

THE MANAGEMENT OF
DISTRIBUTED PROCESSING

by

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The environment of the information-systems manager has evolved significantly in the past three decades. Ever cheaper hardware, vastly more powerful systems software, and an expanding appetite for computer support on the part of the functional managers has increased the information systems manager's realm of responsibility steadily. The data processing department has grown in numbers and in influence. The major operating environment has shifted from batch to on-line. From a start in simple accounting-type record-keeping applications, the I/S manager now oversees real-time operations whose interruption can cost the corporation dearly.

Something has happened to this pleasant progression recently. The Vice President, Management Information Systems, of a major corporation puts it this way: "Yes, the data processing environment has changed steadily. But somehow the last three years have been different. Everything has snowballed. All the trends have accelerated. Most significantly, some new ones (minicomputers, end-user languages, et cetera) have been added and these are threatening to move us from a nice tight, controlled operating environment (at which we've just barely arrived!) into a decentralized, dispersed era in which the managerial approaches, techniques, and tools which have been so painfully developed and implemented in the past few years appear inadequate. More important, in some cases, is that our current managerial methods appear just plain wrong for the future. It seems to me that distributed hardware, increasing user-oriented programming, soaring software costs, and soaring demands by users require, if not a whole new managerial approach, at least a thorough review of the way in which we manage in 'the distributed era'."

This article reports on the highlights of a two and a half day conference convened to examine the new information systems environment and its implications for information systems management. Held at MIT's Endicott House in Dedham, Massachusetts, the conference was jointly sponsored by the Center for Information Systems Research of MIT's Sloan School and Arthur Andersen & Co. It was designed to surface and discuss the major managerial issues associated with the increasing distribution of computing resources.

Early in the conference (part of an ongoing series of conferences initiated by Sloan and Arthur Andersen to discuss major information systems issues) the "new environment" was summed up as caused by four major factors. These are:

- the increasing acceleration in price decrease and variety in available hardware. This has made computer solutions increasingly attractive for all jobs (clerical replacement, decision assistance, et cetera). In addition, the minicomputer has become a very viable and attractive vehicle for distributed, localized data processing needs.
- the increase in computer literacy among computer systems users. Coupled with some apparent user rebellion against existing hardware centralization policies, this has led to a strong demand for distributed systems.
- the increasing user demands for data processing. This increased demand has been not only for traditional transactions processing systems, but also for higher level requirements such as managerial information for operational monitoring, planning, and decision support needs.

It has led to huge backlogs for central systems organizations and has forced, in many cases, the increasing decentralization of systems development personnel.

- the increasing complexity of the information systems managerial environment. All of the above factors have led to vastly larger operations spread more widely throughout the corporation. In addition, product selection must be made from an increased number of hardware and software vendors with a much larger number of products. Users are now involved in systems selection and managing of data processing personnel. Therefore, problems of scale, an exploding technical environment, dispersion of resources, and increased organizational interactions abound.

The conference was attended by twenty-nine participants as noted in the list at the end of the article. Nine participants (noted by asterisks in the listing) made presentations concerning their approaches to various aspects of the management of information systems in today's environment. A major share of the conference time, however, was spent in group discussion of many of the issues which arose and which are noted in three major categories in Exhibit 1.

Twelve of the twenty-nine participants held the primary responsibility for the information systems function in their organizations, their titles ranging from "Executive in Charge of Information Systems" to "Data Processing Director." Eleven other participants were senior data-processing professionals holding a variety of staff and line functions. The remaining six participants were evenly divided between Arthur Andersen & Co. partners from the Administrative Services Division and faculty and staff from the Center for Information Systems Research at the Sloan School.

EXHIBIT 1

ISSUES

Technical Issues with Managerial Implications

Design and control of the network

Technological constraints on decentralization (e.g., Cobol)
(Software Support)

Hardware and software maintenance issues

Reliability of the database

Incompatible databases

Human Issues

Career path problems

The DP professional -- unfreezing -- giving up control
-- care and feeding

The travel burden on DP professional staff

Changing personnel needs (more staff skills)
(also a Management Control issue)

Ensuring user relationships
(also a Management Control issue)

Management Control Issues

Ineffective use of the computer resource
-- cost implications

Common systems

Quality and auditability of centralized/decentralized systems

Vendor "control"

Impact of (1) micros
(2) office automation

Corporate database, executive information (how developed)

Matrix management -- potential problems

Control over:
-- planning
-- projects
-- budgets
-- priorities

Management philosophy and the effect on DP

Interestingly, of the twenty-seven participants providing biographical data, only eleven considered themselves to have had "essentially an information systems career." In relation to job history, the twenty-seven were divided in the following manner:

- Essentially I/S career 11
- Essentially other managerial function career 4
- Mixed computers and other jobs 12

These statistics illustrate the increasing tendency to have top information systems positions held by people with general management experience. Strikingly, of the four with "essentially other managerial function" careers, three now hold the top information systems position in their companies.

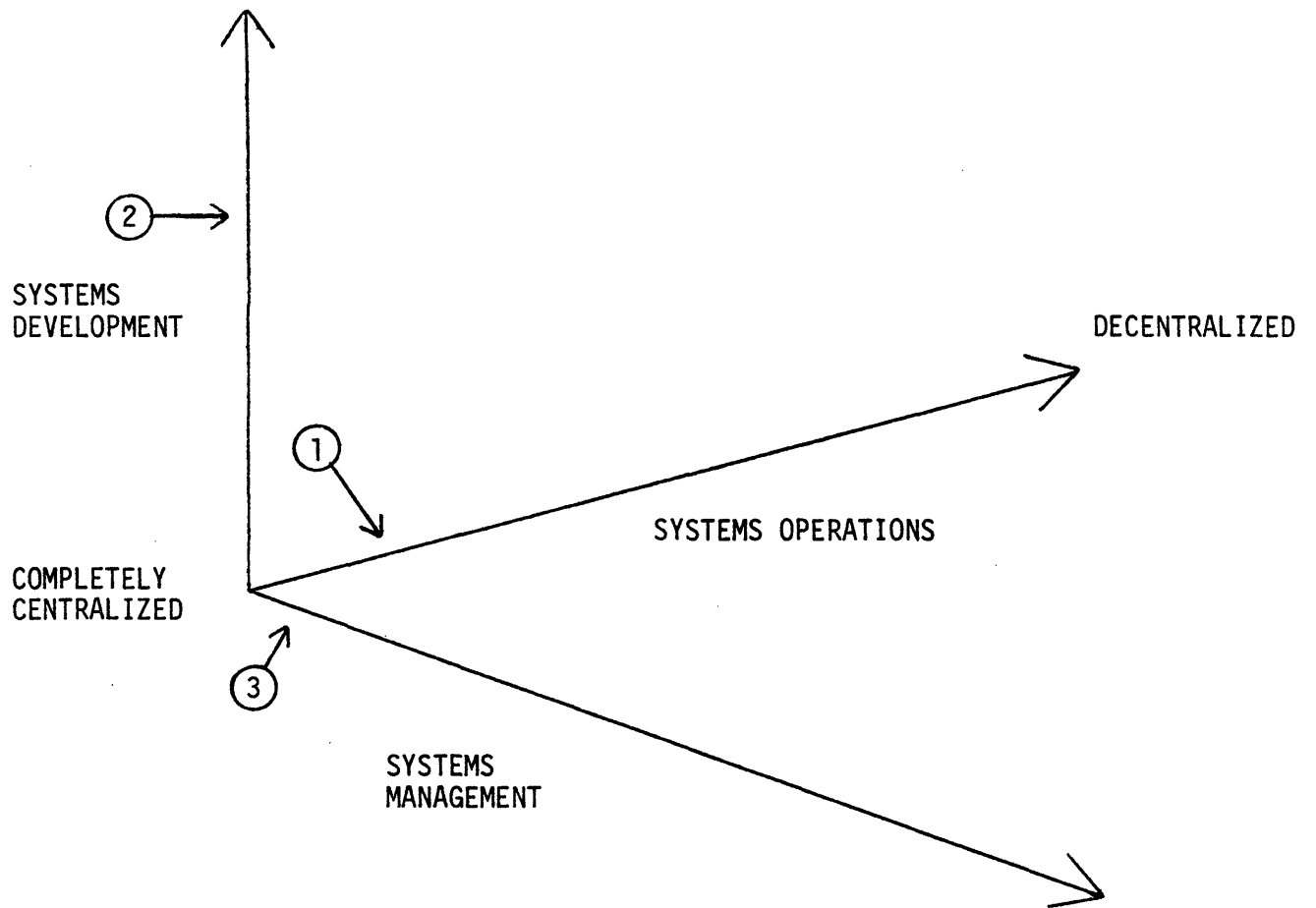
Although there were some who disagreed on the degree or the speed of the change taking place, most concurred that the information systems function was in transition from traditionally centralized data processing to an increasingly distributed processing environment. This change has been characterized by an experimental and pragmatic approach on the part of many companies. The conference was aimed at exploring successful approaches to many of the issues, but was equally concerned with defining the issues and noting those areas in which increased knowledge must be gained.

A Framework For Analysis Of Centralization and Decentralization

In discussing centralization or decentralization of the computing resource, there are three major dimensions (noted in Exhibit 2) which must be considered. The first is the centralization, distribution, or decentralization of operations. It is this dimension which is most discussed. Toward

EXHIBIT 2

Dimensions of Centralization/Decentralization



the centralized node, an organization can be "completely centralized"--with all its computing in one major installation--or "essentially centralized" with computing placed in two or three locations for reasons of security, size, et cetera. ("Essentially centralized" organizations include companies who have major divisions in the billion-dollar-plus category. Each division has its own computing establishment usually with the equivalent of multiple IBM 370/168s.) On the other end of the equipment dimension are totally decentralized companies with each suborganization having its own small unconnected computer. Many intermediate points exist on this dimension. For example, a company which is essentially centralized but has a few minicomputers doing specialized jobs can be shown on this dimension as noted in Exhibit 2 by the arrow marked "1."

The second dimension on which an organization can either centralize or decentralize is the dimension of "systems development." This dimension involves the use of human resources to design, program, test, implement and maintain systems. Again, all of this can be done by a central systems design and programming staff. Alternately each sub-organization can have its own "decentralized" data processing, systems development, and programming personnel. An organization in which some common systems are developed by central personnel staffs, but in which other development is done at local sites, would be shown mid-way on the systems development line as noted by arrow marked "2" in Exhibit 2.

The third data processing function which can be either centralized or decentralized is the "management control" function. In this function are included all the processes of standard setting, resource allocation, and data processing decision-making which are pertinent to the allocation and management of the human and capital resources which make up the

data processing function. Included among these tasks are the choice of hardware standards, the choice of software standards, development of a project management system, the control of data processing projects, planning for data processing, decisions on database standards and the actual content of the database, the choice of the projects which are to be implemented in the forthcoming budget period, and so forth. A company in which a central group performs hardware selection, sets software standards, and rules on which systems must be "common systems," while perhaps allowing user organizations some limited managerial power, such as the ability to prioritize their own systems projects, would be shown near the origin of this dimension as noted by arrow "3."

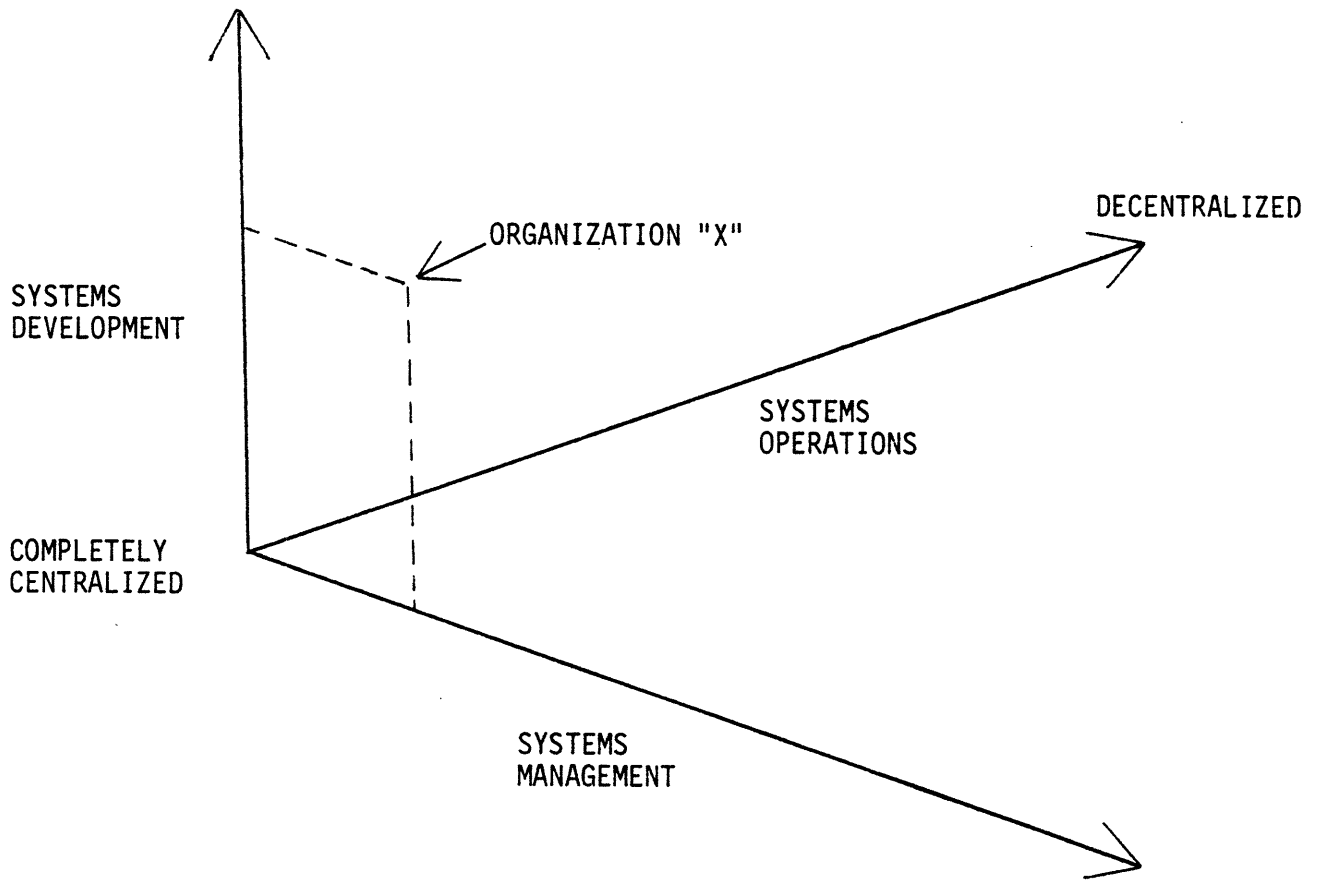
As noted in Exhibit 3, the posture of any particular organization with regard to centralization/decentralization can be graphically shown utilizing these three dimensions. Organization "X" as shown has centralized hardware, distributed system development and a heavily centralized managerial process for information systems. This three-dimensional conceptual approach is discussed more fully elsewhere.¹

Participant Actions With Regard to Centralization and Decentralization

The participant companies were asked to locate themselves on this diagram as they "essentially exist" at present. They were then asked to note their "current direction" in regard to all three dimensions. With regard to the management control dimension, all but one saw themselves as being reasonably close to the centralized pole or moving essentially in that direction. Several participants felt that they were under increasing pressure by user organizations to yield some of the management control functions, but felt that most of these responsibilities would ultimately reside in a centralized information systems function.

One organization, however, was aggressively decentralizing the process of information systems management. A participant from this organi-

EXHIBIT 3



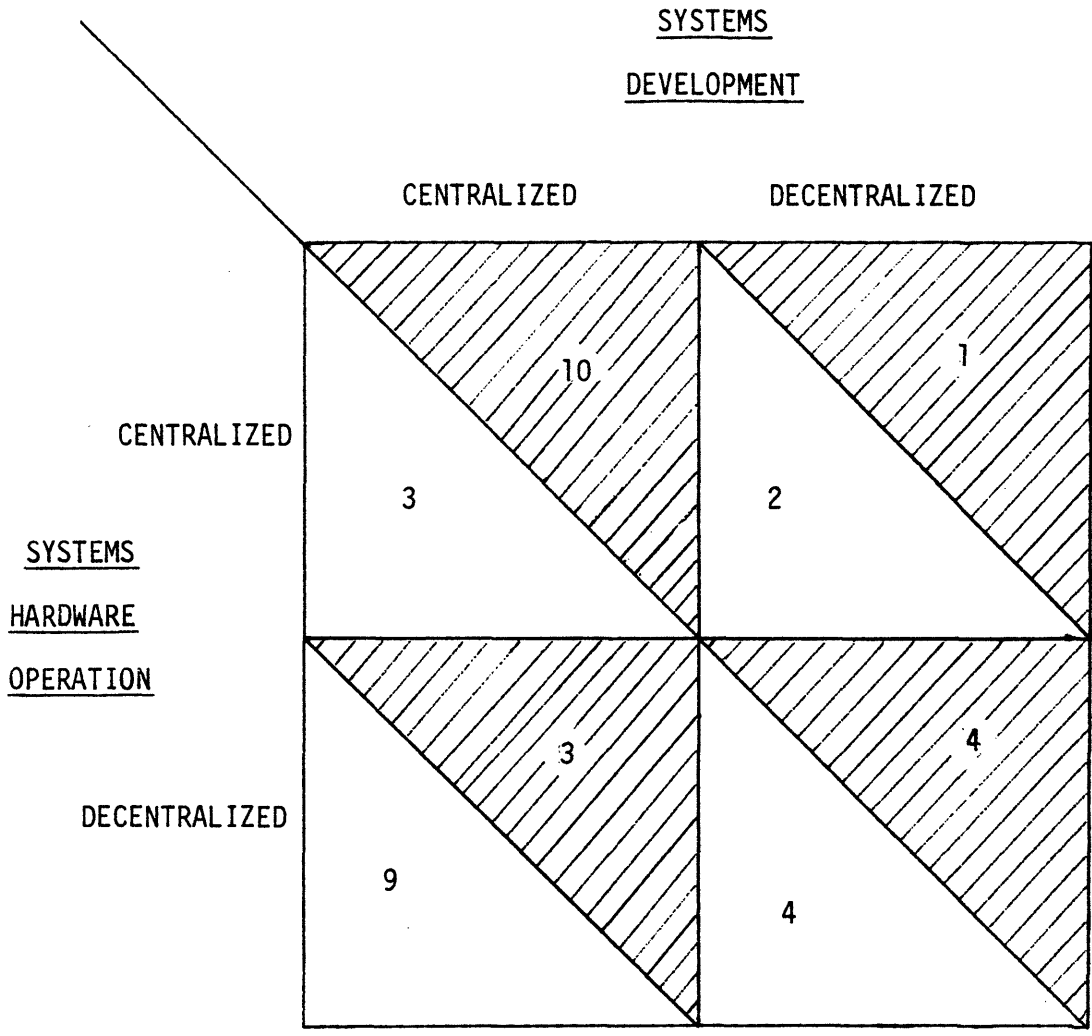
zation noted a rapid movement of most management control functions from centralized to an increasingly decentralized basis. This was occurring as the organization itself was changing from what had been, in essence, a single integrated firm to a multi-division, decentralized structure.

Although at the time of the conference hardware and systems development were done on a centralized basis, the right to initiate and manage local data-processing resources had already been turned over to the divisions.

Exhibit 4 provides a summary of the participants' replies for the direction of movement of centralization/decentralization of the other two dimensions (hardware and systems development). The upper right (shaded) half of each cell shows the current status of each of the eighteen companies reporting with regard to the centralization or decentralization of these activities. The lower part of each cell notes the number of companies whose "current direction" is as noted in each cell. The major switch implied in this matrix is apparent. Whereas ten companies of the eighteen currently see themselves as essentially centralized with regard to both hardware and systems development, only three see this as their current direction. The majority of these companies are moving toward decentralization of hardware as shown in the lower left cell of the matrix. While only three companies currently have decentralized hardware with essentially centralized systems development, nine companies are moving in this direction.

While the facts underlining each company's current status and direction of movement are interesting, the matrix itself tends to under-emphasize the amount of change currently taking place. For example, one of the three companies whose current practice is in the lower left cell is not one of the nine companies whose current direction is indicated in

EXHIBIT 4
CURRENT STATUS AND DIRECTION OF MOVEMENT
OF SYSTEMS DEVELOPMENT AND COMPUTING
OPERATIONS IN PARTICIPANT COMPANIES



KEY

- Current Status
- Direction of Movement

that cell. In fact, it has moved to the upper right to join another company "coming in from the upper left." The sole company now in the upper right hand cell is moving to the lower left.

Some Comments on "Current Directions"

Extensive discussion of each company is inappropriate in this short article. However, this and the following paragraphs comment briefly on the "current direction" being taken by these companies--since we believe they are representative of the diverse directions being taken by other companies throughout the nation. Three companies are noted as moving to essentially a centralized direction for both hardware and systems development. Of these, two are major companies which are essentially centralized at very large divisional centers. The third is an educational institution, the bulk of whose administrative computing and systems development is handled on a central basis.

Most of the nine companies moving to decentralized hardware with centralized systems development are companies who previously had centralized hardware. Many of them are moving increasingly toward decentralizing hardware for new applications while maintaining the efficiencies of centralized systems development. Two companies in this cell, however, are multidivision companies moving (albeit haltingly and with some difficulty) to this position from one in which both operations and systems development had been decentralized. These companies explain that they are seeking the economies of increasingly centralized "common" systems development while trying to avoid what they believe to be the inefficiencies of too large a scale in hardware operations.

The four companies moving to decentralize both functions are the "liberals" in our sample. They include two banks and two other companies

who are attempting to move both operations and more data-processing resource development personnel out to user organizations. All four organizations believe that "local" control over the building and running of data-processing systems will ultimately be less expensive than centralized development and operations. But the major reasons for this direction concern the ability under decentralization to tailor systems to real user needs and to develop systems in accordance with user priorities without central bottlenecks. (All four, however, are currently attempting to maintain or build a strong central management control function, some as a result of previous poor experience with also decentralizing the systems management function.)

Of the two companies in the upper right hand cell moving to centralized operations with decentralized systems development, one already has a centralized hardware facility but is transferring systems development responsibilities to user organizations. The other is moving from a previously centralized systems and programming group to a perceived need decentralized one while going in exactly the opposite way with regard to hardware. It is currently in the process of centralizing hardware from many installations to one or two major centralized locations.

The conference participant companies, therefore, represented an interesting mixture with regard to both current status and current direction. Many variables (including organization structure, a perceived need for increased efficiency in computing, the desire to couple managerial responsibility with authority over resources, the availability and capability of management, the desires of top management, and so forth) were noted to be motivating the current status of each company. No single factor emerged as predominant in determining future plans.

Overall, the replies summarized in the matrix suggest a decided turn to decentralized or distributed hardware with very little overall shift in the current position of centralized systems development. This tends to recognize today's need to efficiently manage the increasingly expensive segment of the DP budget--the development and maintenance of systems. Thus while many organizations are tending to decentralize the increasingly less expensive hardware, they are keeping control over software expense by centralized management which will presumably perform the function in a more expert and more efficient manner. Six of the eighteen organizations, however, are moving against this trend in the belief that it will be more effective, and perhaps ultimately more efficient, to have software developed by local managers to fit their particular needs.

Today's Important Issues

Toward the end of the conference, each participant was asked to indicate the issues noted in Exhibit 1 which he or she felt were of particular importance. In addition, each was asked to rank the issues selected in order of importance. Twenty-two of the participants responded.

The responses were scored in two ways. One ranking was a simple count of the number of times each issue was noted, regardless of rank of importance. This count is shown in Exhibit 5, Column 1. Column 2 presents the rank order of the issues scored in this manner.

As Exhibit 5 shows, all twenty-three issues were noted by at least one participant. Only 5 issues, however, were noted on more than half of the questionnaires. These five (management philosophy, management control, the corporate database, insuring user relationships, and

EXHIBIT 5

TWO RANKINGS ON THE SIGNIFICANT ISSUES

FACING INFORMATION SYSTEMS MANAGEMENT TODAY

	<u>1</u> <u>TIMES</u> <u>NOTED</u>	<u>2</u> <u>RANK</u>	<u>3</u> <u>WGHTD</u> <u>RANK</u>	<u>4</u> <u>WGHTD</u> <u>SUM</u>
<u>Technical Issues with Managerial Implications</u>				
Design and control of the network	12	4		7
Technological constraints on decentralization (e.g., Cobol) (Software Support)	4			3
Hardware and software maintenance issues.	3			
Reliability of the database	3			3
Incompatible databases.	10	6		
<u>Human Issues</u>				
Career path problems.	8			3
The DP professional -- unfreezing -- giving up control. . . . -- care and feeding	5		6	8
The travel burden on DP professional staff.	1			
Changing personnel needs (more staff skills). (also a Management Control issue)	9			1
Ensuring user relationships (also a Management Control issue)	15	3		6
<u>Management Control Issues</u>				
Ineffective use of the computer resource. -- cost implications	9		3	10
Common systems.	10	6	5	9
Quality and auditability of centralized/decentralized systems	9			1
Vendor "control".	2			
Impact of (1) micros. (2) office automation	5 7			2
Corporate database, executive information (how developed) . .	12	4	3	10
Matrix Management -- potential problems	6			6
Management control over planning, budgets, projects and . . . priorities	17	1	2	28
Management philosophy and the effect on DP.	17	1	1	35

design and control of the network) are clearly all significant issues--and each received conference attention.

A second ranking was aimed at determining which issues were of most concern to the managers involved. In this ranking, only the first three issues noted by each participant were considered. Those ranked as most significant were given a weight of three; those second, a weight of two; and those third, a weight of one. The sum of the weights thus given to each issue is noted in Column 4, Exhibit 5. Column 3 shows the rank order of issues as developed in this matter.

The two ranking systems (one giving weight to the absolute number of times that an issue is mentioned and the other emphasizing the primary concerns of the participants) produced somewhat dissimilar results. The first two issues (management philosophy and management control) are the same in both ranking mechanisms. There was little doubt during the conference discussion that they deserve these rankings. Two other issues of general concern (the corporate database and common systems) also appear in the top six of each list. Under the priority-weighted scheme, however, two new issues make the top six. These are "ineffective use of the computer system" and the "unfreezing of the DP professional" (his or her willingness to give up some resource control). This last issue needs special comment. It is high on the weighted list, but far down on the unweighted list--suggesting that the few who see this as an important issue are heavily concerned with it. (This squares with our general experience that there are a few major installations where data processing professionals have become major obstacles to change today.) Using the reverse logic, "insuring user relationships" was seen as a significant issue by almost three quarters of the participants--but ranked near the top of the list of very few. This issue is thus seen as important by most, but is not a "life or death" issue to anyone at this time.

Discussion of Critical Issues

This section notes several of the major points concerning the most critical issues. We do not attempt to report on all viewpoints or to be comprehensive. Among the issues receiving major attention were:

Corporate Management Philosophy: It is reasonably clear that the philosophy of corporate management toward divisional entities heavily shapes management's view concerning the role of the data-processing function. Assessing this attitude and working in concert with it is clearly a key factor in the determination of a successful strategy toward distributed data processing. Participants at the conference almost without exception related their data processing plans to the environment created by corporate management. For example, distributed data processing is likely to flourish and, in fact, to be demanded by users in a decentralized management structure where divisions have "total" responsibility for their actions and are held accountable to corporate management primarily through bottom line profit figures.

Some felt that the degree of movement to distributed data processing operations can be related to corporate management's attitude toward planning. Planning-oriented managements are more apt to request data processing management to develop a future-oriented and coordinated strategy. The majority of the participants believed that such a coordinated look into the technological and organizational future of the information systems function would lead most companies to decide upon an increasing distribution of hardware and, ultimately, system personnel.

Another important dimension of corporate management philosophy is management's view of the role of data processing. When viewed as a

staff or service function, data processing management takes on a somewhat passive attitude toward changing existing approaches. Where corporate management (and data-processing management) view the function of data processing as an active function with power and "change-agent" responsibilities, an entirely different approach to distributed data processing is found. Either the status quo or evolutionary or revolutionary changes will be found depending on the views and beliefs of the management of data processing.

It is clear that the signals from top management as to the role of data processing and the way in which the information systems function should be managed are a major factor in each company's approach to the centralization/decentralization problem. Several participants stated the need for clear, unambiguous signals which could be comprehended by both computer management and the line functional or product managers they serve.

The Matrix Management "Problem": Under a centralized system, data processing personnel report directly to information systems management. They have one boss. Lines of authority and responsibility are clear. Where multiple hardware installations are present, however, data-processing personnel are often "matrixed," reporting to line management of the division for day-to-day matters, but also having a functional reporting relationship to corporate data processing for planning and other coordination purposes. Central functional guidance is especially important during the development of common systems, during times when "central expertise" must be brought to bear on major systems decisions and for the management of very large projects.

With increasing decentralization of systems and programming personnel, this two-boss "matrix" management mode is increasingly evident in data processing. And it creates a difficult environment. One conference participant noted the constant communication problems, multiple meetings, and divided and/or uncertain loyalties which abound in matrix organizations. Another complained that "the rest of our company is structured hierarchically with everyone having just one boss. Only in DP are we forced to matrix management. I spend what appears to be a disproportionate amount of my time coping with the administrative complexity and personnel problems inherent in matrix management."

It is clear from all the management knowledge compiled over the years concerning matrix management (see, for example, Lawrence and Davis²) that matrix management presents many problems as well as many benefits. Its use should be approached with care. Unfortunately, in large organizations, matrix management appears unavoidable in data processing today unless corporate data processing is to give away all management control responsibilities, which clearly is inappropriate. Therefore, information systems managements will have to learn how to manage effectively under a matrix system and educate their personnel to its requirements.

Effective Management Control of Information Systems: The participants defined twenty-one different major activities which must be carried out if the data processing function is to be properly controlled. It is clear that corporate management must be certain that each of these control functions is being carried out. Of equal importance, corporate management must ensure that the function is being carried out by the most appropriate level of information systems management. For example, strategic planning and network planning may be centrally dominated, but the responsibility to manage routine projects should probably be decentralized to the lowest organizational level.

The twenty-one functions are as follows:

1. Strategic Planning
2. Long Range Planning
3. Definition of Scope of I/S
4. Budget Process Control
5. Hardware Standards
6. Software Standards
7. Communications Standards
8. Database Technical Standards
9. Personnel Procedures
10. Project Management Methods
11. Privacy and Security Standards
12. Career Development
13. Training
14. External Source Management (e.g., the coordination and management of consultants and vendors)
15. Management of the Corporate Data Resource
16. Systems Integration
17. Project Management
18. Subsidiary Audit
19. Systems Assurance
20. Network Planning
21. Management of Reorganization

The list of tasks comprising the managerial side of data processing is clearly extensive. While all of these functions were discussed at one time or another, the importance of the planning function, both strategic and short-term, was stressed by most of the speakers. Emphasis was placed on understanding the corporation's business functions and plans as a base for information

systems planning. Comments on the scope of the information function, career development of information systems personnel, systems assurance and the management of the corporate database are found in subsequent sections of this paper.

The Scope of the Information-Systems Function: This issue arose late in the conference. As each participant described the activities in which he/she was involved, it became apparent that the scope of the information systems role differed from organization to organization. Traditionally, the information systems function has been construed to concern itself with transaction processing and periodic reporting systems. However, the acceleration of technology and the application of micro and minicomputers to a wide range of business tasks has recently broadened significantly the horizons of the activities carried out by the information systems department in many companies.

Today most data processing departments have an expanded role with one or more additional responsibilities. Paramount among these is the communication function which now reports to information systems in many participant companies. This is obviously a direct result of the development of on-line systems and the need to develop networks interconnecting distributed systems. More recently, the area of office automation has become an increasingly important part of the domain of some of the participants. Functions addressed include word processing, electronic mail, and library facilities providing information storage and retrieval. It is evident that many decentralized computer systems will serve both traditional management information system needs and office automation.

Another area in which the minicomputer has been used for some time but which is now being actively merged with the data processing function in some companies is the "process control" of manufacturing operations.

Process control data is in many cases a significant input to operational reporting and the need is now being felt to coordinate process control with traditional system developments.

There is a need, participants agreed, for a conscious redefinition today of the role or roles which are included in the information systems function. Some participant companies have gone as far as including groups of people handling regular paperwork activities (such as the non-automated parts of the payroll function, order entry function, accounts payable, accounts receivable, et cetera) as part of the I/S responsibility. These "administrative" activities are, after all, merely information-processing functions--and thus are more aptly placed in the information systems shop than under the controller's function.

Need for Career Planning: Career planning, although it is an area which has been largely ignored in the past, is beginning to attract much interest from data-processing managers, as evidenced by its inclusion here as a major managerial concern. The key issues discussed by the participants were:

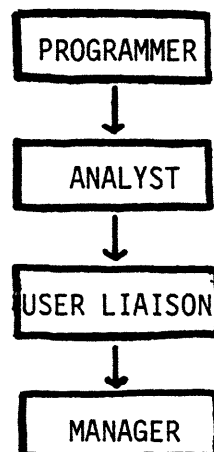
- 1) Career Paths: What are the logical career paths in an organization for data-processing professionals? Are non-DP positions included in this path? Some of the organizations represented have set up groups within data processing charged with the specific organizational responsibility for career-path planning and human-resource development. These organizations both attempt to attract non-DP professionals to the DP area, and to encourage career-path planning which may include, for some employees, planned moves out of DP into the line management of the organization.

2) Critical Mass: Traditionally, DP departments have felt there is a minimum size for the encouragement of a creative work environment. Concern therefore arises with decentralizing personnel to user areas and fragmenting this creative mass.

3) Migration Into Line Positions: Two organizations stated that they expect to keep many of their best people for only about three years. These people are generally in user-liaison roles, and move quickly into line-management positions in the user areas. Both organizations encourage this process. Three major benefits are derived:

- While working in DP, these talented people create excellent relationships and communication channels with user areas.
- Once transferred to user areas, they remain allies for DP to work with.
- This career-path progress satisfies these individuals.

4) Creation of Skills Inventory: Several participants indicated their organizations were creating skills inventories for DP positions. In so doing there was a recognition that the career paths within DP that had been traditional were not necessarily logical and practical. Specifically, the following career path is common:



This path assumes some similarity in the skills that make an individual a good programmer, a good analyst or a good manager. A number of organizations are doing away with these assumptions and recognizing that different skills are necessary for each of these jobs. One result of such an insight is the definition of parallel career paths in DP for technically-oriented and managerially-oriented individuals.

The career-path planning issue is clearly one which is growing in importance generally and must be addressed in light of the increasing decentralization of DP functions.

Ensuring User Relationships: The maintenance of good user relationships revolves around two major factors. First, and obviously, is the need to provide users with the services they feel they need. Second, and equally important, is the need to ensure that user perceptions of the quality of the job that data processing is doing are correct. In effect, data processing can be performing extremely well, yet this can be unappreciated. There is a vital communications link to the users which must be maintained to ensure that user perceptions of the quality of I/S services are in line with the quality of the service received.

In discussing this significant point concerning user relationships, one participant, DP manager of a major New England bank, used a simple two-by-two matrix shown in Exhibit 6. Within this matrix, there are two cells which usually draw DP's management concern. These are the two where "DP is not doing a good job," whether this is perceived by the user or not. Of equal concern, however, is the upper right hand cell where DP is doing

EXHIBIT 6

THE DATA PROCESSING/USER RELATIONSHIP MATRIX

PERCEIVED QUALITY OF DP SERVICE

ACTUAL QUALITY OF DP SERVICE

	GOOD	BAD
GOOD	1	4
BAD	2	3

a good job, but is perceived by users to be not doing a good job. This requires additional communication, education, and even salesmanship of the DP management function to bring perceptions into line with reality.

In recent years, data-processing management has paid increasing attention to this perception problem. Monthly newsletters aimed at the user population which state such facts as response time, percent availability, project completion versus milestones, et cetera, are now not uncommon. These newsletters clearly note the facts with respect to the service data processing is rendering. They also tend to advertise new services and to educate users as to the capabilities of the DP function.

In a decentralized or distributed environment, however, this education function will be--it was believed by many participants--of even more significance. As the user population grows, is more dispersed, and increasingly on-line, down-time incidents will be more visible. Other problems, such as the failure to bring parts of particular projects on-line as advertised, can be blown all out of proportion with regard to user perceptions. Distributed systems are handling more and more vital operational tasks whose performance is critical. As a result, in the increasingly decentralized or distributed environment, the public relations aspect of managing data processing most probably will need additional attention.

Systems Assurance and Audit of Decentralized Units: One of the fears of the corporate data processing manager is that one day he or she will be responsible for maintaining a large variety of systems that have been developed on a decentralized basis, on a wide range of different hardware,

without a common set of standards. On the other hand, a fear of the decentralized user is that he or she will be forced by the corporate data processing department to adhere to arbitrary standards for systems development and hardware selection. It is in the area of systems assurance that these viewpoints are reconciled by ensuring that corporate standards are met while allowing local users freedom to operate within these standards.

Participants at the conference discussed various means for assuring the quality and the continued maintainability of distributed systems. An effective approach discussed by several people involves consultation and review early in the purchase and design cycles, coupled with continued periodic reviews during development and operation to insure consistency of local development methods with corporate standards. Several participants pointed out that systems assurance audits provide an excellent opportunity to become aware of the needs of decentralized users. Security and privacy of distributed systems is an increasingly important aspect of systems assurance reviews.

Common Systems: The single issue on which the least certainty as to "good solutions" was voiced was that of the effective and efficient development of common systems. One participant detailed a typical tale of extended time and dollar horizons in one common systems project. Communication breakdowns and disagreements as to what features should be included had led to considerable discomfort on the project. The representative of another major organization described almost two years of attempting to agree with major users merely as to which systems should be developed in common.

Reasonably successful solutions noted were (1) buying a package which various user groups could then opt to use or not, and (2) developing an "in-house package," originally devised for one or more sub-organizations--with an option given to other divisions--to buy or not to buy. It was felt that research into variables causing successful and unsuccessful implementation of common systems was decidedly needed.

Technical Issues: As shown in Exhibit 5, there were two technical issues which were mentioned by approximately half of the participants as being particularly relevant to the management of distributed data processing. These issues were the design and control of the communications network, and the potential incompatibility of databases under distributed processing.

Discussion of the design and control of the network centered around the need to match the design to the intended communications mode and communications protocols. For example, when remote sites transmit periodically upon instruction of the central location a simple hub organization would be sufficient. However, where immediate communication between remote sites is required a totally different network organization including both communications facilities and supporting software is required.

The incompatibility of databases was pointed out as a problem when company-wide reports and comparative analyses were asked for by corporate management. Multidivision corporations who have prepared consolidated financial statements have historically overcome the incompatibility of local databases by manual translations. However, when key statistical reports and transaction-level data concerning customers' products and

productive entities are computerized, common database organization techniques significantly facilitate the required tasks. Central control of hardware and systems development can ensure compatibility as applications are computerized. Distributed hardware and/or systems development can allow this compatibility to be lost. The need for the corporate information systems function to have the power to ensure database compatibility is thus seen as a necessarily centralized management control function.

Future Actions and Research Needed

In summary, although a few organizations still expect to remain essentially centralized in the near future, most participants saw a clear trend toward increasing decentralization of hardware and/or systems development. The degree of movement away from centralization will vary significantly from company to company depending on a number of contingent factors.

With the pressure to distribute clear, there was at least tentative agreement on several management issues which need to be performed "better" if the trend toward distributed processing is to be well-managed. Included among these factors which need increased attention by information systems management are the process of education of top management to the opportunities and risks in I/S today, the implementation of management controls over distributed installations, the understanding and implementing of improved matrix management methods, improved development of common systems, and improved methods of understanding of real user information needs.

When asked to list areas which needed more research and were "promising" research targets (where "promising" represented a combination of (1) the importance of the issues and (2) the likelihood that useful results could be obtained from research), participants identified many of the issues already noted in this paper. Those "promising" research issues receiving votes from more than one half of the participants are noted in Exhibit 7. Each of these areas is one in which we will have to learn more before we are able to "manage distributed processing" well. A major conference conclusion was, thus, the need for increased understanding of several major I/S problems which have surfaced in the move to increasingly distributed data processing.

EXHIBIT 7

PROMISING RESEARCH TARGETS

<u>Research Area</u>	<u>Number of Participants Noting Area</u>
Management philosophy and the effect on DP	14
Management control (methods)	12
Common Systems	12
Methods of Ensuring User Relations	12
Corporate Database	12
Quality and Auditability of Decentralized Systems	11

REFERENCES

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APPENDIX

THE MANAGEMENT OF DISTRIBUTED
DATA PROCESSING

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