attention to the dynamic nature of the IS environment. From a research perspective it is important to remember that the preliminary findings of this study must be periodically questioned by additional studies to find out how the increased complexities of information processing environments impact IS organizational design. Also, it is important for both practitioners and researchers to realize that a certain blend of cooperation, autonomy, and control will most probably not remain effective for ever. Further research might therefore be undertaken in order to develop recommendations for practitioners about coping with the dynamic nature of IS organizational design. Thus, the expected outcome of future research has to do not only with identifying working and non-working blends along Keidel's triangle, but also the mechanisms for coordination and adjustment over time. The world of information processing has evolved to contain a range of technologies, applications, and personnel, as well as a wide diversity in terms of hardware, software, data, and computing personnel location. The key challenge for IS researchers and practitioners is to effectively blend cooperation, autonomy, and control and to keep monitoring the effectiveness of the blend for possible adjustments as needed.

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APPENDIX: SAMPLE QUESTIONNAIRE QUESTIONS

Background questions (first type)

- Your organization's annual sales/revenues for the last fiscal year:
  - ___ Less than $50 Million
  - ___ Between $50 and $250 Million
  - ___ Between $250 and $750 Million
  - ___ Over $750 Million
  - ___ Don't Know
- The most appropriate industry for your organization:
  - ___ Banking and Financial
  - ___ Computer, Electrical and Electronic
  - ___ Education, Consulting
  - ___ Government, Public Utilities
  - ___ Insurance
  - ___ Manufacturing and Processing
  - ___ Sales and Distribution
  - ___ Service (Data Processing)
  - ___ Service (Non-Data Processing)
  - ___ Telecommunication
  - ___ Other, please specify:
- How long have microcomputers existed formally in your organization?
  ___ Years ___ None formally exist ___ Don't know
- What kinds of microcomputer applications are used at your organization? Check ALL that apply.
  - ___ Personal support (e.g., calendars)
  - ___ Word processing, graphics and presentation support
  - ___ Electronic mail and teleconferencing
  - ___ Downloading data from a mainframe to a microcomputer
  - ___ Uploading data from a microcomputer to a mainframe
  - ___ Sharing data (e.g., local area network)
  - ___ Developing spreadsheet based applications
  - ___ Using database management systems and fourth generation languages

___ Decision support and planning applications
___ Statistical and computational applications
___ Information retrieval from external databases
___ Other, please specify

- Which types of technology are used by users in your organization? Check ALL that apply.
  ___ Mainframe computer
  ___ Personal computer connected to a mainframe
  ___ Networked personal computers
  ___ Stand-alone personal computers
  ___ Don't Know

Research agenda questions (second type)

- The degree of IS centralization (i.e., the extent of control by the formal IS group) today and five years ago:
  Today:

Primarily Centralized			**Balanced**			**Primarily Decentralized**			**Don't Know**
1	2	3	4	5	6	7			9

  5 Years Ago:

Primarily Centralized			**Balanced**			**Primarily Decentralized**			**Don't Know**
1	2	3	4	5	6	7			9

- What is the relationship between the corporate IS group and the IS groups in the functional areas (e.g., Marketing, Finance etc.)?
  ___ The functional areas do not have a formal IS group
  ___ There is no central corporate IS group
  ___ The corporate IS group has direct control over the functional area IS groups
  ___ There is no control relationship between the corporate and functional area IS group
  ___ Don't know
- Does your organization have a group that is responsible for managing data and information as a corporate resource?
  ___ Yes, a single formal unit
  ___ More than one such unit exists
  ___ Information resource management is done informally
  ___ No
  ___ Don't Know
- To what degree is IS planning incorporated into the overall corporate planning process?
  ___ Completely
  ___ Partially
  ___ Not at all
  ___ No formal corporate planning process
  ___ No formal IS planning
  ___ Don't Know
- Which of the following were significant reasons for the introduction of microcomputers at your organization? Check ALL that apply.
  ___ The unresponsiveness of the IS Department
  ___ The process of satisfying requests takes too long
  ___ Because our competition is doing it
  ___ To get more computing power for the money
  ___ To have greater local control over our data
  ___ Other, please specify

- For the following information systems goals and activities, please indicate the importance placed upon them in your organization by placing a number on the line preceding the statement. Use the following scale:

Very Important			Neither			Very Unimportant	Don't Know
1	2	3	4	5	6	7	9

___ Managing the quality, integrity and accessibility of data on the organization's mainframe computer
___ Managing the quality, integrity and accessibility of data on the organization's computers regardless of size or location
___ Reducing redundancy of data
___ Improving the timeliness, quality, reliability, consistency and accuracy of corporate information
___ Maintaining a global view of the corporate data
___ Separating the management of data from the management of technology
___ Treating information as a corporate asset and/or competitive weapon
___ Making sure that information systems mirror actual information flows in the organization
___ Achieving the integration of technology, functions and data across departmental and divisional lines
___ Establishing and enforcing information processing standards
___ Classifying data according to its criticality to the success of the company
___ Establishing appropriate cost/benefit measures of information
___ Developing information processing, access and dissemination policies
___ Improving productivity
___ Having a corporate IS plan which includes both mainframe computers and microcomputers
___ Achieving systems integration
___ Viewing the user's role as critical in the determination of a system's success
___ Using corporate goals to influence the selection and use of technology
___ Providing good training for users
___ Relating information system priorities to the overall goals and objectives of the corporation
___ Having an explicit IS planning process
___ Encouraging data sharing
___ Coordinating the use of shared data
___ Maintaining the security and privacy of data in mainframe computers
___ Maintaining the security and privacy of data in the microcomputers
___ Having the most senior information systems executive be no more than two levels below the CEO

- For the following statements, please indicate your degree of agreement by placing the appropriate number on the preceding line. Use the following scale:

Strongly Agree			Neutral			Strongly Disagree	Don't Know
1	2	3	4	5	6	7	9

___ From a personnel and facilities point of view, use of microcomputers results in a distributed data processing configuration for the organization
___ From a personnel and facilities point of view, use of microcomputers results in a decentralized data processing configuration for the organization
___ With the introduction of microcomputers, more the responsibility for the dissemination and enforcement of standards shifts from the IS group to functional areas
___ Centralized data storage as a mechanism for coordination and control is not viable when microcomputers are used
___ Users are becoming more accountable for adherence standards
___ The enforcement of standards becomes more difficult when there is no clear line of authority between the users and the IS organization
___ Distinguishing between personal and corporate data is important in the establishment of information processing policies and standards
___ Personal data is outside the domain of corporate control
___ Data quality assurance becomes more difficult when microcomputers are used

___ The cost of implementing planning and control mechanisms is shared by the IS and the user departments
___ Costs associated with managing the use of microcomputers environment are more difficult to justify because the benefits are harder to see
___ The increased number of options for data access, processing and sharing when using microcomputers results in a more complicated information processing environment
___ Users believe that rules handed down to them from the IS organization interfere with accomplishing the task at hand
___ Users believe that the IS organization should support any hardware and software that they decide to use
___ The motivation for microcomputer use is user desire for more personal control over information processing
___ The education of users has expanded to include not only functional skills but knowledge about access to and appropriate use of data.
___ Microcomputer use complicates the task of maintaining links between the IS and the overall corporate plan
___ Users should only use the hardware and software on organizationally approved list
___ In general, information processing policies increase the productivity of users
___ In general, information processing policies increase the ability of users to communicate

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