U.S. Department of Transportation

μtps Microcomputers in transportation

ADDRESSING ORGANIZATIONAL ISSUES

SELECTED READINGS VOLUME 3

UMTA/FHWA Technical Assistance Program

ADDRESSING ORGANIZATIONAL ISSUES

VOLUME 3 OF UMTA/FHWA'S
MICROCOMPUTERS IN TRANSPORTATION
SELECTED READINGS SERIES

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16. Abstract

This document is one in a series of selected readings covering a range of topics related to microcomputers. This volume was preceeded by "Getting Started in Microcomputers" (Vol. 1) and "Selecting a Single User System" (Vol. 2). Volume 3 has been designed to give the transportation professional practical suggestions for ways to increase the effectiveness of their computing tools. First we identify those factors which seem to make a difference when and after new computing tools are introduced. In effect, this is a checklist of "good practices" which the transportation professional ought to keep in mind. Closely following this discussion of good practice is a framework for self-assessment of your particular situation. Using this framework should be a first step toward identifying your needs for organizational changes to be a part of managing computing tools. In the third section an outline of specific actions which have been taken in a variety of industries is presented, together with mention of the types of problems which can surface and actually have occured. Where possible, these actions and problems are illustrated with short case examples developed from experiences of public transportation agencies. Finally, the last part rounds out the guidebook with a discussion of the larger context in which informational resources are developed in an organization. An appendix with a variety of related readings, plus an extensive list of references are also provided.

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ABSTRACT

This guidebook has been designed to give transportation managers practical suggestions for ways to increase the effectiveness of their computing tools. First, we identify those factors which seem to make a difference when and after new computing tools are introduced. In effect, this is a checklist of "good practices" which the transportation manager ought to keep in mind. Closely following this discussion is a framework for self-assessment of your particular situation. Using this framework should be a first step toward identifying your needs for organizational changes to be a part of managing computing tools. In the third section an outline of specific actions which have been taken in a variety of industries is presented, together with mention of the types of problems which can surface and actually have occurred. Where possible, these actions and problems have been illustrated with short case examples developed from experiences of transportation agencies. Finally, the last part rounds out the guidebook with a discussion of the larger context in which informational resources are developed in an organization. An appendix with a variety of related readings, plus an extensive list of references are also provided.

FOREWORD

The first two documents in this series provide assistance to those transportation agencies which are in the process of considering the acquisition of new computing tools. The first volume of "Selected Readings" includes essays which outline procedures to follow when assessing an agency's needs for information and the resulting potential for computing technologies to be part of meeting these needs. The second volume, Selecting a Single User System, deals with specific configurations of computing tools and the factors to be weighed in their evaluation. This third volume provides assistance to help ensure that computing tools, once selected, actually meet the needs of an organization and are productively used by its members. It has been structured so that professionals in transportation agencies can readily identify those factors which may be essential to successful implementation in their operations. Actions which seem to have worked in a number of settings are also described. In addition to the original material in the main section of this document, we have included in an appendix, papers, brief reports and articles previously published or issued elsewhere. These illustrate points in the main text, and are reprinted here with permission of their authors or publishers.

We do not distinguish among products which are or could be found in transportation agencies; their range is too vast and possible configurations innumerable. We presume that parallel or prior to implementation, you will have evaluated alternative products and selected those most appropriate for the tasks at hand. Nonetheless, microcomputers show up in examples because they permit many organizations to consider automating functions previously thought to be inaccessible due to size, complexity, cost, skills needed or similar factors. As a result, more and more organizations need to evaluate a larger number of potential applications. Since the use of new tools, whether or not microcomputer-based, generally changes the way people do their jobs and can, over time, influence the distribution of power and resources in an organization, anticipating their potential effects is essential to "successful" implementation. The present volume should be a useful companion to your efforts in this regard.

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10. Selected references related to organizations and computers.

I. THE AGENDA OF GOOD PRACTICE

A. Introduction

We assume that the reader is concerned with increasing his or her agency's productivity and is looking for ways to do this in conjunction with the introduction and use of computing tools. You are probably asking yourself questions such as:

* How can computing tools be used to do jobs better?

* What do we need to do to minimize disruption to what people are doing? (e.g., continue producing what we produce)

* How can we ensure that we will get the best results for the money? How is this defined? ...from the perspective of the functional department? ...from the perspective of the agency as a whole? Are there more appropriate criteria?

* How can we encourage sharing of the new microcomputers and software and avoid counterproductive turf battles?

* How can we get the most out of the existing equipment and staff?

* What are the signposts we should be on the lookout for in terms of people and organizational problems?

* What degree of control should we exercise?

Answering these and related questions for your particular agency of course has to be done by you and your staff. Nevertheless, we feel that by describing the attributes of "good practice" we can begin to give you a picture of what your agency might be aiming toward. Armed with ideas of where your agency ought to be, the "self-assessment" section and certainly the actions suggested later should make sense.

B. Characteristics of a Successful Application

Though the word 'successful' clearly has a subjective meaning to most people, there are attributes of good practice which seem to be widely accepted. Because many of these characteristics can only be partially measured, they would be better understood as targets or points of reference for the manager looking for guidance. A "good" application of computers typically:

* is well managed
* has one or more "champions" who promote the new tools and procedures
* helps accomplish the agency's mission
* becomes integrated with an agency's set of computing resources
* reflects anticipation of potential problems
* helps people do their jobs better, possibly with more satisfaction
* has key managers' support and encouragement
* involves one or more line managers or skilled technical persons who are in touch with daily activities
* educates but doesn't overwhelm managers with technical details

In the discussion following, suggestions are made for steering your use of computers in successful directions. These embody one or more of the attributes listed above and, in many instances, are illustrated with the case example drawn from transportation agencies. Bear in mind, though, that applications can only be judged meaningfully with criteria you define as critical to your organization's success.

Do more than just buy the right equipment

Nearly everyone in the transportation industry who has been involved recently with computing tools has probably heard of an agency which has acquired a microcomputer, associated peripherals and software with the hope that "productivity" would somehow improve. Having started, no one in the agency knew how to keep going, that is, how to integrate the new tools with people's jobs. If the equipment ever made it out of the packing crates, the manuals may have been only scanned. Once a computer retailer's half day course on using the new micro has been attended, often there is little else available to the staff person interested in really improving his or her job.

It has become clear that 'good implementation' means much more than buying the "right" tools and learning how to turn on a computer. Indeed, we have little reason to doubt that technically "good" solutions will be available, given the needs of most transportation agencies and the rapid pace of improvements in computing tools. As recently pointed out, however, third or fourth generation computing tools are often introduced and used with first generation organizational strategies (e.g., "brute force").

PUTTING TOOLS BEFORE THE TASKS MEANS TROUBLE

In spite of its good intentions, a small western agency (36 peak buses) implemented a computer information system in a manner which was not well organized, coordinated or supported. The results were a system with limited capabilities and one not utilized to its full potential. The managers developed three independent applications including:

- *Accounting on an outdated minicomputer using software which is no longer supported;*
- *Word processing on a dedicated word processing computer; and*
- *Elementary financial analyses and ridership reporting applications processed on an Apple-II.*

Decisions on each application were made independently and the operation of the systems has not been coordinated. No one systematically planned what applications should be implemented on computers and which specific computer systems should be used.

The Apple II was recently procurred with the intention of identifying software which could be adapted by the agency. To date, however, nothing has been identified and acquired other than a spreadsheet program. This computer has been programmed to a limited extent by a payroll clerk who has shown skill in operating computers. The clerk, though willing to tackle any problem when a relatively easy programming solution exists, has not yet developed a major application.

Because implementation proceeded only because money was available, no plans were made for what the system should be used for or how the computer should serve the organization. While a few applications have been developed, different types of hardware have been used and the entire system is not coordinated or supported. Management is not interested in developing an integrated computer system, though it appears to have staff which is capable of participating in the design and operations of such a system (e.g., the payroll clerk who is now in a position to help design, implement and maintain a system).

Understand current practice in the organization

New computing tools are often acquired piecemeal as funding is available and applications arise. The larger the agency, the greater the likelihood that purchases and uses across functional areas will not be coordinated. After a year or two of such developments, an agency may have a good deal of computing power, yet have realized only a small fraction of its potential. In spite of having apparently "state-of-the-practice" tools, many of the original problems go unsolved. Acquiring and using new tools (such as microcomputers) does not necessarily improve an organization's productivity or the quality of its information.

Since introducing new tools can change both the way people work and how organizations function, it is imperative to anticipate the full range of their likely effects in advance. Not to anticipate effects on the "people systems" can result in unused or underused tools, worsened employee morale, unnecessary and counterproductive conflicts across functional areas, and an inefficient use of resources generally. By trying to manage computing tools, an agency can create important opportunities for itself. Making the most out of new tools requires a careful look at how effectively and efficiently information and data are used. Especially if several or many computers have found or will find their ways into an organization, there may be a golden opportunity to re-think current practices and goals.

COMPUTING TOOLS HELP ACHIEVE ORGANIZATION-WIDE GOALS

The Information System (IS) group of a large state DOT had an enormous backlog of requests for assistance, including both standard reports (for day-to-day management and operations) as well as ad hoc requests (for specialized reports and new programs). The backlog caused inefficiencies throughout the organization, as manual processing of data was required to meet deadlines. Performance also suffered because managerial and operational decisions were based on incomplete and outdated information.

Upon examination of the backlog, the director of the IS group discovered that many of the requests could be met with the use of microcomputers. Consequently, top management decided to introduce microcomputers to relevant functional groups throughout the agency, assisted by a microcomputer users' support unit within the information services group. The unit is responsible for providing training and technical advice, developing and implementing policies and procedures for acquisition and use of microcomputers, and monitoring the overall process.

The strategy has been quite successful from a number of standpoints. The allocation of computer resources among data processing requirements is more efficient, since the mainframe is now dedicated to uses requiring that capability. Also, the IS staff members are more effectively utilized, focusing on tasks requiring their expertise and resources, and supporting microcomputer applications. Overall, the backlog has been reduced to a manageable volume and data requests are being met sooner.

Staff in functional units find the new system very satisfactory. Not only is information provided more quickly, but the microcomputers allow analysts more control over the details of methods and their execution. The Transportation Planning group is using micros for developing patronage forecasts, performing fare policy analysis, examining service design alternatives, and performing other analytical tasks. The director of inventory management has turned to microcomputers as a mean of developing interim tools for improved inventory control while an enhanced mainframe program is being developed. The capital budgeting group also has expanded its kit of tools (e.g., doing for strategic planning and contingency analysis to support short and long-range capital planning). Overall, ***the new approach has resulted in more responsive information services support and more control over data processing capabilities****.*

Know What People Do

The enormous success of several recently developed software tools (especially electronic spreadsheets) can probably be attributed to their good general fit to what many professionals do in their jobs. When a tool has been based on a solid understanding of manual procedures and is perceived as a means to improve and upgrade one's job, success is nearly inevitable. Think through how tasks are performed in your areas of responsibility. Evaluate the skills required if people were to carry out current procedures with a computing tool. Mismatched or poorly

introduced tools can be a prime cause for resistance among staff. If a new tool doesn't really help a person do his/her job better or changes procedures in an unknown or threatening way, expect problems.

PLANNING DIRECTOR RESPECTS STAFF'S WAY OF WORKING

At a medium-sized transit authority (250 buses), the time required manually to maintain operating data, prepare Section 15 reports and conduct route evaluations consumed valuable staff time and limited the range of useable methods. The Director of Planning and Develpment believed that a microcomputer could be used to improve the speed, depth and quality of the route analyses. ***She sought*** *to develop software to process on/off counts and corner load checks and* ***to integrate it into her staff's way of working****.*

Many of the staff members, most of whom came up through the bus garage, didn't know the first thing about computers or programming. Since the Director realized that initially the software had to be simple to use and understandable, it was developed to replicate manual techniques. Also, user guides were written and training structured for beginners.

The Director discovered that it was particularly useful for a single individual to develop the software as that person could control design and implementation, letting the ***skills of the staff dictate complexity****. Since the staff had an extensive transit operations background, they could understand sophisticated analyses. However, the* ***software developed expressed the analyses in common terms*** *rather than in "computerese." In addition to facilitating training, this approach* ***allowed the staff to gain confidence in and commitment to the new tools****. Once training was complete, the time required to perform these functions was significantly reduced, allowing staff the opportunity to introduce methods which had only been considered desirable but never actually used before.*

Strategize

Strategies typically fall on a continuum between degrees of being hierarchical and participatory. Understandably, most agencies tend to be managed in more hierarchical fashion. Decisions are made from the top down and supervisors are presumed to know what works best for their charges at each step in the organizational pyramid. This style of management works well when automating routine tasks (e.g., strictly clerical functions) in which there is relatively little judgement required and the dominant issues are technical in nature. Until recently, most easily computerized functions fell into this category (e.g., payroll generation and other accounting functions). Only in rare cases did computerization of routine

tasks require individuals to do anything really differently or affect others not directly involved in the tasks. The same functions were performed faster, more cheaply and more accurately.

By contrast, the automation of non-routine tasks in which judgement and intuition play a central role typically warrants more participatory strategies. Managers and professional staff are generally more involved with non-routine work and are less easily controlled by supervisors with respect to the details of their jobs. If new systems imply new tasks, participatory schemes are most likely to achieve results that also match developmental goals of the agency. Since people and organizations can become quite defensive if their accustomed patterns are disrupted, you ought to make sure that your management style matches the changes to be accomplished.

GENERAL MANAGER INVOLVES EMPLOYEES TO GAIN CONFIDENCE

A twenty bus transit agency is in the process of installing its first computer, a three terminal multi-user system. The first applications include accounting, inventory, spreadsheet, word processing, and Dispatch-a-Ride (elderly and handicapped) client and trip registration. The General Manager (GM) is supportive of the project and also understands the problems in getting staff involved in planning and design and properly motivated and trained. The staff is reacting with varying levels of acceptance and cooperation. The comptroller and Dispatch-a-Ride manager are accepting and able to participate in the project. The Director of Operations and Maintenance, Dispatch-a-Ride dispatcher, and secretary are all wary of the computer. None of these people feels that his or her job is threatened, but each thinks he or she will not be able to master the computer. The first two want to be involved with the computer and will become active users once programs are installed and effective training conducted. The secretary is not likely to learn word processing because she has a hard time understanding the system's technical operations and is intimidated by the computer hardware. Management has been unhappy with her performance in most other aspects of her job, and she may be encouraged to retire (for which she is eligible).

Two strategies are being used by the GM to involve employees to ensure successful implementation. First, he ***concentrates on training those with the greatest interest in computers and introduces other employees to the system gradually.*** *Training initially emphasizes functional use of the computer to complete one or two specific tasks, then expands to general procedures and concepts. The Director of Operations and Maintenance is being brought into the process slowly. He is responsible for completing all manual forms and the office staff will enter data from the forms into the computer. By involving him with the computer in a productive task, the GM hopes to overcome his fear gradually. The GM's second strategy is to* ***introduce simple, non-threatening applications of the computer that make people feel comfortable.*** *The computer has been used to transmit electronic messages between personnel in the office. For example, the GM often greets the office staff in the morning with a humorous message on each individual's screen. In addition, staff meetings are often*

announced on the computer. Messages make the computer operations seem like "fun," yet individuals are getting a basic introduction to the system and are overcoming fear and apprehension.

Plan with your agency's strengths and weaknesses in mind

Clearly, both people and technical "systems" need to be considered when designing strategies. Each system has a history which strongly affects what we find when we examine the current status of things. As a result, we know that since almost no agency starts from scratch, we have to take people and technical systems as we find them, that is with their strengths and weaknesses. Few empirical studies of implementing computing tools in the public sector have been conducted, and those available contain no claim to providing an equation for managing strengths and weaknesses or predicting the future.

Nonetheless, from the many experiences in both the private and public sectors we can extract generalizations to provide managers in transportation agencies at least with rough guidelines for shaping productive use of computing tools.

STATE DOT USES ITS RESOURCES TO AID SMALLER AGENCIES

A state DOT's Public Transit Division recently held a regional meeting of transit operators. While not on the formal agenda, there was much discussion among managers about the capabilities of microcomputers and how they could benefit small urban and rural transit agencies. One of the managers had purchased computing tools and others were talking about budgeting for them. Some of the authorities had access to county mainframe computers, but were not using them. Others had no automation. While all were excited by the potential of "micros," they also were somewhat intimidated by the tremendous range of products and unfamiliar jargon and were afraid they couldn't justify the expense of acquiring the tools.

The top managers in the Public Transit Division decided that providing advice and counsel with respect to microcomputing tools would be an excellent addition to its technical assistance program. Expert advice and coordination could circumvent many potential barriers to selection of appropriate software and hardware, as well as effective use of the computing tools. Consequently, the Division established a funding and technical assistance program to facilitate the introduction of microcomputers to the authorities.

The Division became a centralized resource for hardware/software assessment and authority-specific selection of computing tools. An individual implementation strategy was prepared for each authority, depending upon priorities within departments. In addition, the Division prepared an RFP (Request For Proposal) for consultant training, reducing the potential of duplicate requests by individual authorities. State-sponsored educational sessions exposed transit staff to a broad range of possible applications. Coordination with existing Data Processing (DP) departments and development of communication policies between mainframes and microcomputers were included. The Division anticipated delays in the grant process by recommending that each authority arrange funds for purchase well in advance of actual hardware selection. As a result, when time for deployment drew near, adequate funding was available. Currently, the computing tools are in place and appear to be improving both the authorities' management and transit services.

Encourage Experimentation

Regardless of the dominant style of management, an agency would do well to encourage a spirit of entrepreneurship with respect to computerization. Especially at the outset, it may be wise to manage staff only loosely and to allow a variety of possible competing or overlapping technical directions to be explored. Similarly, contacts among staff may be forged across functional areas previously unrelated to each other. If policies and procedures are narrowly defined early in the process of automation at least two counterproductive results could occur: (1) staff members do not feel as if they have had a chance to develop opinions about how the tools are used in their work and to have the opinions reflected in the agency's policies; and (2) creative uses of computing tools may never have a chance to emerge. It is not a sign of management's strength to have strictly enforced and detailed policies, at least before trends have emerged and benefits of several options compared.

EXPERIMENTAL APPROACH BRINGS A STATE DOT REWARDS

The highway design unit of a state transportation agency implemented a computer-aided design (CAD) system to meet the demands for increased output despite decreasing staff resources. ***The first project was small in scale and was facilitated by moving draftsmen willing to use the system into new and higher wage categories.*** *There was no shortage of volunteers.*

The small system quickly demonstrated cost savings. Construction costs were reduced through development of more efficient and more accurate project designs. Another result was more rapid turnaround of redesign, making the design unit more responsive in preparing changes and resulting in further construction savings as delays in completing design work were reduced.

The success of the initial system encouraged the State to expand the system and to add applications. *A mini-computer interactive graphics system was introduced and the existing mainframe computer upgraded to a state-of-the-art central processing unit. Additional benefits were realized when other functional units began to use the system. For example, the system now supports the major stages of the transportation planning process from systems planning, to corridor and route location studies, to site planning and environmental impact statements, to conceptual design. The system has also been used by other departments. The Department of Natural Resources uses the system for land use planning (color coding land use maps, digitizing of aerial photographs). By using the same database, transportation planning has been more effective and efficient in reflecting State land use development in its planning work. Finally, microcomputers are being used to tie the field operations into the system through support to survey crews and in the manufacture of chips for traffic signaling.*

Get commitments from key people

To be truly successful, it is essential to have the cooperation of those affected by the introduction of new tools and procedures. Besides actively involving those who will actually use new computers, successful computer applications almost always have the explicit backing of top management. Most people in transportation agencies look to an executive director or general manager and possibly a board of directors for setting priorities and for leadership. If a top manager does not recognize information systems as organizational resources or does not perceive inter-departmental conflict over computers as an agency-wide problem, solutions will be hard to realize. If a top manager actively opposes changes in computing resources (like getting new microcomputers), chances are good that nothing will happen.

MPO DIRECTOR'S ROAD TO MICROS ROCKIER THAN EXPECTED

The Director of Long-range Planning in a Metropolitan Planning Organization (MPO) had been affected by the "micro" bug for over a year, subscribing to a number of trade journals and joining several "user groups" related to the equipment he had purchased for use at home. He had identified a long list of functions in operations (18 professional plus five clerical) which could be computerized via micros and proceeded to put together a proposal for a major acquisition of computers, peripherals (printers, modems, etc.) and software (23 items were identified) to carry out his plan. Most of the proposed improvements made sense (e.g., cutting in half the time to make population projections for subareas of the region) and his staff for the most part shared his enthusiasm. The Director went ahead to secure a Federal commitment of 90% funding for the capital acquisitions.

A presentation before the MPO's Board of Supervisors was needed, of course, before the remaining 10% local share of money could be obligated. The Director promptly received the coldest shower of his professional career. Board members were ***angered that the Director had left consultation with them until the last moment****. While four of the six understood the reasonableness of the proposal and appreciated the low cost to the MPO, two were thoroughly suspicious of "computers" and took every occasion to ask questions like "How did you manage so well without them all these years?" The two doubters were so adversarial in their questioning in spite of the Director's fairly convincing responses that the Board tabled the proposal "for further study," a phrase that had been a death knell for most other proposals.*

Anticipate Snags

In closing the loop between understanding how tools and people mesh and implementing (micro)computers, we need to anticipate potential problems. In mapping out difficulties, we are, of course, often merely describing symptoms. By going beneath the surface we can also uncover possible sources of difficulties, and then lay a solid foundation for carrying out strategies. Three primary types of problems seem to surface: (1) individual protest; (2) organization-wide inefficiency; and (3) inter-departmental conflict.Each type of problem is discussed and illustrated in the "self-assessment" section. Prior to that, however, several cautions are in order. What are considered "problems" varies by one's position in an organization. The manager of bus scheduling may not perceive any problem by ordering machine "ABC," even though another department already has an "ABC" and could easily share its hard disk storage with the scheduling people. An accountant whose job has been radically restructured to exclude interaction with other people deliberately slows down production. For the accountant the problem is the lack of contact with colleagues, whereas for superiors the problem is insubordination and decreased productivity.

GENERAL MANAGER SIDE-STEPS RESISTERS AMONG STAFF

In the early 1970's, a small transit system was converted from a private to public carrier. Since then there have been continual efforts to integrate "old-timer" and "post-takeover" staffs. Nothing seems to emphasize differences between these groups more than the introduction of a computer system which has required the General Manager (GM) to face staffing issues squarely. (The first set of applications include revenue and ridership reporting, budget development and other spreadsheet software applications, as well as vehicle history recordkeeping and daily servicing input). The GM is very enthusiastic and has decided that many of the other staff members will readily

accept and learn about computers. However, two major problems are making it difficult to go forward with implementation:

- *a few of the "old-time" staff members are afraid of using the computer and are resisting any change from established operations and procedures; and*

- *many of the manual procedures traditionally used in the office (specifically accounting and maintenance recordkeeping) are not well organized, thus complicating any efforts toward automation.*

One key staff member is not willing or able to learn about using the computer for administrative and accounting applications. In addition, the Maintenance Supervisor is reluctant to become involved with any automation of recordkeeping procedures. As is typical with many small agencies, the Maintenance Supervisor was promoted from a mechanic's position and is not a trained administrator; as a result, the Maintenance Department is not well organized and even manual recordkeeping procedures are not well structured.

The GM plans to begin with those applications which involve receptive staff and to delay implementation of applications involving "old-time" resistant staff members. *One staff member who accepts the microcomputer implementation will be in charge of operating the spreadsheets, the revenue and ridership reporting software, and vehicle maintenance recordkeeping application programs.* ***Other staff members will gradually be introduced to the microcomputer.*** *Personnel changes will likely be required in order to address the problem with microcomputer applications. Such changes will take place over a long period of time and will be as a result of other factors besides the computer, for example, attrition (one key staff member resisting microcomputers is very close to retirement) and a recent project designed to organize maintenance manual recordkeeping procedures.*

Phase-in New Procedures

People get used to doing their jobs in a particular fashion; relations to others in an agency tend to be fairly static at most times. Most people's attitudes towards change tend to range from conservative to resistant. Because introducing new computing tools may upset trusted and known procedures and be quite threatening, steps should be taken to anticipate people's fears and to enable them to be open to new methods. Once a climate of acceptance has been created, actually changing procedures should be undertaken. Since people cannot usually tolerate continual change, attitudes and procedures need to become part of a routine (i.e., "old" tools).

BUILDING COMPUTER CONFIDENCE IN A CITY'S DOT

The Systems Management Division of a city's Department of Transportation was beset with a backlog of analyses and studies to perform (all "high priority"). The division chief decided to purchase micrcomputing tools to lighten the burden on her division. Off-the-shelf software was applied and phased in over a six month period.

During implementation, ***staff had the opportunity to learn at their own pace under the supervision of the division chief, already well versed with microcomputers.*** *Initially, everyone was encouraged to set aside a few hours a week to use some "canned" software. Through this approach they first gained familiarity with the keyboards and the diskettes, then used spreadsheets to duplicate simple manual procedures. The next step was to perform analyses on the computer, initially on non-routine tasks, so as not to disrupt the flow of data within the division. It was only* ***after staff grew confident with their skills that day-to-day analyses were converted to the micro.*** *This eliminated potential disruption of the flow important of information to the other departments and* ***allowed the staff to integrate these new tools into their work patterns slowly.***

Mistakes which did occur were made early, on non-critical tasks. Both the frequency with which the computers were used and the complexity of the analyses performed were increased. Initial tasks included highway accident reporting and preliminary budget preparation. The complexity of the analyses performed on the computer grew to include traffic flow studies. Gradually, by using the tools, the backlog of analyses diminished, and new, more comprehensive studies were performed. Additional software (file managers, statistical packages) was purchased and other divisions began to rely on the System Management people staff for hardware/software assessment, as well as analytical support.

Integrate new with existing tools and staff

In larger transportation organizations in which a mainframe or mini-computer has existed for a number of years, data processing (DP) departments and staff have seen a growing number of users in their agencies shift from asking for help to helping themselves. The relatively easy acquisition of micro-computers, often not controllable by the DP staff, enables non-computer specialists to design and carry out their own solutions independently. This shift often causes consternation among the DP staff, due in part to the resulting loss of control and ability to coordinate and also in part to the calling into question the traditional roles of DP staff. This problem can be alleviated by accounting for the potential of integrating new tools with the old and with current staff to everyone's mutual advantage.

COMPUTER STAFF JOINS FORCES WITH USERS

Management in a large agency encouraged individual departments to purchase their own microcomputer hardware and software. At the same time, to control the implementation process, policies and procedures concerning the purchase and use of microcomputing tools were developed. To increase control and to realize certain economies, training was centralized and the common use of documentation, user manuals, and databases was established. To carry out these procedures, the Information Systems (IS) department was put in charge of managing the process, including evaluation of all software and hardware requests, conduct of training, provision of technical support, maintenance of a microcomputer library and monitoring and evaluating use of equipment. ***The IS group's technical and administrative responsibilities are guided by a computer users' group****. This formally recognized group establishes policies and procedures governing the use of both the mainframe and the microcomputers. For example, the group reviews computer use data as part of an evaluation of implementation and further development of computer tools.*

This approach has not only increased the agency's computing power, but also strengthened the entire organization. The approach to implementation clarified its structure and responsiblities and established a more orderly process for the use and further development of computing tools. It has resulted in a better allocation of staff with the information services personnel using their expertise to provide mainframe services and technically to support microcomputer tools located in various functional areas. The ***division of responsibility between the IS group*** *(technical and administrative)* ***and the users' group*** *(policy and management)* ***has resulted in improved communications and more responsive information services****. Early success has encouraged interest and commitment on the part of top management to identify and take advantage of additional more costly but bigger payoff opportunities.*

Develop the Organization Along With the Tools

From the wide variety of actions which are described in trade literature, the more successful ones reflect attempts to improve an organization's effectiveness as well as efficiency. The first question to be tackled is: what's going to change? Merely buying a single microcomputer and its associated peripherals may or may not be disruptive to the organization. Trying to create a "comprehensive management information system," with many new machines and procedures is likely to encounter a number of roadblocks. Remember that before a specific strategy can be designed, you must have thought through your agency's needs for information, the technical options for meeting those needs as well as how proposed new tools and procedures would change what and how work is done. While doing this, it is essential to be as clear as possible about: (1) what organizational purposes are to

be served and (2) the approaches to or styles of management which fit your agency and its past.

The message is clear: introduce computing tools and develop information systems as part of improving an organization and the ways work is done. In managing informational resources, there are many choices which must be made. Since the outcomes of these choices often affect the distribution of control and influence in an organization, managing computing tools can provide valuable levers for directing an agency toward whatever goals have been articulated (e.g., raise productivity, improve performance, increase job satisfaction).

AUTOMATION OPENS PERSONNEL OPPORTUNITIES FOR AGENCY

A 120-bus transit authority procured and installed a precoded minicomputer-based transit management information system which automated functions as diverse as accounts payable/accounts receivable, spare parts inventory and accident reporting. Previously, the agency's only use of computers was in the areas of payroll, fuel reporting and RUCUS (Run Cutting and Scheduling), all run by service bureaus. Though implementation affected personnel and job descriptions as diverse as the functions automated, those primarily affected were the agency's financial staff (supervised by the Assistant Director, and consisting of a head bookkeeper, an assistant bookkeeper, and an accounting clerk). None had previous experience working with computerized systems.

As a forceful promoter of computers within the authority, the Assistant Director was determined that the automation of the financial systems would be successful. Nonetheless, during conversion to the automated system, several problems arose. In the case of Accounts Receivable data, discrepancies between details and totals led to the conclusion that the assistant bookkeeper had not kept his data current. While several nights of overtime work corrected the problem, the computer was thereafter viewed by the financial staff as a means by which management could catch their mistakes and embarrass them. In another instance, it became apparent to management that the senior financial staff was afraid to use the computer for any purpose other than data entry and report generation. Despite the system's easily understood report writer software, these individuals continued to do analytical work with calculators and hand-generated spreadsheets. When questioned, they responded that they were afraid that they would break the computer if they entered an incorrect command or performed any process that was not defined in the procedures manual. In the last case, the accounting clerk became more proficient in the use of the system than the senior staff. He seemed to have fewer preconceptions about the computer and immediately saw its benefits in data entry and computation. His rapid grasp of the capabilities of the automated system placed his immediate superiors in the embarrassing situation of having to ask him for guidance in using the new system.

*The **Assistant Director**, with the approval of the Director, **responded to these situations by gradually changing the procedures of the financial group**. He realized that their initial perception of the system as a means for management to catch their mistakes stemmed from having a relatively inefficient manual system in the first place. He supposed that their perception would change as soon as they saw the assistance the system would give them in validating input, calculating totals, and making them more efficient generally. Rather than use persuasion, the Assistant Director **sought to redesign jobs**. The accounting clerk was put in charge of entering all transactions into the system (in the past each staff member had been responsible for posting some of the accounts). The accounting clerk, who liked using the computer, readily accepted this responsibility. The two senior staff members were made responsible for reviewing, auditing, and approving the computerized listing of data input. They accepted this function as appropriate to their positions. As a result of their new audit function, the senior staff members began to see how the system's validation processes reduced the number of errors and simplified their tasks. They were able to prepare reports to management faster and were more confident of their contents.*

Although the procedural changes satisfied the clerk and senior staff and, eventually, built confidence in the output of automated systems, senior staff themselves still resisted using the computer. To address this problem, top management began to reject manually-prepared financial statements and analysis. Although, initially, this was limited to the formal financial statements (which were already produced by the system), management began to ask for relatively simple computer-generated analyses of accounts payable and inventory status. With some assistance from the data processing personnel, the financial staff, initially with much trepidation but then with increasing confidence, began to generate these analyses using the computer's report writer software. Eventually, management required that all financial analyses be submitted as computer-generated reports. The senior financial staff, having grown confident of their computer skills, were able to prepare increasingly complex analyses for management. Eventually, they began to view preparation of any form of manual analyses as a hardship.

While most of the changes prompted by increasing the use of computers occurred slowly, their cumulative effects over time were substantial. Not only were processing times for many functions reduced, but positions were re-structured in light of new and changed responsibilities. For the most part, the positions affected received more status. Perhaps the most important result of the automation was the longer term re-vamping of jobs and procedures which led to a more effective organization.

II. ASSESSING YOUR SITUATION

A. Introduction

Applying the suggestions in the first section becomes meaningful only when related to your agency. You probably already have a good sense of where potential or actual problems are in your organization and of which actions might be appropriate. This section has been structured to help you determine the key attributes of strategies which seem right for your particular situation. In the absence of an outside consultant, you will need to formulate your own definitions of what is important and of how to achieve your goals.

Just as a consultant might want to have an overview of an agency before making suggestions, someone doing a "self assessment" ought to be aware of the context in which computing tools are to be introduced. In smaller organizations, this may mean nothing more than finding out or knowing whether anyone has previously tried to acquire computing tools, and if so, what institutional reactions occurred. (For example, did a board of directors balk and why?) The larger the organization, the more complicated this part of the assessment is likely to be. Knowing the history of prior efforts to bring in new computing tools can be invaluable in avoiding pitfalls encountered earlier. Also, by getting a sense of the directions the agency is taking generally, more informed strategies can be developed. It should become clear that a computer management strategy which cannot be fit into an agency's overall mission will not stand much chance of success.

The purpose of the self-assessment is to encourage anticipation and planning. Your "plan of action" ought to reflect at least an educated guess of how changes in people, organizations and computing tools will interact. Be aware that bringing in new computing tools may not be as simple as bringing in new office furniture! Try to reflect on the experiences you have had and the extent to which they match the points made here. Pick and choose the ideas relevant to your own situation and in any case, tailor the final design to your agency's particular needs. Jot down answers to the questions in Tables 1-4 and use them to evaluate the actions discussed in Section III.

Four diagnostic areas are outlined here, ranging from the most permanent organizational factors to the most fluid and retractable. While their degree of permanence varies, across agencies, they are all interconnected and should be approached separately with care. First come the organization's structure and operation, whose characteristics are quite difficult to change, especially with larger and more established agencies. Second, the people who staff an organization obviously give it flesh and blood. Though functionally an organization can remain essentially unchanged for years, particular people come and go, often making the critical difference in the success or failure of a strategy. Third, the material resources (including computers and software) at the command of staff can also be crucial, but compared to persons, be acquired or discarded with greater ease. Last, the policies an agency uses to develop its computing staff and material resources may, like rules anywhere, be established, re-written or rescinded at the pace managers find comfortable.

Before thinking about options, assess what are considered problems in your agency. Are descriptions generally in terms of technical issues (e.g., quality of data spotty, turn-around time too long, required reports too expensive to generate, data not easily shared, no one knows how to operate the new computing tools)? Are there tensions between departments (e.g., Finance and Service Planning) which lurk close to the surface? Is lack of funding (e.g., for acquisitions or new staff) invoked as a barrier to solving problems? Since perceptions of problems usually are the basis for analyzing conditions and designing solutions, take care to make these perceptions explicit. It may even be appropriate to develop a strategy which widens perspectives on what actually constitutes a "problem."

Assessing how individuals and their organization interact provides many valuable clues to good designs. That is, know your organization's strengths and weaknesses. Though you may feel that you already have sufficient experience, mapping out how things work will help you discover features which mediate for or against particular strategies.

TECHNICALLY BEST SOLUTION CREATES TURF BATTLE

The agency, which shares administrative staff and support services with other city departments, recently encountered a situation which has substantially disrupted its current MIS operation and expansion plans. Together with its sister city agencies, a decision was made several years ago to upgrade their IS (bringing batch processes on-line) significantly and add many more applications. To do this, they brought in an outside data processing management firm to run their data center and assist in putting up new applications. In reviewing the two major operating environments supported by the data center, the management firm recommended dropping one operating system (OS) and converting all applications to a single environment to better provide efficient computer services.

The Director of IS has initially supported this recommendation because he believes it will allow him to avoid some headaches and develop and support improved applications more quickly. However, several transit departments are extremely concerned because their current applications run on the operating system not selected for continued support and they fear potential difficulties in effecting a transition to a new operating system. The Scheduling Department is especially hurt by this recommendation since their current RUCUS program was on the wrong OS.

The agency is now in some turmoil over this decision and all new IS work has slowed to a crawl, in some cases significantly delaying transit efficiency improvements. The ***conflict from wanting to have a more efficiently run data center and at the same time meeting user's needs*** *in a large multimodal agency has become a major internal issue marked by bitter turf battles. In short,* ***overall agency policy goals have been obscured by self-interested departmental missions****.*

B. Organizational Set-Up

Table 1 lists questions to help you articulate the main attributes of your organizational set-up. If an agency tends to suppress open conflict and "solutions" are passed down from top management, the "right" strategy will be quite different than for a participatory type of agency. Though the degree of intensity varies depending on an agency's size and complexity, conflict across areas of functional responsibility is nearly inevitable, regardless of what tools are used. In fact, it is virtually an expected part of organizational life that managers and those responsible for a particular area will seek to "maximize their welfare" in terms of degree of autonomy, proportion of the total budget, number of employees, number of high visibility/prestige assignments, etc. A microcomputer, for example, should be seen simply as another kind of resource which not only can increase its owner's status and capacity to do work better, but also can lessen dependence on "outside" experts.

TABLE 1

What Kind Of An Organization Is Yours?

* What is the agency's primary mission?

* What management style dominates? (e.g., top-down, bottom-up, participatory)

* How are responsibilities assigned?

* How much autonomy is permitted in managerial tasks? In technical matters?

* What are the lines of authority? How much control is exercise in data processing matters? Who determines the budget for data processing? How?

* Who makes decisions about acquiring new computing tools? How?

* How are conflicts resolved? (Use a recent information systems case as an example.) Do people involved usually feel outcomes are fair/just?

* What non-data processing issues currently dominate the agency (e.g., budget crunch, staffing shortages)?

* In light of changes considered in computers, what organizational changes might be appropriate (e.g., reassignment of personnel, re-structuring of functional responsibilities, creation of a new support center for entire agency)?

Is control centralized in one person or department? Be aware that there may be discrepancies between what shows up as a "computer-related" purchase and what is actually bought. Organizations which have developed a separate department for data processing (DP) or information systems (IS) seem to encounter conflicts most quickly when microcomputers begin cropping up. Especially in larger organizations (transportation agencies being no exception), there is a familiar litany of complaints which most "end-users" (label given by DP people) lodge against their DP department: long turn-around time, unresponsive staff, lack the functional area's concerns, poor documentation of software.

IGNORING TURF IS RISKY BUSINESS

The Director of Socio-economic Analysis in a metropolitan planning organization (MPO) decided that the use of microcomputing tools would increase efficiency and delivery of his division's services (environmental reviews, survey data analysis, etc.). He expected to achieve cost savings as well as improve products and was certain the MPO'S board of supervisors would applaud such an outcome. Lacking formal policies or procedures for acquiring software or hardware, the Director proceeded on his own. He knew that this would be faster than seeking the assistance of the agency's Information Systems (IS) group and that the end product would better satisfy his particular requirments. The Director began by first defining the objectives of the agency and the role of his division in realizing these objectives. He next outlined the information needed by his division to carry out its responsibilities effectively. Based on this analysis, he compared software packages (and required hardware) which would serve his needs. Purchase was financed out of the current year's operating budget.

By delivery time, the Director and his staff had already become familiar with the computing tools through a vendor's training course. Though anxious to begin, ***the division's efforts were foiled as they learned that their micros were incompatible with the mainframe on which the IS department maintained all of the operating statistics*** *(i.e., could not be passed back and forth directly).* ***The proper solution meant rewriting the files and maintaining a duplicate set of data on the mainframe. The IS department,*** *however,* ***was reluctant to do this****. They maintained that it was an inefficient use of their resources, particularly in light of other current priorities.* ***Close to the surface of their reluctance was the fact that they were not consulted about the purchase of the microcomputing tools****. They felt that had they been consulted, the problem would not have occurred.*

The Director then decided that his staff would write a program to transform the data files into an acceptable format. The program, particularly given his staff's inexperience, turned out to be complex and required twice the expected number of hours to complete. The final product was less than satisfactory, in no small part because microcomputer software could not be used to its fullest capability.

Regardless of whether the complaints are justified, the advent of microcomputers, if matched with an ability to purchase them without DP approval has led many functional departments to develop their own facilities. Though "end-users" may then have more immediate means to process information as needed, they also run increased risks of creating a new set of problems. First, to the extent that sharing with other departments is required, increased autonomy could result in the proliferation of bad data. Second, to the extent that applications are similar across departments, staff time and energies will be wasted if resources are not shared or at least coordinated. Third, unless people in a particular functional area have a background in computer use, they may suffer the same maladies they find in traditional DP departments, i.e., lack of any or understandable documentation, inconsistency across applications and unmet expectations when products cannot be delivered as fast as promised (many think microcomputers can help perform miracles in seconds flat!).

COMPUTING TOOLS CAN SERVE ORGANIZATION-WIDE GOALS

The manager of the Office of Fiscal Resources in a metropolitan agency was the subject of increasing criticism for her inability to resolve recurring cash flow problems and budget overruns. In the manager's estimation, the problems stemmed from things outside of her control. One cause was the poor budgeting and expenditure control practices of the departments. A second cause was the untimely and cumbersome financial reports she received from the data processing center.

The manager decided that the ***solution to her problem was to increase her control over the budget preparation and monitoring process, while at the same time increasing budget accountability of the other departments****. To accomplish her objectives, she developed a microcomputer-based financial information system. The system has the following components:*

- *a standard set of budget preparationprocedures, including reporting requirements and formats;*
- *a common database to support budget preparation, which is controlled by themanager;*
- *a single database for maintaining budgeted, actual, and short-term expenditure projections;*
- *a formal set of criteria to evaluate budget implementation performance by functional area and procedures for monitoring performance, rewarding good performance, and taking remedial actions;*

- *an ad hoc inquiry capability for access to up-to-date budgeted and actual expenditures, revenues, and cash flow status; and*

- *a set of programs to support preparation of budget projections and to perform financial analyses.*

*To implement the system, **microcomputers with access to the mainframe database were provided to each department.** Appropriate staff were trained in use of the computing tools and new management procedures. The **system has resulted in** better budget and cash flow control through more **centralized control of the budget preparation and implementation process and more decentralized accountability for budget performance.***

C. People

From the above discussion, it should be evident that tools cannot be assessed without considering the tasks for which they are used and, of course, the people who perform the tasks. Traditionally, computing has been done most often in and through a department of finance. The first waves of automation occurred in clerical functions involving the manipulation of large volumes of numbers (e.g., payroll, accounting). Though most transportation agencies are not exceptions, an increasing number of non-clerical professionals are turning to (micro)computers as tools for their work. Be careful to identify those individuals not directly involved in data processing who may have a strong interest in future computerization.

Have a look at Table 2 before you introduce new tools. Are people invested professionally (or emotionally) in a particular manual procedure? For example, an analyst may be able to justify taking two weeks to complete computations which otherwise would take two days with a microcomputer. Having the longer period means less direct supervision and more opportunity to bury slack time, both of which may provide autonomy and social contact. In short, switching tools may have side effects beyond the immediate tasks to be performed. Not to assess the people layers beneath data processing activities is to invite trouble, as the following case shows.

TABLE 2

Checklist For People Factors

* What are the main types of work performed in your agency?

* How do people interpret thier tasks?

* How will jobs be affected by the various computing tools to be introduced? (e.g., speed, degree of interaction with others)

* What are the likely perceived threats from a new system: How realistic? By what mean can they be identified and diffused?

* Will descriptions or definitions of jobs change or need to be changed?

* Where in the agency are the people (1) with the technical background best suited to the new tools? (2) with the organizational savvy to help put the tools to best use?

* Where in the agency are the people most likely to resist new tools or even create a "counter-implementation"?

* How will reporting relationships be influenced? Will levels and difficulty of assignments and responsibilities be changed?

EDUCATION SHOULD COVER MORE THAN JUST COMPUTERS

Traditionally, the staff in the Office of Training of a large transit agency have been responsible for compiling, investigating, and issuing periodic reports on operator accidents. An extensive record exists for each accident which identifies the driver's employee number, years of driver experience, type and location of accident, extent of damage, etc. Although the database is potentially useful in identifying accident patterns and leading to new training programs or operational procedures, the data have never been utilized in this way. Data were compiled and reported manually for several years until the IS Department suggested that accident reports could be automated easily and that the agency would save time, money, and have more detailed data analyses. A file format was developed and sent to the training office so that forms could be developed to transmit the accident data to IS.

After a few weeks' practice the ***new forms were regularly completed and submitted; however, the training personnel kept compiling*** *a limited number of* ***statistics by hand*** *and generating periodic reports manually. The general feeling among training staff was that the computer report "would take too long."* ***The training personnel really did not understand the process of developing more detailed and informative reports from the computer file, but data processing personnel also never took any initiatives to help develop new reports.*** *As a result,* ***a computer file has*** *regularly been generated which has* ***been used by no one within the organization.***

This fact had further negative consequences. The potentially most valuable use of the database (i.e. generate a wide variety of accident trend reports such as, accident rates by garage, by operator experience, by location, etc.) has unfortunately never been realized. Data processing staff, feeling that no one was using the data, has regularly purged the file at the end of each calender year. ***Because people issues*** *(e.g., training to correspond to the new tasks)* ***have not been addressed, none of the original objectives of computerization were met.***

Anyone who has worked in a professional organization knows that people all have unwritten "rules" of behavior (e.g., who eats lunch with whom, which people can be asked about what types of problems, etc.). Although some of these rules may have no bearing whatsoever on the success of new computing tools, one should map out the apparently relevant ones in advance. If a particular person is usually consulted with regard to a manually performed task (and thereby gets status), he or she may resist computerization.

Unwritten rules often reflect the quality of relations among staff members. In changing the way people work, these relations will inevitably be affected. Take time to understand how people within and across functional areas (or departments) compete and cooperate. Computers are resources and, as such, will probably be in scarce supply. Whatever cooperative or competitive behaviors already exist will

probably not be changed by the adding of new tools in itself. If current practice is not simply to be extended, then some action will need to be taken to change behaviors. For example, if relations between the planning section and data processing/finance are characterized by suspicion or mistrust, putting finance people in charge of procuring tools for the planners could be a ticket to failure.

The most obvious things to assess about individuals in an organization are the skills they bring to a job. Clearly, there must be at least a willingness to learn new procedures (e.g., entailed with microcomputing tools). At the same time, a person's attitude toward new tools plays a critical role in whether or not productive applications can result. The persons' personal/professional backgrounds inevitably influence what are considered valid options for the agency as well as how the tools are received.

Productively using new computing tools (e.g., micros) typically means giving explicit attention to the "key" people in the agency. Have another look at Table 2. Though most staff will be somewhere in the middle, the world can be divided roughly into "resisters" and "champions." While good implementations may not have encountered resisters, they almost always have someone who enthusiastically promotes the new technology. Such a person doesn't necessarily need to be a computer expert or be part of the DP shop. However, promoters generally have a good sense of the organization and know when to provide which information to top management. It is a good idea to provide such individuals with important roles.

Key people may also play the opposite role from champions. It is widely acknowledged that increased use of computers can alter people's jobs enough to cause distress and dislocation. When the use of a computer results in peoples' needing to exercise less professional judgement or having their performance more closely scrutinized, resistance or even sabotage should not be unexpected. This can take any number of forms, virtually none of which is productive to an organization.

AGENCY COPES WITH COMPUTER RESISTER CREATIVELY

A 75-bus local transit authority procured and installed a precoded microcomputer-based transit information system to automate many of its functions. Implementation meant a significant redefinition of jobs. Although most personnel responded favorably, the Payroll Manager resisted the computerization of "his" payroll system vigorously. He was not only the single person who understood the entire process, but he also kept a great deal of payroll/personnel information (e.g., deductions, schedules, employee classifications) in his head. The General Manager and departmental managers consulted him frequently because he was the ony source of personnel information. In the context of the manual system, he wielded considerable organizational power.

Automation threatened this power because it would change his "private" information into data available to all members of management. *Since top management had approved automation of the payroll system, there was little he could do to stop it. Instead he adopted a policy of noncooperation. Although professing enthusiasm, when the project team met with him to collect information for the new system, he was always "too busy to deal with the stuff now."*

Faced with his resistance, the project team informed the General Manager that their conversion date for the payroll system could not be met because of the payroll manager's lack of cooperation. The General Manager, who was afraid that the Payroll Manager would quit if forced to comply, gave the project team permission to use the payroll records surreptiously to build the system. Working late at night without the Payroll Manager's knowledge, the team was able to find most of the information needed to build the employee master files and the payroll history. However, certain information, such as deductions and schedules, had to be confirmed with the Payroll Manager since only he knew that information. This was extracted either by direct questions (to which he sometimes responded) or by having the chief accountant make knowingly incorrect statements about payroll processing in staff meetings which caused the Payroll Manager to contradict him with the correct information he otherwise would not have provided.

The project team built and tested the system on an overtime basis in order to avoid arousing the Payroll Manager's suspicions. With senior management unwilling to force him to participate and the calender year-end drawing near, the project team had little alternative but to develop the system secretively. ***Once the system test was completed and the General Manager was satisfied with its accuracy and completeness, the Payroll Manager was informed that the system was operational, that top management considered it to be the official payroll system. He was given the opportunity to learn the system and assist in the year-end conversion.*** *Instead, he retired and was replaced by his chief clerk.*

D. Material Resources

Assuming you have followed the procedures suggested in Selecting a Single User System ("Selected Readings," Volume II), you have already identified some

computing tools which meet your agency's or departments' needs. Perhaps you have or soon will have several microcomputers and associated peripherals (disk drive, printer, etc.), plus word processing and spreadsheet software. Though the process may have seemed quite straightforward, consider Table 3.

Think about the decisions made when you bought your current tools. If you or someone in your agency (or department) already had computers, in all likelihood your decision was based on what tools would complement the current situation. Perhaps you selected a statistical package for a microcomputer and a letter quality printer. For next year, additional microcomputers may be in the planning. Whatever the sequence, accumulating tools now means that some future options may, at least partially, be foreclosed. Consider carefully the likely directions your organization and its staff will take, especially in terms of the kinds of information requirements. Don't get locked into any particular configurations without very good longer term reason! Compatibility, for example, becomes more and more of a potential problem if decisions to purchase are uncoordinated. Communications with other people's machines may not be a concern now, but if no provision is made, currently acquired tools may not match future requirements, a situation which may be costly.

Without doubt, tools' value to an agency is largely a function of how well its staff members' jobs are improved by their acquisition. At least two things are important here. First, are the tools physically available? If they are monopolized by one person or department, friction is bound to result. Second, how well are people's jobs really improved? If some computing tools are already used, try to assess their usefulness compared to manual procedures. If none exists, talk to someone in a similar organization.

MICROS REDUCE MPO'S COMPUTER COSTS

Faced with the loss of computer support provided by a state agency, the director of a small metropolitan planning organization (MPO) explored using microcomputers as a viable alternative. Because the primary support was in the areas of traffic engineering and transportation system management, she focused her research on tools in these areas. She found that ***for a relatively low cost*** *for (software and hardware under $10,000), and* ***no additions to existing staff she could replace the state's support services with a microcomputer****.*

TABLE 3

Checklist for Material Resources

* How much does your agency spend on computing tools annually (e.g., including outside service bureaus, consultants, etc., as well as machines and software)? How much of this did you guess because accurate figures don't exist?

* Does anyone else in your organization or in a nearby agency already have a microcomputer?

* What have you learned from their experience with acquisition?

* Do data created on their machines need to be transferred to yours?

* How easily will this happen? How often would this be required?

* How often do applications involve sharing data or information with people outside (e.g., with a state or federal agency)?

* How compatible are hardware and software (especially within larger agencies)?

The introduction of the computing tools proved more successful than anticipated. Initial uses of the tools included intersection capacity analyses, project planning, corridor analyses, and analyses of TOPICS projects (channelization, parking policies, circulation systems, signalization). The organization also reduced its overall computer costs with the ***elimination of time-sharing expenses associated with using the state's facilities****. The initial success encouraged other applications. These have included site impact assessments, long-range planning, transportation air quality studies, population forecasting, ecomomic development analysis, and other comprehensive planning functions. What at first looked like a possible crisis actually led to improved productivity as well as reduced overall computer costs.*

E. Policies

Since explicit or even legal arrangements can be changed more directly than informal "rules" of behavior, an assessment of policy takes on added importance in terms of developing strategies. In contrast to assessing individuals, the focus here should be on formal processes related to procurement and use of computing tools. Consider Table 4.

The larger the agency the greater the likelihood that computing tools will not be used efficiently across the organization. Especially when sub-groups (departments, divisions, etc.) have autonomy to purchase and use their own tools without prior consent from elsewhere in the organization, duplication is almost inevitable. (Bear in mind, however, that the cost of sharing in terms of paperwork and scheduling may exceed the cost of duplication.) Examples abound in the transportation field, as well as in other parts of the public sector, of departments treating microcomputer equipment as "stationery" or as "office furniture." Once managers or professionals in more than one department have figured out how to by-pass the channels which exist to screen the acquisition of larger scale tools (e.g., mainframe or minicomputer-related equipment), decisions about what tools to purchase and how to use them cannot be assumed to be coordinated. Each person evaluates options from his or her functional perspective, of course. If assistance from the traditional sources of computer know-how (Finance or DP) is perceived as insufficient, then evaluations also have the additional criterion of needing to develop tools independent of other functional areas.

TABLE 4

What Policies Govern Computers?

* What provisions are made for training? At what levels of the staff? (e.g., can managers also get technical computing skills?)

* What skills are valued?

* Are there committees for coordinating data processing across functional areas? Are they "standing" or "ad-hoc"?

* Does your organization have an agency-wide committee? How often does it meet? What decisions does it make? Are they binding?

* Has an explicit policy for acquiring microcomputers been articulated? By whom? Does the policy apply equally to all departments in the agency?

NO "MICRO" POLICY CREATES COMPUTING CRISIS

Over the last several years most staff people who need help with data processing (DP) have learned either to do it themselves or let an outside service bureau handle the task. The ***DP specialists****, located in the Finance Department of this 200-plus vehicle transit agency, have been busy fighting their own fires. Their eight year-old minicomputer is "down" over 60% of the time and they* ***spend large chunks of their work days trying to install or maintain Finance-related software*** *(most currently, a forecasting package). Relations between DP staff and everyone else has been, until recently, frozen; it's easy to see why.* ***Requests for training and assistance typically go unanswered****.*

Proliferation of microcomputers threatens to move DP's relations with line staff from cold to actively hostile. Current count showed four hardware vendors and two incompatible operating-systems, none linkable to the minicomputer. While DP was consulted on two of the micros, the other two were slipped in as "office furniture" or "miscellaneous project expenses" after a moratorium was declared on computer acquisition last fall. The agency's minicomputer is used less and less. ***The head of the DP insists he has no time for controlling the spread of personal computers and everyone else looks to the Executive Director to step in to the picture****. He remains idle in the matter.*

Through sometimes costly experience, agencies have found themselves laden with computers, software and accessories (e.g., floppy diskettes) only some of which are compatible. Further, tools may be used less often than would be considered acceptable in the traditional mainframe or minicomputer environments. If no standards have been developed and enforced in the purchase and use of computing tools, particularly those related to microcomputers, seeds may be sown for deeper problems related to the effectiveness of an organization.

III. SPECIFIC ACTIONS TO CONSIDER

Enough evidence on actions carried out in various industries is available to begin to develop guidelines which could be used by transportation agencies. The discussion below is offered as a summary of promising steps to take, some of which may be relevant to your organization. Keep in mind that single actions in themselves will rarely make a significant difference, but should be part of a well conceived strategy accounting for the organizational and people-related as well as the technical factors in your agency.

The section following this discussion of actions lays out a framework for analyzing your own situation. Once your agency's goals and needs have been clarified and its problems made explicit, an action plan can be put together. Because no predictive model yet exists, the contents of such a plan spring mostly from your own professional judgement. While analogies may be drawn to similar organizations, there's no substitute for careful analysis of your own agency, its goals and informational needs.

A. Conduct an Information Needs Assessment

In order to ensure that new computerized methods support an agency's goals, a clear assessment of the need for information should be drawn up. Many approaches have emerged in recent years as part of "business planning." While they have a variety of labels, their content typically includes:

* identifying tasks for increased automation
* grouping tasks by function
* specifying the information needed to carry out each task
* defining how the information produced in one task gets used in other tasks

* evaluating the pros & cons of current information production and consumption

Experience has shown that those managers who have agency-wide responsibilities ought to be actively involved in the process of identifying "needs." If computer or functional area specialists alone are in charge of etermining and planning for informational needs, longer term goals of the agency are lost. For example, integration of various sources of budgetary data may fall victim to "empire building" actions of individual task managers who all want their own "financial" databases. Analysis of informational needs for "the whole" will usually produce results different than for the "sum of the parts." Agency-wide managers don't necessarily have to be involved in detailed descriptions of functional tasks, but should check in at several critical points in the process, not only when the final draft has been prepared. Knowing informational needs should be treated as a central component of good management practice as well as the foundation for directing an agency's plans for automation.

B. Develop a Policy Statement

With growing frequency public agencies as well as private concerns develop a "policy statement" as an explicit point of reference for staff. (an example of a policy statement plus a generic description are included in the appendix to this guidebook.) While the form and content of these statements vary, the more useful of these share a common set of traits; they:

* define and justify the role of microcomputers

* establish which hardware configurations and sets of software to support

* specify how tools will be acquired and serviced

* outline the roles and responsibilities of managers, users and support staff

* anticipate future issues (such as micro-mainframe data communications) to ensure compatibility with existing information systems

By specifying physical requirements and limiting the number of vendors whose products receive active support, not only are staff resources conserved but also future acquisitions are effectively channeled so as to help minimize incompatibility across functional areas. This is particularly useful in larger organizations. By enforcing the statement in practice, a clear message will be sent out to the different departments: don't become data processing experts, but focus on knowing your functional specialty so that non-procedural (i.e., usable with little or no programming) tools can be used to good advantage.

Most observers agree that any policy statement should be a part of an overall plan for processing information and helping an agency toward improved realization of its goals (e.g., cost-effective delivery of service). If possible, it should reflect the directions the agency would like to take over the next few years, for example, toward the currently much discussed "multi-function workstation." In any case, the more useful policy statements seem to encourage staff to focus on the functional applications which call for computing tools, rather than the tools themselves.

C. Provide Training and Education

Since most transportation professionals have only recently begun to consider the place of (micro)computing tools in their jobs, education and training are very important actions. Beyond simply sending an employee to one of the many private or public short courses available, a number of organizations (initially private companies like IBM and Xerox, but more recently public transit agencies) have set up "information centers." (IBM coined this phrase in 1979; other organizations also use the terms "resource" or "support" center; while some talk about "in-house stores" it is rare that tools are actually sold on the premises.) There is wide variation in levels of sophistication in and approaches to such centers (in terms of commitment of staff and time), but most try to employ available staff to help users become comfortable with and competent about computing tools. Usually support staff come from among information systems/data processing personnel, but not always. (A reprinted article in the appendix illustrates the idea of a center.)

In larger public agencies, their creation should not be too different from the private sector. In smaller ones, a training "center" could be shared with other public

agencies (e.g., in the region, in a city or county government), as a means of pooling scarce computer support staff. Part of this arrangement could certainly be agreements to make "volume purchases" at discounts for a set of smaller agencies. Usually, well conceived "centers" are, like policy statements, a reflection of the agency's attempts to:

* help solve functional problems, but not necessarily write software
* assist in identifying information needs and therefore the appropriate tools
* determine the expected benefits from increased use of computers
* promote self-sufficiency in dealing with data-related problems
* eliminate duplication of effort

Occasionally, centers serve data processing professionals as a means of controlling the proliferation of microcomputers by directing users to consult them as technical problems occur. Often, they become valuable means of providing "hands-on" experience to non-data processing professionals, which in itself may be the most important form of "training" an agency could provide.

Besides establishing a "center," an agency has a number of other readily available means of self-education. It can encourage staff to form a user group or join one of the many which have been formed in the last few years Further, one can subscribe to the user groups' newsletters and to selected trade magazines or news weeklies, a growing number of which include articles on organizational topics.

In addition to computer training, many agencies would benefit from increasing the sensitivity among professional staff to the organizational effects of technologies. Whatever your current stage of automation, additions to your department's or agency's computing tools beyond today's planning horizon will also affect organizational development. It makes good sense to train key staff to be able to conduct assessments of the organizational changes which ought to accompany technical improvements. There are a growing number of appropriate short courses

provided by universities and by consultants. Care should be taken to choose staff members who are: (1) most able to recognize organization-wide trends; (2) have rapport with staff across functional areas; and, (3) are respected by top managements.

EDUCATION PROGRAM BENEFITED MORE THAN JUST MICRO USER

The key managers of a medium sized transit agency believed microcomputers could be used to increase productivity. While the authority had most of its computing resources dedicated to the existing mainframe, management wanted to decentralize computer use and programming for specialized functional applications. To accomplish this, a well-coordinated implementation process had to be conceived. To facilitate the infusion of microcomputers into the authority, the Information System (IS) department was given responsibility for their selection and implementation in other departments. Because it became apparent that data would need to be shared between IS and the functional areas, IS became very concerned about the compatibility of machines, networks, and communications. To impart this concern to the staff, an educational program that relied on internal and community college training for both "hands-on" users and their supervisors was initiated.

The training resulted in two benefits. ***The staff learned how to apply computer tools, and they learned what analyses were performed in other departments.*** *As a result,* ***communications*** *between staff in various functional units* ***improved.*** *Since many units shared data resources, improved communications led to an increased understanding of functional reponsibilities and roles. The staff could now understand the range of analyses being conducted on shared data and the data necessary for various activities. For example, operating data was used in forecasting and budgeting whereas maintenance and operating data was used by purchasing.* ***Many departments began to share data directly instead of going through the IS department.***

To ensure continued success, various policies and procedures were established. One such policy required that all management staff be proficient on the microcomputer as part of their job responsibilities. Management's knowledge of the microcomputer applications strengthens its relationship with not only its own staff, but also other staff, ensuring that communications among departments continues.

D. Create Avenues of Participation

The most evident form of organization-wide participation is the "advisory committee." Typically this takes the form of having a representative of each department or functional area meet periodically to discuss computing issues of mutual interest. Unfortunately, such a committee is only as effective as the quality of inter-departmental relations allow. For example, if the Data Processsing ("DP") section is perceived as ineffective at meeting the demands for various applications,

a committee chaired by a DP person may be discounted from the start. Moreover, "advisory committees" don't necessarily involve actual users of computing resources. The larger the agency, the higher the chance that users' supervisors may not understand applications and the needs for coordination across areas.

Using more ad-hoc approaches may have a greater impact than having standing committees, especially if they are integrated into the process of introducing new computerized methods. Working groups with a limited life and tightly defined mission can be formed at strategic times and for a variety of purposes:

* identify areas most in need of automation

* generate ideas for how to computerize manual procedures

* develop the agency's policy on acquisition and support

* set priorities for training (topics and methods)

* review performance of tools

* study potential enhancements to existing system (e.g., data communications)

* recommend preferred options

DOT'S PLAN NEARLY FOILED WITHOUT PARTICIPATION

The Director of Information Services (IS) in the State DOT attended a convention at which microcomputers were featured. She was impressed by the range of applications available (e.g., project management, financial forecasting and accident analysis) and was convinced that microcomputers would enhance DOT's effectiveness in many divisions. More urgently she also thought microcomputers would relieve IS's backlog of requests for custom programs and reports by other divisions. When she returned from the convention, the Director had her staff develop a plan for the purchase and deployment of microcomputer hardware and software throughout the State DOT. Plans were based on a review of requests for programs and reports made by other divisions and the IS staff's perception of which software applications which could improve the performance. The plan was sold to top management and the computing tools were purchased and deployed. The first step in implementation was sending a memorandum to all division directors outlining the plan to use microcomputers and explaining what improvements in performance could be expected. This was followed

by a demonstration of software applications. Participants were informed about microcomputer courses available to them and given instruction manuals.

Much to the IS Director's surprise, reception to the plan was cool. During the demonstration, participants questioned microcomputers' relevance to traffic engineering and transportation planning. As a result, many of the analyses that seemed to be conducive to the microcomputer environment continued to be performed by hand. The expectations of improved efficiency and productivity that convinced top management to embark on the plan were not forthcoming within any reasonable time, the IS Director was asked to explain the poor performance at the next senior management staff meeting. In her review, the IS Director found that: (1) they were being used, but not to the extent that she had expected; (2) the computing tools when used were only being used for rudimentary and unimaginative purposes; (3) even in these applications, the approaches were inefficient and cumbersome; and, (4) the more creative uses of the micros were largely being ignored. The problem finally came to a head at the management staff meeting when the IS Director's findings were reported. One after another of the directors of functional areas openly criticized the "declining performance" of the IS Division as well as the unilateral approach the IS Division had taken to the selection and deployment of computing tools. Further, it came to light that ***both management and technical staff judged the training provided to be inadequate and felt that IS was presumptuous in trying to judge how other divisions could improve their performance.***

As a result of this meeting, a user's group was established which reviewed and redeveloped the entire plan for deploying computing tools. ***A substantial effort was made to involve staff of the various divisions in articulating needs and to provide effective training courses and continued technical support.*** *Though reluctance to use the tool has not fully dissipated, micros are gradually being more fully integrated into functional tasks.*

E. Conduct a Pilot Project

Especially if new ways of performing jobs are being introduced (e.g., via a microcomputer), "phasing" is often an essential characteristic of successful implementation. The first application ought to solve a real problem (i.e., "felt need") with a small piece of technology (e.g., a stand-alone microcomputer) and deliver something regularly. If designed carefully, such a strategy can incorporate a number of the other "actions" listed above. The central idea is to start modestly with applications which have a high chance of success, then move on to build more complex systems. This approach also encourages experimentation which is essential to obtaining the most creative use of new tools.

Since no single application can be identified as generally appropriate for a pilot or prototype project, each agency must decide what has the greatest chance of success

based on current needs. Keen (see article on policy statements in the appendix) proposes assigning a "coordinator" for microcomputers. A pilot project would be a prime time for such a person to help implement a "policy statement." Using Keen's approach, possible characteristics of a "phase one" prototyping strategy might be:

* results in demonstration of application's suitability for computer
* uses recommended (see "policy statement") hardware and software
* introduces user to new technology (e.g., microcomputers)
* motivates user about computer's potential
* shows capability of computer to meet requirements of applications
* gains approval for additional development
* limits programming work to five days

PILOT PROJECTS HELP STATE DOT ARTICULATE FUTURE

While the Director of Finance in a mid-sized State DOT was convinced that microcomputers would play a major role in helping his staff (and ultimately the entire agency), he chose a gradual, phased strategy for implementation. The backbone of his actions was a series of three pilot tests. Hardware items (microcomputer, disk drives, printer) were selected based on the software available to carry out tasks in various functional areas.

The first of the micro set ups is located in a residency office and has been used for local record keeping and report preparation (related to road stock items, commercial and utility permit applications and traffic count data). Though no dollar savings has been pinpointed, time for responding to data requests has been cut by 70%. The second micro system is found in the Central Budget Division. Its spreadsheet and word processing features are used frequently by several offices (sign-up sheets often need to be used) and analysts can evaluate the effects of proposed changes in the budget in a tenth of the manual time. The third micro has just been purchased and will be assigned to a project inspection team which plans to use it to assist with routine record keeping on specific construction projects.

*In light of his experiences in the three pilot tests, **the Director** is in a good position to begin to establish a policy to manage the purchase, use and evaluation of micros. He **now has tangible evidence on the strengths and weaknesses of his staff with respect***

to the new tools, and some ideas of how to make the best out of both. Because there are a wide range of types of applications, the Director has created a new position for a person to be responsible for coordinating the specification, evaluation and implementation of micro hardware and software. The person will be expected to chair a committee of managers across functional applications and to reach concensus on the specifics of Departmental micro policy within the next half year.

F. Design and Carry out an Evaluation

Particularly when new products and procedures are introduced, some change is not only likely but desirable. Anticipating the changes, however, is only the first step in the process of improving practice. People will react differently than expected and tools do not always perform without flaws. People who appeared to be either supporters of or at least neutral with regard to new computing tools can evolve into resisters or critics. Conflicts across functional areas arise as competition for use of a new tool intensifies.

Since it is essential to determine if changes have actually provided enough benefits to be justified, some regular process should be established for evaluating the use of computing tools. Such an evaluation should:

* be quantitative where possible, i.e., develop indicators of benefit to be compared over time; Keen lists categories such as:
    - work eliminated
    - costs avoided
    - return on time
    - improved decision-making
    - quality of work life
    - spin-offs
* involve key affected people
* incorporate unexpected developments in its course
* lead to specific recommendations for shifts in procedures or future acquisitions as a response to comments received
* be guided by overall objectives of the organization, rather than by narrow technical criteria alone; for example:

- quality of information for decision-making
- flow of information throughout the agency
- quality of the work environment
- distribution of power as well as operational performance as judged by speed and other technical measures

* be honest in terms of the extent goals have been met

* point toward a self-generating process (routinization of practice)

Building in a "feedback loop" is perhaps the most important action you can take if changes in computing tools are to be a part of longer term improvements in the way your staff does their jobs. Increasing use of microcomputers and associated software, for example, may require more adapting than ever before in the agency's history. As computer systems are called into question, the financial implications can be quite serious. If an agency makes a large commitment to a particular set of tools (e.g., a million dollars worth of mini-computer equipment and software), admitting that another configuration could serve the agency's needs better and more cheaply becomes very difficult and even painfully embarrassing. Smaller scale and much less expensive micro-computing tools lend themselves to phasing-in and reconfiguration as needed. In this regard, smaller agencies without prior experience with or commitment to particular computers have an advantage over larger organizations already linked to specific vendors and products. If an explicit and reasonably objective evaluation is conducted of pilot tests of a computer or software battery, an agency can get information valuable in deciding whether and how much of an additional commitment should be made.

IV. MATCHING YOUR ASSESSMENT WITH ACTIONS

A. Developing a General Strategy

As you went through the actions proposed in Part III you probably wondered how they matched the answers to the questions raised in Section II. By this point in the document you probably realize that there may well not be a neat match between problems and actions for your agency. Further, it should be clear that a publication such as this cannot possibly serve to guide your agency in developing strategic plans. Though the list of variables which are key for most agency's strategic planning is finite, it is varied enough across agencies to make generalization fruitless. It seems most productive to recognize managing computing tools as directly linked to managing people, and that by applying sound and fundamental principles of managment, adequate solutions can be found. Except with simple applications, creating productive strategies definitely requires some talent in managing people. In particular, skills at planning and at recognizing the need to change your organization based on new experience or evidence are crucial.

Because a computer is simply one part of the means to carry out an agency's mission, a manager needs to have a good idea of how computing meshes with the many other agency-specific factors. Though more scientific "models" of organizational change are being developed, they are not yet at a point where they can be applied more than generally. For most cases, managing change around new computing tools usually means creating trends. If the process of introducing and using new tools is seen as evolutionary, alongside or together with developing an organization, then actions should be selected to complement both the agency's present and desired future condition. For example, if little prior experience with computers exists in the agency, then conducting a small pilot project would definitely be a means to evaluate computers' usefulness and ways to manage them. If a good deal of knowledge has already been assembled, actions ought to build on it as a strength. For instance, it may be wise to transfer technically talented people to an agency-wide support center temporarily. Once "resisters" to a proposed new computer system have been identified, including them in an advisory committee may be a healthy move.

B. Using Outsiders

Perhaps you have gone through this guidebook and begun to think about how organizational issues could be addressed to increase the benefits from a new computer. In smaller agencies with a professional staff numbered on one hand, appropriate actions may be straightforward and evident to most general managers. For example, if several staff people are afraid they are not competent to use a computer, careful phasing with gradual pressure to change procedures may be all that's needed. At the other extreme, in larger agencies with little prior experience with computers among non-DP staff, suitable organizational actions may not be evident. Even if you are ready to try out several of the actions, it may be unclear how best to stage them during or after bringing in new machines. This point, could be the right time to use outside help. A wide variety of services are available, but a productive mode of operation would be training selected staff members to become skilled in organizational diagnosis and the management of change in organizations. Especially if your agency is to develop its people resources along with its tools, one of your best long-term investments may be to train your own staff (managers as well as technical) to plan for and carry out actions designed to get the most of computing tools. Since consultants and training courses are available for those purposes, resources may be wasted by trying to train staff without any outside help.

C. Knowing You're on the Right Track

Assuming you have developed at least a semi-formal process of evaluation, you may wonder how to know when you have had "success." Go back to the list of technical and organizational goals you set prior to implementation and assess current and likely future conditions. Ask yourself:

* Do the new tools or systems operate as designed?

* Have resisters been incorporated into the process constructively?

* Has individual and organizational support for new procedures been drawn out to the fullest?

* Does top management still support the project? How is their support expressed?

* Are the computers used for purposes to which they are best suited (e.g., considering their speed versus available alternatives)?

* Are the tools used by the most appropriate staff (e.g., considering the cost of time relative to others who could carry out the tasks)?

* Do current procedures represent substantial improvements compared to before the new tools were introduced?

To the extent that the answers to these and similar questions are negative, have another look at this guidebook and its appendices. In any case, organizational issues rarely can be foreseen entirely in advance, and the set of important factors for your agency may well change over time. Even if your current implementation seems to be "successful," try to keep the issues raised in this publication in mind for future cases.

APPENDICES

1. "A Policy Statement for Managing Microcomputers," by Peter G. W. Keen, reproduced from Computerworld, May 16, 1983, with permission of CW Communications, Inc., Framingham, Massachusetts.

2. "Microcomputers-An Interim Approach," Minnesota Department of Transportation, July 5, 1983

3. "Information Centers on Rise/Need DP Management Boost," by Bill Dooley, reproduced from MIS Week, vol. 5, #23, 6 June 1984, with permission of Fairchild Publications, New York, New York.

4. "Charter for a Microcomputer Support Center," developed by Tri-Met, Portland, Oregon, 1984

5. "What Human Services Can Learn From Business About Computerization," by Dick J. Schoech and Lawrence L. Schkade, reporduced from Public Welfare, summer 1980, pp.18-27, with permission of the American Public Welfare Association, Washington, D.C.

6. "Evaluating Sponsor Commitment to New Technology," by Daryl R. Conner, reprinted with permission of O.D. Resources, Inc., Atlanta, Georgia.

7. "Technological Change Readiness Scale," by Daryl R. Conner, reprinted with permission of O.D. Resources, Inc., Atlanta, Georgia.

8. "Building Commitment to Technological Change," by Daryl R. Conner, reprinted with permission of O.D. Resources, Inc., Atlanta, Georgia.

9. "Overcoming Computer Resistance," by Arielle Emmett, reproduced from Personal Computing, Vol. 8, #5, December, 1983, pp. 80-93, with permission of Hayden Publications, Hasbrouck Heights, New Jersey.

10. Selected references related to organizations and computers.

"POLICY STATEMENT FOR MANAGING MICROCOMPUTERS"

by

Peter G. W. Keen

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CW Communication, Inc.
Framingham, Massachusetts

(originally in Computerworld, May 16, 1983)

A Policy Statement For Managing Microcomputers

By Peter G.W. Keen

How can organizations achieve the productivity benefits of microcomputers without threatening the integrity of the corporate data resource or creating duplication, inefficiency and waste?

The generic policy statement presented here balances local autonomy and central integration in managing micros in the workplace. The statement can be applied generally even though each company works according to specific constraints and needs.

The word "control" does not appear. The moment centralized DP publishes anything about controlling micros, users substitute the word "preventing." They see "controlling" as yet another plan by DP to protect its traditional territory.

Nevertheless, there must be a policy. Too often authority and accountability in the overall application of

A MICRO POLICY

information technology are no more than implicit in the areas of microcomputers, office automation, development priorities and distributed processing.

Policy basically involves defining mandates and directives: *who* decides, rather than *what* is to be decided, and who has responsibility.

The Policy Statement

1. The general philosophy is to encourage cost-effective applications of microcomputers; allow end users every opportunity to acquire hardware and software; and coordinate the recommended software and hardware with education, consulting support and sharing of experience and applications.

It is also essential to establish procedures for acquiring micro tools and to assign clear responsibility for auditability, security and, where relevant, maintenance.

2. Each major business and/or DP unit will appoint a coordinator for micros. The coordinator must have some prior (but it need be only limited) experience with micros as a user or builder of systems.

3. The coordinator will identify up to three recommended hardware configurations. These may be from different vendors, but each machine chosen must have communications capability so that it can be used as an intelligent terminal and access data from the company's mainframes. The coordinator must ensure that maintenance and technical support will be easily available to all user locations and should also set up, where possible, arrangements for quantity discounts, maintenance, leases or anything else that can reduce the cost to the company without increasing risk or decreasing benefits.

4. The coordinator will prepare a list of recommended software, which must be proven and reliable, require minimal technical support, be easy to learn and use and offer clear productivity opportunities for the company's business units.

The recommended software list will define a software spectrum, including low-end and advanced packages. The spectrum provides users with options for a given type of application. (The box on In Depth/39 shows a sample software spectrum for the Apple II.)

The coordinator must become thoroughly familiar with the software on the list and be ready to answer users' questions about it.

5. Users who wish to acquire software and hardware must register their requests with the coordinator. Each request should indicate the expected applications and identify potential benefits. These should be discussed with managers in the user department. Users are asked to quantify the economic value of the benefits even if they can provide only subjective estimates. The purpose here is to ensure that both costs and benefits are reasonably thought through. However, no formal return on investment, payback or cost/benefit analysis is required.

Users are urged to:

- Select hardware from the recommended list: The coordinator will provide assistance in locating supplies and resolving any maintenance problems only for hardware on the list.
- Select software from the software spectrum. The coordinator will provide training material and limited consulting advice for these.
- Have the coordinator evaluate packages not on the recommend list.
- Avoid programming. The policy is to use end-user packages and languages. Users are totally responsible for maintaining any applications they develop. Under no circumstances will resources be diverted from DP to deal with programming problems, errors or maintenance.

Users are reminded that software engineering can be difficult, risky and expensive. It requires professional expertise.

The frequent turnover of qualified technical staff may leave them with a substantial maintenance problem.

6. Users are responsible for obtaining approval for acquisitions from their own management. The coordinator has no authority to reject any request.

7. Further user responsibilities include the following:

- Compliance with all legal and audit requirements.
- Security of hardware, software and data.
- Data integrity. No user application may update a data base created or stored on a remote machine. If such a capability is justified, it must be provided by a centralized organization such as DP.
- Report integrity. Any report generated by an end-user package must be clearly identified with the label "Micro Report" so that it is not mistaken for an official report generated as part of the company's formal management information services (MIS) function. In situations where a micro report has basically the same format as an MIS report, the user must make sure the two cannot be confused.
- Ethics. Piracy is a growing problem for software vendors. Users are responsible for ensuring that the spirit and letter of the laws of copyright and trademark protection are followed to protect both the individual and the corporation.

8. The coordinator functions as a "gatekeeper" responsible for:

- Assisting users in the following areas of acquisition and application (only for hardware and software on the recommended list): purchasing, maintenance and troubleshooting; basic training for users and builders.
- Identifying and evaluating new software and hardware and adding items to the recommended lists.
- Identifying completed applications that may be of value to other users. A major part of the coordinator's role is to disseminate information and provide basic education and support, such as a standard half-day or one-day seminar on software, hardware and/or applications.

Basic Rationale

This policy statement should answer most questions from users, DP, senior managers and skeptical bystanders. The core issue is incentives. The micro is here to stay. No rearguard action by DP can or should obstruct the first real contribution of computer technology to the everyday demands of managers, professionals and staff.

DP needs incentives to respond to the accelerating interest in exploiting micros as a low-risk, high-yield investment in productivity.

Users need incentives to cooperate with DP, which is, in effect, the guardian of the computer information resource. Up to now, that resource has mainly been an aggregation of transaction processing, ill-structured files and inaccessible machines. DP is rapidly creating flexible capability in which terminals provide access via data communications to a range of services and products.

DP is also building an integrated

A MICRO POLICY

IN DEPTH

delivery vehicle and information base that is more and more relevant to all levels and functions of the business. If users fiddle around, diverting funds and efforts and spreading incompatible machines, undocumented systems and inconsistent and redundant data bases, DP will at some point have to pick up the pieces.

Why a Coordinator?

The need for a coordinating role is clear. The software and hardware markets are changing rapidly and the current channels of distribution are poorly suited to meeting the needs of corporations. Retail computer stores focus on the consumer and their staffs generally have limited understanding of the product.

One salesman in a store specializing in sales to small businesses was asked, "How do you demonstrate software?"

"We really don't," he answered. "We let the machine do the selling."

Retail stores focus their effort on the low end of the market. There is an immense gap at the moment between corporate demands and retail supply channels. It is hard for companies to locate good software. Some central gatekeeper in the organization is essential to act as a focal point, a purchasing agent and a researcher.

The policy statement requires the coordinator to select up to three recommended machines, each capable of communications. Companies must find a mid-point between the two unattractive extremes of allowing incompatible machines to proliferate and trying to impose a simple machine standard on users. A likely selection of machines will be:

- The Apple Computer, Inc. Apple II or Radio Shack TRS-80 for their supply of end-user software and because they have strong loyalty among professionals and software developers.
- A Digital Research, Inc. CP/M-based machine, since this is now the *de facto* software standard.
- A personal computer manufactured by a mainframe vendor (for example, the IBM Personal Computer or the Digital Equipment Corp. Professional). The IBM Personal Computer will surely become a Systems Network Architecture terminal and thus an integral component of many companies' distributed processing capability.

Three machines may seem too few, since several vendors have recently launched attractive new products and other 16-bit micros will appear within a few months. On the other hand, companies must tackle the issue of proliferation now.

A key requirement in the policy statement is for communications capability. This need is based on the widely held assumption that the world is converging on the multifunction workstation and that the stand-alone micro is just one starting point; by augmenting it with communications, it becomes an intelligent terminal. In that situation, the needs of both end users and DP are satisfied. The distributed micro can be used in stand-alone mode with zero operating cost, in communications mode for access to a data resource and in intelligent-terminal mode as a workstation in a distributed system.

Development Strategy

The software spectrum is the base for a development strategy. Micros are, above all, an end-user concept. It makes absolutely no sense to encourage the growth of amateur DP shops or to divert resources from DP. There is room for small ad hoc (Basic) programs, but the main aim should be to provide a range of first-rate nonprocedural tools with which people who know the application area well can develop systems both small and large.

By providing low-end and advanced tools, the coordinator can give every incentive for end users to move in this direction. He is saying, in effect: "Look, if you want a quick, simple project analysis system, have your secretary spend an hour a week typing in figures and use Visicalc. Later on, you may want to use DSS/F, which is much more powerful."

Or, he might advise: "You can do this with Visicalc, but it's very likely you'll want to create some more complex reports. Try DSS/A."

It is absolutely vital that whatever software the coordinator adds to the recommended list be proven. That list is in itself a safeguard against users getting into trouble and needing expert help, having to abandon projects or finding it difficult to maintain the systems they develop. Instead of trying to control the users, the policy statement aims at steering them toward first-rate, low-risk, reliable, cost-effective tools.

The coordinator's distinctive contribution to the organization — the effective use of advanced tools — lies in the development of the software spectrum. Being explicitly responsible for providing basic support (answering reasonable questions) for the software on the recommended list gives him plenty of incentive to evaluate potential additions thoroughly.

The most contentious aspect of the policy statement is the acquisition request. This point puts authority solidly with the user and leaves the coordinators (and DP) with no veto. The requirement that users be responsible for auditability, maintenance, security, data integrity, report integrity and ethics provides necessary bounds on user freedom. The business justification is really an issue for user management. By requiring users to obtain their own budget instead of being funded centrally the issue of benefit analysis and accountability for results is placed firmly where it belongs — with the user.

About the Author

Peter G.W. Keen is chairman of Micro Mainframe, Inc. in Cambridge, Mass. He is coauthor, with Michael Scott Morton, of Decision Support Systems: An Organizational Perspective.

Minnesota Department of Transportation

Transportation Building, St. Paul, MN 55155

Phone 296-3005

June 28, 1984

David Damm-Luhr
USDOT
Transportation Systems Center
Kendall Square
Cambridge, MA 02142

Dear Mr. Damm-Luhr:

I am enclosing a copy of Mn/DOT's "Micro-Computers--An Interim Approach" document for inclusion in the "Microcomputers in Transportation" publication. This document was developed last year as the first wave of microcomputers began arriving in Mn/DOT. We felt it was necessary to develop a framework within which changes in responsiblities and organizations could take place in order to take advantage of the microcomputer technology.

This approach was written with the intention that it would be reviewed periodically and modified to reflect significant changes in the Mn/DOT or microcomputer environment. No modification has been made to this date.

Mn/DOT is very happy to share this information with other agencies. Please have them contact me if they require additional information. We are looking forward to reading the other articles in your upcoming publication.

Sincerely,

Judith A. Pinke

Judith A. Pinke
Assistant Commissioner
Finance and Administration Division
Minnesota Department of Transportation
408 Transportation Building
St. Paul, MN 55155

MICRO-COMPUTERS--AN INTERIM APPROACH
MINNESOTA DEPARTMENT OF TRANSPORTATION
July 5, 1983

With the increase in requests for personal micro-computers (micros) in Mn/DOT comes an accelerated need to identify and specify the manner in which information as a resource and technology as a tool are to be managed. This aspect of the broad topic of information management must be given appropriate oversight by Mn/DOT 's managers.

Role--User Management

As all of management begins to use the tools of information technology, the risks of the proliferation of incorrect information for decision making are greatly expanded. One need only project the possibility of a manager in a district, for example, having personnel or budget or project information on his/her own micro, producing reports, and submitting those reports to his/her management for decision making. Concurrently, a central office section might have the same or similar information on its micro and produce a different set of reports for submittal to the same decision makers. This sets up a conflict between the two parties supplying the reports as to which of them is accurate.

It is necessary, therefore, to put in place an approach to information handling that can utilize technology--that is, micros and the software connected with them--in a manner that continues to provide valid, correct, and consistent information to decision makers at all levels. This cannot be accomplished by controlling the kinds of micros installed or the kinds of software used. It must be accomplished through attention paid by the users of information at all levels to the problem of conflicting and competing information sets.

Consequently, the responsibilities are complex, must be undertaken by all levels of user management, and cannot be delegated to technicians, computer people, or staff people. In order to effectively utilize these new tools, it will be necessary for managers to

agree collectively which information is needed and is not needed at various levels, determine how its accuracy can be guaranteed, and ensure that the information supplied can be used with confidence. It is thus necessary to create a managerial environment in which the tools of technology can be used. In this environment, users will develop and administer their own systems, with the support of the Office of Systems and Support Services, write their own systems documentation, and provide physical security for their equipment, data, and programs.

Role--Distributed Data Processing Planning Committee

The Distributed Data Processing Planning (DDPP) Committee, composed of representatives from each district and the central office, will continue to share information on learned experiences, problems and solutions, applications, and priorities. It will also provide the link between user management and the Office of Systems and Support Services. A subcommittee, the Systems Review and Evaluation Committee, has been established to ascertain the use and effectiveness of systems. The DDPP Committee will play a major role in containing duplication and redundancy of databases, just as it has played a role in containing duplication of software development.

Role--Office of Systems and Support Services

The Office of Systems and Support Services serves a planning, coordinating, and support role in Mn/DOT's acquisition and use of micros. Micros bring in a new computer environment with new methodologies.

In order to help users help themselves, the Office of Systems and Support Services will have the following responsibilities in connection with micros. Responsibilities with respect to other tools may differ.

1. Assist users to select appropriate technology.

2. Research and acquire special purpose software and hardware.

3. Research and maintain a library of general purpose software.

4. Provide training and support to users in identifying and developing their own programs or systems.

5. Inform users of applicable Mn/DOT and state standards and the consequences of violation.

6. Discourage repetition of existing databases and programs by establishing standards and guidelines.

7. Serve as a clearinghouse/distribution center for data profiles, software, and systems, including those newly created by users.

8. Maintain a "shared pool" of micro software and hardware for users to draw upon--borrow--as needed.

9. Ensure availability of hardware maintenance service.

10. Assist users to implement prototyping as an appropriate way of developing systems on micros.

11. Refer users to other sources of help as appropriate, e.g., ISB's EDP Training and Information Center or the University of Minnesota.

12. Assist users in modifying or adapting programs; actually write a program for a user only in the case of a critical and immediate need.

13. Provide support for the following levels of application programs:

    a. Programs prepared by the Office of Systems and Support Services for ongoing systems will be documented according to current standards and supported as needed.

    b. Programs prepared by others for ongoing systems, if documented according to current standards, will be tested and reviewed for completeness by the Office of Systems and Support Services and, if

accepted, will be fully supported as needed.

c. Programs prepared by others for ongoing systems that are not documented according to current standards will be supported to the extent that help will be given on a time-available basis.

d. Other software will not be guaranteed support, but questions will be answered whenever possible.

14. Provide support for the following micro-computer hardware:

a. Hardware that is attached to the state network or purchased on the standard state contract will be fully supported.

b. Special purpose hardware will be supported at the level agreed to by the user, vendor, and Office of Systems and Support Services at the time of purchase.

c. Other general purpose micro-computer hardware will not be guaranteed support, but questions will be answered whenever possible.

All requests for micros, accompanied by justification, will be made to the Office of Systems and Support Services. Examples of things that should be considered for justification are:

1. The micro will provide new, better, or faster information for decision making.

2. The acquisition of a micro is compatible with the department's information strategy.

3. The micro will quantifiably increase the effectiveness or output of a specified employee or group of employees.

4. The micro will not duplicate existing or planned systems.

5. The micro will supplement or replace the hardware for existing systems that have become inadequate.

Data Management

For the purpose of this position paper, "database" is used to mean any formal collection of data. Information produced from our databases must be available, accurate, and timely. As the number of professional and managerial employees using micros grows larger, the potential for gathering, entering, and maintaining redundant or contradictory databases arises. This speaks to the need for identifying and gathering into a central clearinghouse a profile of all existing Mn/DOT data, which now reside and are maintained throughout the department on a variety of equipment, and making that profile available to others.

Each database will have a specific user manager assigned to it by the appropriate Office Director/District Engineer, who will be responsible for controlling the integrity of the data in the specific database. Authority to establish rules by which the database can be changed and updated will be restricted to that individual. That person will also establish rules on who can access the data, particularly private or confidential data. Those individuals assigned this responsibility will not be staff personnel in the central office or districts but actual owners or first-hand users of the data. Existing data processing coordinators will maintain their coordination role. In most cases they will not be the individual mentioned above who is assigned to a specific database. A method will be developed for reporting newly created databases to the Office of Systems and Support Services.

In addition, query language software will be acquired to enable micro users to easily access the information in the databases and get ad hoc reports. Furthermore, an attempt will be made to acquire software that demands or forces database control.

Communications

Of the electronic communication tools available, System Network Architecture (SNA) from IBM is the technology used by the statewide network. This allows a micro to be operated as a terminal or as a stand-alone. The advantages are: access to data and programs from other sites, local computer power and data entry, and a reduced need for cross-training on a variety of equipment. This

approach can also be used in the future for statewide network-dependent systems such as electronic mail. Therefore, Mn/DOT is acquiring equipment using this technology to meet current needs and to provide potential expansion to meet future needs. In some cases, access to other communication networks, such as the University of Minnesota, will continue to be provided.

Another concept--a local area network of micros--is just beginning to be realized in the marketplace. A local area network electronically ties together in one location business communication technology such as computers, word processors, and copiers. Some advantages that local area networks may offer are the sharing of resources and the elimination of data re-entry. Mn/DOT will monitor developments and improvements in this technology.

Standard Practices

In carrying out the designated roles where micros are concerned, Mn/DOT will follow these standard practices:

A. Acquisition

1. Recognition of need will be presented in the biennial budget process.

   a. Initial requests will be developed at budget review and preparation time with individual sections and divisions.

   b. Need and requests occurring within bienniums will be presented by the division data processing coordinator.

   c. Equipment may not be purchased from individual AID's; however, beginning in October 1983, consideration will be given to transferring funds to the Data Processing Development AID for such purchases.

2. Guidance on how decisions will be made in the biennial budget process will be provided before accumulating requests

so that there will be a consistent approach to making those decisions.

3. The Office of Systems and Support Services will evaluate equipment technology to select appropriate response to needs and to coordinate compatibility with existing equipment components.

B. Implementation

1. The Office of Systems and Support Services will coordinate systems software development with hardware component configuration selection.

2. Requisition of micros will process through the Office of Systems and Support Services for confirmation of funding and for specific application of requested component.

3. The Office of Systems and Support Services will coordinate appropriate training and assist in developing user manuals as new systems require.

C. Review/Evaluation

1. The DDPP Systems Review and Evaluation Committee will review use of data, system software, and hardware after an appropriate period of system operation.

2. The Office of Systems and Support Services will make a periodic review and analysis of hardware compatibility and sufficiency at each office of Mn/DOT operation.

3. The Office of Systems and Support Services will make recommendations for expansion/upgrade based on:

a. Related experience.

b. Advancing technologies.

c. Changing departmental needs and objectives.

d. Budget constraints.

Future Approach	This is an interim approach only. As more is learned about the use of micros, and as technology changes, it may be modified or its direction changed. This approach to micros will be reviewed quarterly with the Computer Applications Management Committee (CAMC).

"INFORMATION CENTERS ON RISE"

by

Bill Dooley

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Data Center Strategies

Information Centers On Rise

Need DP Mgmt. Boost

By BILL DOOLEY

BOSTON—End-user reaction to the concept of information centers—heavily promoted by International Business Machines Corp.—generally appears to be positive. However, support for it from the corporate structure and veteran data processing personnel could be better, according to users, vendors and consultants in the field.

Helping push the information center concept is the increasing widespread use of personal computers and end-users wanting more access to information historically under the domain of data processing professionals.

Leonard R. Bergstrom, an information center specialist and vice president of Real Decisions Corp., Stamford, Conn., said, "Users come in all shapes and sizes, from the push-button-only variety to the menu-oriented types, to those who perform simple programming functions and then conceptualize and initialize a private database—to the totally self-sufficient user. The information center must be aware of the 'flavor' of its user community. It must be able to supply the right tools and support to respond to the level of computer literacy."

Bergstrom added that the basic premise was that, with proper education, support and tools, data users would directly satisfy a portion of their own computer requirements.

But problems have arisen within the original concept, according to experts in the field. Some of the problems include:

- End-users still have "computeritis," as one consultant called it, describing this as a fear of trying to learn something new, new ways of doing things, new equipment, new procedures and new responsibilities.
- Corporations' reluctancy to invest more capital without positive assurances of at least a dollar return for a dollar spent.
- Data processing professionals' fear of educating end-users to the point where they, or their staffs, may be reduced when the end-user becomes more sophisticated and is able to secure much of the information previously only provided through their domain.
- Difficulties in operating a user environment, developing and justifying a charge-back and identifying economics realized.
- Software products which were first available were insufficient and newer products are unfamiliar.

Full Support Needed

Marilyn Bracy, marketing manager for information at Boeing Computer Services Co., Vienna, Va., stressed the absolute need for the data processing manager's support in the formation and support of information centers.

"If the DP manager does not commit his or her full support, the information center will ultimately fail," Bracy said.

Outlining some of the responsibilities a DP manager must undertake in connection with an information center, Bracy said, "The DP manager must commit and remain committed to the concept throughout the start-up cycle by organizing, planning, staffing, enhancing and promoting the concept.

"The key to the success of an information center," she added, "is to identify the right manager and this individual must be enthusiastic, persistent, optimistic, energetic and innovative, as well as being comprehensive and appreciative of the line business function and be service motivative."

She frankly admitted that in several of the companies she had worked with, "some of the data processing personnel were actually hostile toward the information center concept" and she feared for the success of the centers.

"In one instance," she said, "an actual member of the information center staff was trying not to give away his knowledge to make the user too self-sufficient because then his values, he felt, would be diminished. I saw a real bad case of that."

But these problems are easily solved by a DP manager, once they are recognized.

Some Companies Reluctant

As to the reluctance of some companies to consider the installation of information centers, Bracy said, "I think most of the resistance I've seen is from upper-level management who didn't understand it (the concept), who were frustrated, who didn't have the data they needed and didn't understand that the information center was the means to solving the problem."

The major factor influencing the future of information centers is the hidden data processing backlog, according to Hugh W. Ryan, a partner with Arthur Andersen & Co., Chicago.

"Estimates of the known backlog are only one-third of the actual backlog, with the remainder of the 'hidden' backlog consisting of applications desired, but not requested, by users because of the inability of data processing to meet the known needs."

He said that the information center is designed to address this hidden backlog with users reducing the backlog by developing their own systems.

For the future of information centers, Ryan said, "Over the next two years, we can expect to see continued growth. Most centers will follow IBM's lead, consisting of a large collection of software products. But in the belief that software is the answer, little effort will be given to staffing these sites with the right people."

Explaining The Tools

He outlines that the user's perspective will be that they know some tools have been made available but they cannot find anyone to explain, in terms they understand, what they are or how to use them to solve business problems.

"Many data processing areas may view information centers as a threat, and will begin to describe them as a lot of software the users never use," Ryan adds, seeing it as a trend over the next two to five years. "Information centers will tend to be viewed as failures. This view will claim that the software is unused or that the centers are uncontrollably large users of machine resources."

However, as he pointed out, "The information center will remain alive, though under a new name. Three factors will keep it alive: the hidden backlog will still demand attention; some cases of success, where the right people are staffed, will confirm the potential; and the use of microcomputers will grow and users will increasingly demand to know why they cannot use mainframes in the same manner they use microcomputers."

Thus, Ryan concluded, this will be the time-frame of solutions. "End-users will settle on the use of a microcomputer for many information center needs, the information center specialist will shift focus to the delivery of data out of the corporate data resource to an information resource which is fragmented over many microcomputers. The mainframe emphasis will be on a high-volume, high-performance transaction system having many integrated databases."

"In the meantime," Ryan concluded, "distributed databases will emerge. These will have built-in facilities to move data from one site to another. As such, they will be able to move data from the corporate to the distributed information resource and will have the ability to move the data on a scheduled basis or based on criteria. The software will be able to do full or partial extractions, based on user specification. Also," he added, "the software will track who has the data, how often it is refreshed and what activity there is against it."

He and some other specialists believe that from the user's perspective, the information center will appear to be a microcomputer. Local applications will largely run on local data, and high-level distributed database management software will provide access to other data sites, as the distributed database management system controls access, extraction, refreshment and status management.

Local tools will grow in number, but relatively few will be found on any one machine and the user will have an in-depth knowledge of the tools and will be able to build local systems to address those business problems of concern to the user.

In the end, many analysts see the information center losing its identity as an organization with the users viewing the local micro as an information port providing access to all data in a way that allows users to focus fully on business problems.

CHARTER FOR A MICROCOMPUTER SUPPORT CENTER

developed and provided by

Tri-County Metropolitan Transportation District
4012 S.E. 17th Avenue
Portland, OR 97202

CHARTER FOR A

MICROCOMPUTER SUPPORT CENTER

Microcomputers are becoming an important tool in the development of information systems at Tri-Met. With the advent of the 16-bit microcomputer with .5 million bytes of internal memory, these versatile machines now provide capability for fairly extensive development of software applications in many functional areas of this agency. However, they also represent a potential for serious misapplications if inappropriately used. It is, therefore, incumbent on Tri-Met to maintain the means of coordinating and guiding the development of information systems on microcomputers. To do this, MIA and Data Systems have established a Microcomputer Support Center.

CONTEXT

In discussing the Microcomputer Support Center, it is important to note that the microcomputer environment is not really an isolated one. There are very few information systems at Tri-Met which do not share data in common with functional areas other than the one in which they are developed. Just as our functions are interrelated, so must our information about these functions be integrated. This means that microcomputer-based information systems should be designed to share data with other micro or mainframe information systems wherever appropriate.

An ultimate objective is to effect a direct telecommunications link between the IBM Personal Computers and the IBM 4341 SQL (Structured Query Language) data base (now under development). This link will allow "downloading" of information from the central database into the microcomputer. Once in microcomputer storage, the data may be processed, analyzed, edited, or reported at the microcomputer work station. The essential concept here is that microcomputer users will be sharing common information and it is important that the data they generate is designed in a form that can be used by others.

Software, as well as data, is a common resource. Tri-Met microcomputer users are presently employing a variety of electronic spreadsheet systems, data base packages, and operating systems. Each of these have their strong and weak features, but they are generally not compatible with each other or with the mainframe system. It is therefore important to adopt standardized applications development software which is integrated. This means that the data you produce on your text editor or electronic spreadsheet can also be read into your database (say for sorting or retrieval) or into your report generator (for output). Another ideal feature of such software is compatibility with the central relational data base management system. This means that the structure of your microcomputer data tables is similar to that of the SQL system so that transfer of tables from SQL to the microcomputer data base will not require extensive reformatting or learning a new manipulation language. The relational data base management system also affords easy access and retrieval of your stored data.

OBJECTIVES

The overall goal of the Microcomputer Support Center is to provide an alternative software applications development tool which, under some conditions, can produce information systems either faster or better than could be done with more conventional means. There are at least four program objectives which can be identified to achieve this goal:

1. Select the appropriate development medium (hardware, primary software, data sources) for the information system application under consideration;

2. Assist (users) in development of software applications that are well structured and flexible. This means helping you developing an information system that not only meets your current needs, but also can be adapted to meet your ever expanding requirements;

3. Insure that provisions are made to interface your information system to other interrelated systems. This means that you can tap into other data resources which can help you and allow others to share your data as well; and

4. Help you manage your information resources. This objective can be met by providing guidance and means of inputing/updating your data, retrieving it, storing it and securing it.

FUNCTIONS AND RESPONSIBILITIES

What then is the Microcomputer Support Center doing to accomplish these wonderful objectives? Before answering this question, I want to emphasize that the Center serves a support role to what is primarily a self-service function. In other words, for those applications appropriate for microcomputers, it is your primary responsibility to develop your own information systems. Neither Data Systems nor MIA have the staff resources to devote to extensive microcomputer applications development requiring lots of programming. But that doesn't mean you are entirely on your own either. Here are the services we are providing:

1. Requirement Evaluation: In concert with the MIS plan and identified information systems needs, the MSC determines the appropriateness of developing the requested system on a microcomputer. If appropriate, the MSC will assist the user in selecting the best available software and development strategy. This function also provides estimates of staff and data resources needed;

2. DBMS Design Assistance: The MSC assists the user in identifying data sources and interfaces between this information system and other (existing or planned) information systems. This function also provides assistance to users in designing their microcomputer data bases according to sound relational data base management principles;

3. Applications Development: As mentioned above, the MSC does not have the staff resources to undertake projects requiring extensive applications programming. However, the MSC can provide design support for formatted data input screens, output report formats, and some relatively simple computational algorithms;

4. Technical Support: The primary service here is ad hoc consulting to answer "what do I do now?" questions. In addition, this function includes providing data communications interfaces such as data conversion utilities or telecommunication links. MSC is also providing user training on microcomputer software;

5. Data Resource Protection: MSC develops guidelines and standards for backup and security of microcomputer data. Also, MSC will assist users in establishing responsibilities and procedures for updating and editing data to insure accuracy and integrity;

6. Vendor Support: MSC serves as a central liaison to vendors of (Tri-Met "standard") microcomputer software and hardware. However, in order to serve this function, MSC must serve as a clearinghouse for recommending purchase of microcomputer software and hardware; and

7. Clearinghouse for Mutual Support: The MSC serves as a focal point for microcomputer users to share their software applications, "helpful hints", and other information that might be useful to others. This is done through rap sessions and memos, as well as by "word of mouth".

STAFFING

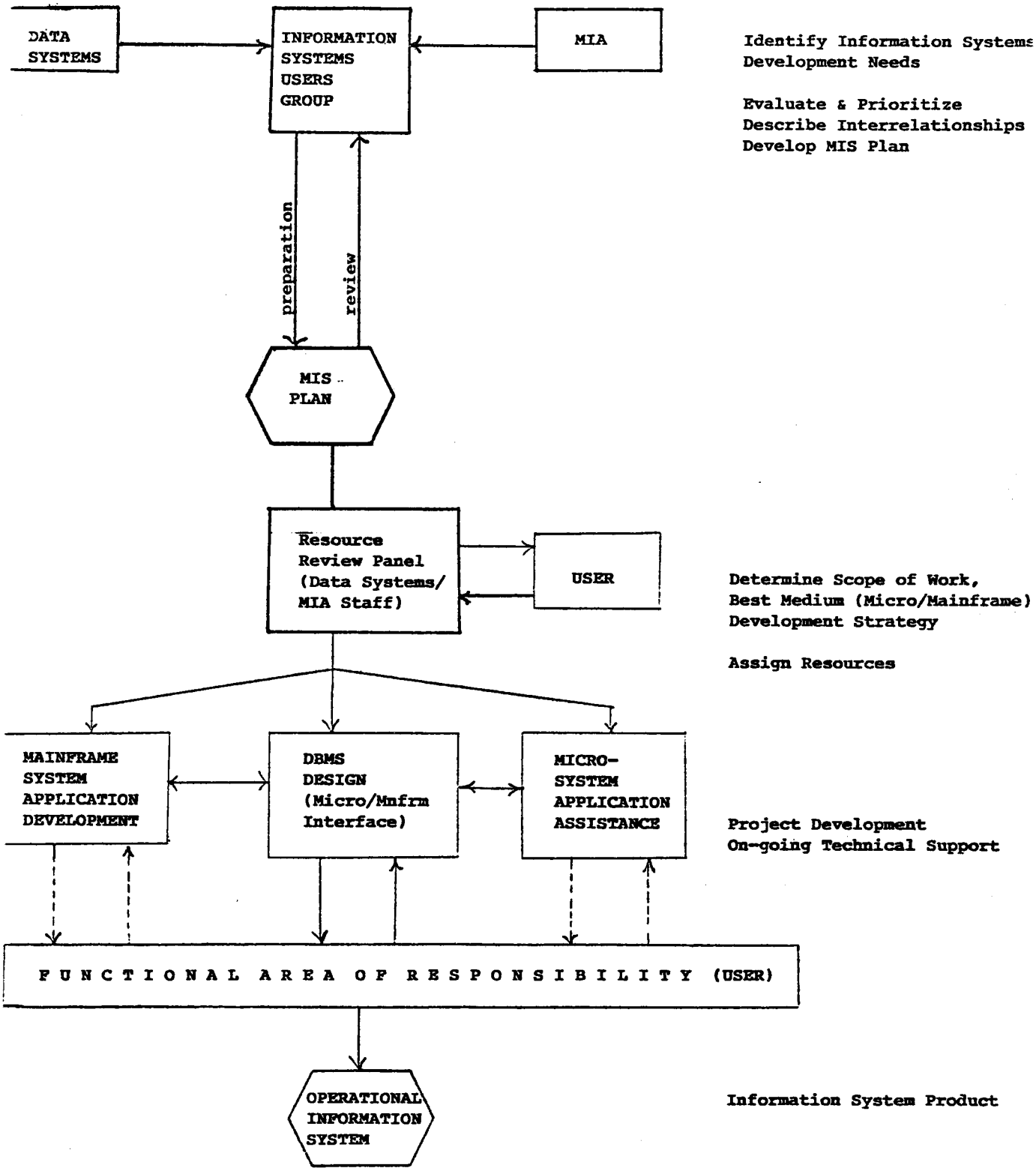
Presently, the Microcomputer Support Center is staffed by one full-time Systems Analyst (in Data Systems) working under the Director of MIA. As appropriate, staff from both the Data Base Administrator and/or the Applications Development Manager may be assigned to the MSC on a temporary basis in order to assist in developing interfaces between the microcomputer systems and the mainframe data resources. Over time, the staff resources assigned to the MSC may be adjusted depending on relative priority and needs of microsystem applications.

PROCESS

Usually, the development of information systems on microcomputers will be simpler and therefore faster than their mainframe counterparts. However, all but the most trivial of these must be accomplished within the established information system development process if we are to allocate limited developmental resources fairly. This means that the information systems needs should be identified within the Management Information System (MIS) plan (now under development). It does not mean that the MSC will refuse to provide some assistance/advice to ad hoc requests, but these activities must take second priority to established needs.

The attached figure depicts a flowchart describing the basic steps toward developing a microcomputer information system or microcomputer data processing application. Note that the primary information system developmental needs and priorities emanate from the MIS Plan. However, the Resource Review Panel, coordinating with the requestor, will determine the appropriate medium (micro/mainframe) for development and the best development strategy.

INFORMATION SYSTEMS DEVELOPMENT PROCESS



"WHAT HUMAN SERVICES CAN LEARN FROM BUSINESS ABOUT COMPUTERIZATION"

by

Dick J. Schoech and Lawrence L. Schkade

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American Public Welfare Association,
Washington, D.C.

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What Human Services Can Learn from Business About Computerization

BY DICK J. SCHOECH AND LAWRENCE L. SCHKADE

Company president to executive committee: "The company's data processing is getting out of hand. The computerized accounting system worked well enough, so we decided to computerize the data in other departments. But now we seem to have lost control. Our director of data processing is buried in the accounting department and is too computer-oriented to understand the needs of our department heads. Since he is the only person with extensive knowledge of the whole computer system, it would not be easy to replace him, and he threatens to quit if we hire someone over him. I guess we should have been more involved from the beginning, but the computerized accounting system was running satisfactorily. Besides, we had other more pressing problems to attend to. It seems that some of our short-term decisions on data processing have resulted in a larger overall problem. I wish I had known then what I know now."

This hypothetical situation is typical of what has happened in some businesses, and it will be repeated in human service agencies as they begin implementing data processing (DP) systems, unless time is taken to learn from the experience of the business world and that of human service agencies with more advanced data processing operations.

The historical growth of data processing in business in the past thirty years portends the shape of things to come as DP increasingly pervades human service organizations in the coming decades. Human services will be able to manage their data by purchasing DP technologies that took business years to develop. While a human service agency can purchase sophisticated DP technologies, it still must go through the long, tedious, and frustrating process of adapting the DP system to the organization and the user if the system is to be successful. While the adjustment of the DP system to the organization and the user is a process that cannot be purchased or rushed, human service administrators have a tremendous potential advantage because they can benefit from lessons learned the hard way in business.

This article projects a growth pattern for DP in the human services similar to that experienced in business data processing. It also presents guides for effective DP system development drawn from business's broad experience with the design and implementation of successful systems.

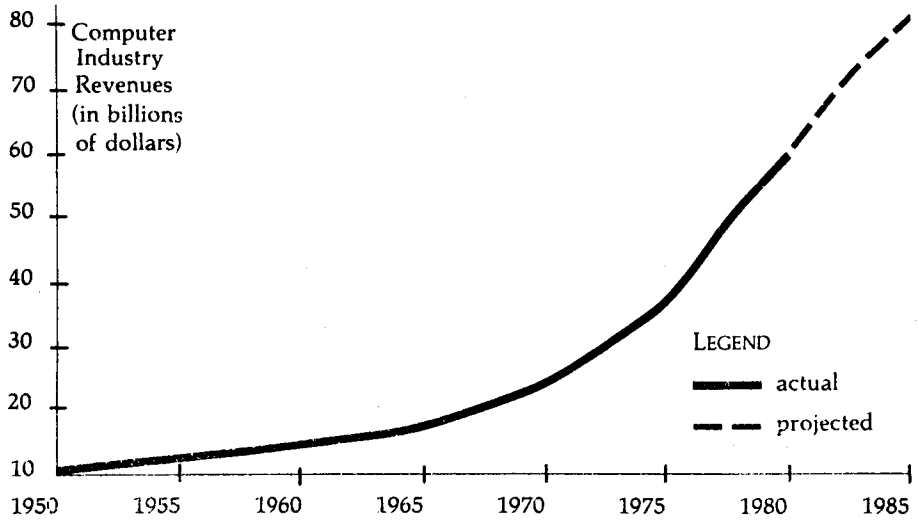
Several terms currently in use refer to computing in organizations, e.g., electronic data processing, management information systems, decision support systems. In this article, the term "data processing" will be used to include all automated data collection, storage, manipulation, retrieval, and reporting that occur in the operation and management of an organization.

Growth Stages Can Help Agency Plan for the Future

The growth of data processing in business during the past thirty years exhibits the type of pattern shown in Table 1 which reflects growth in terms of billions of dollars in computer industry revenue. There are several other measures that may be used to determine growth, but most show the same curve when corrected for inflation, where applicable. The initial phase of development began with automated accounting applications and extended through the mid-1960s when computing hardware became widely available and generally affordable. The second—or expansion phase—extends until about the

TABLE 1

GROWTH OF COMPUTERIZED DATA PROCESSING IN BUSINESS



SOURCES: Adapted from John L. Kirkley, "Editor's Readout," *Datamation* 25, no. 6 (25 May 1979): 7; C.W. Getz, "DP's Role Is Changing," *Datamation* 24, no. 2 (February 1978): 120; and "Getting Control of the System," *Dun's Review* 110, no. 1 (July 1977): 73.

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current time, as there is now a leveling off of the *rate* of increase of expenditures for business data processing, although total expenditures are expected to continue to increase indefinitely.

Stages in the organizational DP growth curve are described in Table 2. These stages, or subphases, can help an organization identify its current position on the growth curve as well as the growth stages it can anticipate in the future.

Since all organizations are moving in the direction of maturity (Stage 6), it is important to discuss maturity in greater detail. While the precise nature of a mature DP environment is still evolving, several characteristics of this stage can be identified. In maturity, data and information are considered basic agency resources that can be managed similarly to other basic resources such as dollars, people, and property. DP expenses become an item in the agency's budget and are subject to cost-benefit analysis. As an organization moves towards maturity, the DP function moves higher in the organization. This happens when the number and type of DP applications increase from the automation of several information storage and retrieval functions at the operational level to automated processing throughout the organization. The DP function is eventually headed by an information services executive who has a management rather than a technical orientation and whose status probably equals that of the comptroller.

As an organization matures, the

TABLE 2

GROWTH STAGES OF ORGANIZATIONAL DATA PROCESSING

Stage 6 ● Maturity

Stage 5 ● Data Administration

Stage 4 ● Integration

Stage 3 ● Modification

Stage 2 ● Extension

Stage 1 ● Initiation

NOTE: Growth rate is based on an organization's data processing expenditures.

DESCRIPTION OF THE GROWTH STAGES

Stage 1: INITIATION
Automation of several low-level operating systems in a functional area, typically accounting, with the DP organization specialized in technological learning and with lax planning and control.

Stage 2: EXTENSION
Automation expanded into operational systems. Emphasis is on extensive applications and innovations. Overoptimism and overuse may result in a system that is overloaded, and even more laxly planned and controlled than in Stage 1. Users change from a "hands off" stance to superficial enthusiasm.

Stage 3: MODIFICATION
Emphasis shifts from managing the computer to managing the data. Documentation is upgraded and there is restructuring of existing applications with the DP organization now at middle management level. Formalized planning and control are introduced and user accountability is demanded.

Stage 4: INTEGRATION
Retrofitting of existing applications takes place using data-base technology, and the system grows rapidly as it again moves out to the user. Interactive terminals may be used. Planning and control systems are tailored for each function.

Stage 5: DATA ADMINISTRATION
Rapid growth again creates problems. A data administrator is hired and the function is moved higher in the organization. There is integration of applications through shared data and common systems.

Stage 6: MATURITY
System matures; all applications are completed. The system mirrors the organization's data flow. A balance exists between use and control, central and distributed processing, etc.

SOURCE: Adapted from: Richard L. Nolan, "Managing the Crises in Data Processing," *Harvard Business Review* 57, no. 2 (March/April 1979): 115-126.

DP system changes from providing data for routine structured decision making by a few people to supporting the decision making of multiple users throughout the organization. DP in the mature stage consists of a mix of centralized and distributed processing capabilities that are tied together to support decision making regardless of where the hardware or the user resides.

While DP changes substantially from Stage 1 to Stage 6, the people, the organization, the basic organizational decisions, and the information needed to make these decisions are essentially unchanged. That is, the same people need the same information to make the same decisions in the same organizational structure. Thus, as an organization moves toward maturity, DP adjusts to accommodate the user, the organization, and the decision maker, rather than vice versa.

In maturity, data and information are considered basic agency resources that can be managed similarly to other basic resources such as dollars, people, and property.

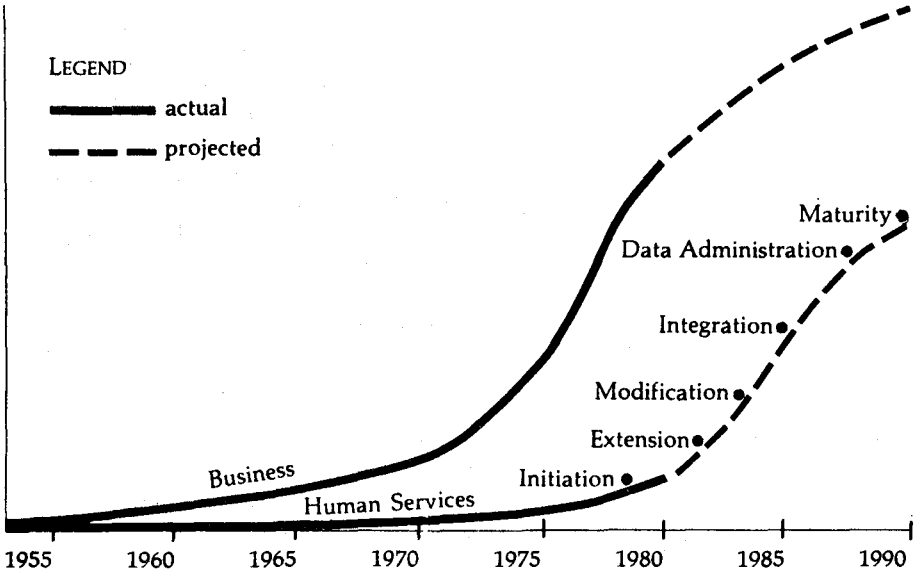
New Pressures Spur Growth in Human Services DP

The growth stages of data processing in human services can be compared to those of DP in business (see Table 3). While some areas of the country may have more sophisticated systems than others, the general pattern of system development throughout the country is represented in the table. The important factor to note in Table 3 is that the pattern of growth of computerized data processing in the human services will roughly parallel the previously recorded growth in business.

Several factors underlie this prediction. First, the shrinking dollars spent in delivering human services, due to inflation and a more cautious and conservative mood in the United

TABLE 3

COMPARISON OF DATA PROCESSING GROWTH IN BUSINESS AND HUMAN SERVICES



NOTE: Growth rate is based on total calculations and data manipulations.

States, are causing an increasing demand for accountability and sound management. Programs with ready documentation of activities and measurable positive program benefits will have a better chance of obtaining funds. The ability to provide timely program data is becoming crucial for agency survival. Second, expenditures for computer hardware go further because the capacity of small computer systems is increasing, making relatively sophisticated inhouse DP systems more affordable.

Third, the complexity of delivering human services has increased as evidenced by recent heightened emphasis on planning, evaluation, and monitoring (evidence the Title XX amendments and the health planning legislation, PL 93-641 of 1975; PL 94-63 which requires community mental health centers to spend 2 percent of their budgets on evaluation; and the monitoring functions of professional standards review organizations). Managing complex systems requires access to timely information about programs.

Fourth, the development of data administration concepts and technologies, e.g., data base concepts and data dictionaries, and the availability of a limited but growing number of trained consultants and vendors who can readily adapt these concepts and technologies to the human services, are now a reality. For example, it is now possible for some human service agencies, such as mental health centers, to purchase sophisticated packaged agency information system hardware and software for $50,000 to $100,000. These systems make it possible for an agency to move from Stage 1 to Stage 3 or 4 of Table 2 in a relatively short period of time.

> The entire range of persons who will be using the DP system, including all decision makers and users, must participate in its design and implementation.

Three factors, however, will tend to slow down the rate of development. First, it is very difficult to develop standardized measurable units of service for defining the outputs of human services and the impact these services have on clients. This difficulty relates not only to the problems of quantifying the services per se, but also to the constantly changing goals, mandates, and emphases inherent in our democratic system of planning. The second factor has to do with the lack of a human service delivery system at the community level. At present, collecting service data across agency boundaries is extremely difficult because of the political and territorial nature of our diverse and fragmented community delivery systems.

The third factor tending to slow development is that, while human service agencies can buy technologies to move the organization from Stage 1 (initiation) to Stage 3 or 4 (modification or integration), much more is required to get from Stage 4 (integration) to Stage 6 (maturity). This is an evolutionary process requiring considerable learning and adaptation on the part of the agency. Changes in this phase cannot be rushed: the information system must be revised and adapted until it fits the organization. In the latter stages of DP development, the organization turns its attention from implementation of new technology and systems to achieving a balance of systems, data, staff, integration, control, and security that meets the decision-making needs of the total organization at a price it can afford.

How the Experience of Business Can Help Human Services

This section summarizes the characteristics of successful negotiation of the developmental stages outlined above. It compresses successful business experiences and lessons learned through trial and error into a series of guidelines.[1] If followed, these should help an agency to plan its progress in DP utilization rather than merely solving problems as they arise. In this way, agencies can avoid

disruption and anticipate problems along the way to DP maturity.

Guideline 1: Prepare by defining goals and involving staff.

In order for a data processing system to work well, the entire range of persons who will be using it within the organization, including all decision makers and users, must participate in its design and implementation. Participation is particularly important in human services agencies because now organizations are able to purchase and quickly implement prepackaged systems, bypassing many of the learning processes that occur when an agency develops its own system. It is essential, therefore, to plan learning experiences—for everyone involved—that will substitute for the lost learning process.

The agency. To be ready for designing and implementing a data processing system, an organization must be prepared psychologically, financially, structurally and procedurally, and in terms of its data structure. Philip Ein-Dor and Eli Segev, members of the management faculty of Tel Aviv University and consultants in information systems, refer to this quality as organizational maturity.[2] The agency that is most successful in designing and implementing DP will already be functioning well, since it can take the time and risks associated with the changes required in implementing such a system. An organization in crisis—or one barely getting by—will not have the time, energy, or morale that will be required. Similarly, financing must be adequate for the smooth and orderly development of the system.

Structurally, an agency must have well-defined and formalized goals, procedures, and systems because the DP system will become an information model of the organization. An agency with frequently changing goals, structures, and procedures will find its DP system very quickly outdated and not related to its major operating functions and decisions. The reason the system becomes rapidly outdated in an unstable organization is that a DP system is time-consuming and costly to change.

Finally, the organization must collect data that reflect its basic decisions and guide its basic control mechanisms towards its goals. In welfare agencies, especially in such areas as social services and child welfare services, quantifiable measures of goals, client outcomes, and quality control indicators are often nonexistent. Thus, defining and quantifying the data and information necessary for goal-oriented decision making is one of the major programmatic tasks necessary for a successful system.

Human service administrators have a tremendous potential advantage because they can benefit from lessons learned the hard way in business.

The agency that is most successful in designing and implementing DP will already be functioning well, since it can take the time and risks associated with the changes required in implementing such a system.

Top-level decision makers. In order to lead the effort effectively, top-level decision makers must demonstrate their commitment by carefully preparing themselves for the DP system. As Gary E. Bowers and Margaret R. Bowers, who surveyed the use of information systems in human services for HEW's Project SHARE, point out, "in most major system development efforts, the survival or demise of the system can be traced back to a key decision maker, or a key leader (or lack of one, in the case of failure)."[3] Consequently, top-level decision makers must:

- Make certain the organization is reasonably stable.
- Clearly establish organization goals and objectives.
- Expend the extra time and energy that will be required of them throughout the implementation process.
- Educate themselves so they will not be dazzled by the computer's capabilities and the promises of vendors, and so they can maintain control over the total DP effort.
- Guarantee education and training for the user.
- Assure employees that the information and data—and thus the power inherent in the system—will be used for goal achievement and not for personal gain or punishment of particular employees.
- Separate organizational changes precipitated by the DP system from other changes, i.e, do not blame DP for organizational changes that management has been reluctant to make.
- Openly demonstrate commitment and involvement by such activities as attending key meetings, assigning quality personnel to the effort, and making timely and firm decisions. Employees will not respect the system if the organization's leaders do not take it seriously.
- Assume responsibility for resolving conflicts that arise in the course of implementation.

The users. Users and those who come into contact with the system by supplying the information or using the results are obviously of crucial importance to the implementation

TABLE 4

COMPUTER AND INFORMATION SYSTEMS GLOSSARY

HARDWARE—electronic and mechanical devices that store, manipulate, and retrieve data.

SOFTWARE—programs, routines, and documentation, i.e., the directions that guide the computations and other operations of the computer.

PERIPHERALS—any storage or communication equipment separate from, yet tied to, the central processing components of the computer, e.g., keyboard and video displays, storage disks, printers.

ON-LINE—describes a system in which the user is in direct contact with the central processor and in which the system responds immediately to user commands.

REAL-TIME—refers to a system on which the user does not experience significant delays between interactions with the computer.

INTERACTIVE—a mode of communication with the computer which is on-line and in real-time and in which the computer carries on a dialogue with the user.

CONVERSATIONAL—refers to real-time interaction with computer that asks questions of and responds to the answers of the user in the user's own language and logic.

DATA-BASE—a collection of records in one or more files where those records are identified and managed in such a way that they can be easily manipulated and retrieved.

DATA BASE MANAGEMENT SYSTEM—software specifically designed to store, manipulate, and retrieve the data in a data base.

INFORMATION SYSTEM—a system, usually computer based, for collecting, manipulating, retrieving, and reporting data.

DATA PROCESSING—the automated activity in which programmed routines are used for the collection, storage, retrieval, and reporting of data.

DECISION SUPPORT SYSTEMS—a high-level information system that allows the user more flexibility and control over the manipulation and retrieving of data.

DATA ADMINISTRATION—the management of data as an organizational resource for effective decision making.

DISTRIBUTED PROCESSING-a computing enivronment in which diversified combinations of centralized and/or decentralized systems perform the data processing function.

DATA DICTIONARY—a basic data management tool that contains a listing of the description, attributes, relationships, and users of all the data items of a data base.

WORD PROCESSING—indicates type of computer hardware and software that collects, stores, edits, and prints the written word according to user specifications.

process, yet their preparation often is neglected. Preparing the users is a process of involving them directly in the total implementation process or indirectly through representation on an agency steering committee. User involvement is the only way staff can develop a truly effective and appropriate system. Such involvement provides valuable training, opens communication channels, reduces unrealistic systems design, reduces fear and resistance, and secures commitment and future use. *It is the lesson most frequently mentioned in publications that address the problems of data processing.* To insure user involvement, the following steps should be taken:

Employees will not respect the system if the organization's leaders do not take it seriously.

1. Design the system to fit the user's needs, such as reduction of paperwork, improved data retrieval, etc.

2. Expose the user to an example of a positive DP system application as early in the process as possible.

3. Provide adequate training geared to those uninitiated in DP.

4. Be willing to commit funds to introduce users to the system by way of presentations, demonstrations, assistance to users in initial contact with the system, etc.

5. Make system use as easy, enjoyable, nonthreatening, and rewarding as possible. It is essential that users find it easier and more rewarding to use the system than not to use it.

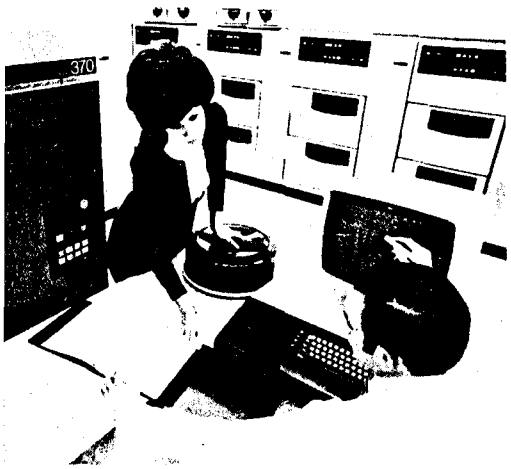
6. Include the system and its use in the standard operation procedures of the agency.

7. Provide for early payoffs from the system. Sample programs can be used to help demonstrate the system's capabilities.

Guideline 2: Avoid overreliance on a small number of technical specialists.

A DP system is basic to the organization's goals, policies, processes, and procedures; therefore the technical specialists must be controlled by

The ability to provide timely program data is becoming crucial for agency survival.



If system developers are left to work in isolation, the end product will tend to address the designer's perceptions rather than the agency's needs.

and be in close communication with the agency. If system developers are left to work in isolation, the end product will tend to address the designer's perceptions rather than the agency's needs.

To prevent overreliance on outside technical specialists, a high-level agency steering committee must take responsibility for the success of the system, acting as go-between for the organization and system designers. The committee can establish DP policy and procedures, monitor the implementation, and allocate DP resources. The steering group must make certain communication is established at the operating level as well as the management level. Management, however, must take responsibility for resolving problems or conflicts that occur during implementation. When conflicts develop, the committee should refer such matters to management for resolution.

Jargon and technical terms peculiar to particular disciplines can be a problem. Computer technicians, systems designers, managers, and caseworkers each use terms that are often peculiar to them and their peers. To help communication between the agency staff and designers, words that are not commonly understood should be defined in writing and circulated to all concerned. A sampling of such DP terms appears in Table 4. Similar lists of terms should be prepared by agency staff for the designers.

Overreliance on one person in the development and implementation effort can also present serious risks for the agency. A consultant may change firms and leave a system stranded. An inhouse designer may threaten to quit, an action that could destroy or at least set back the whole DP effort. Continuity must be assured for the two or three years required to develop a major system, regardless of the personnel changes that occur.

Guideline 3: Proceed by gradually implementing independent modules of a total system.

Gradual and modular implementation lessens risks, increases flexibility, spreads out costs, and—most important—gives the organization the time needed to plan and gradually adjust to a DP system. The key to this kind of implementation is the conceptual plan for moving the agency from Stage 1 (initiation) to Stage 6 (maturity) of Table 2. Rather than simply planning one system at a time, the agency needs to look ahead to the next and subsequent phases in order to progress as smoothly as possible. Each computer application cannot be expected to evolve through Nolan's six stages, but the agency will do this in the course of advancing to a complete information system. If a comprehensive plan has not been developed, an initial module or subsystem may have to be changed substantially as the system grows.

Overall conceptual planning is increasingly important as departments and individuals have begun to purchase their own microcomputers and develop their own data bases. The overall plan must indicate how individual and departmental data bases will be coordinated and tied together. One method of doing this is called a distributed processing environment.[4] In such a system, triggers, or automatic connections between data bases, become especially important. For example, as client intake data is automated in a department such as financial aid, client profiles could be analyzed to see how closely they match those of clients needing additional services. Or, a profile of high errors in eligibility decisions may trigger specific alerts on verification requirements. Thus when client profiles match certain predetermined criteria, appropriate departments could be notified. Distributed processing (see glossary) can be a useful concept in considering agency DP systems as a subsystem of a community human service information network, especially in relation to Title XX social services. The concept can be particularly important because welfare agencies are a part of the larger community service delivery system. How an agency system will be integrated into a larger network should be addressed in the DP plan since a community information system is basic to agency activities. Such a system, for example, could monitor clients from intake through any number of services to follow-up. Confidentiality and security must be taken into account during this part of the planning.

Guideline 4: Place the information system effort in a separate high-level department.

The experience of business has demonstrated that success is severely limited if the person in charge of the DP system reports to anyone two levels or more below the chief executive.[5] This has been a frustrating lesson to learn because the tendency is to place the DP system in the department of first application and to create a separate high-level unit only when the first application proves viable and others are being added. Such a practice conceals a serious trap as computer consultants Cyrus F. Gibson and Richard L. Nolan write:

> The department that controls the resource becomes strongly protective of it, often because a manager or a group within it wants to build up power and influence. When the time

comes for computing to assume a broader role, real conflict arises—conflict that can be costly in terms of management turnover and in terms of lingering hostilities that inhibit the provision of computer services and applications across functional areas.[6]

Although high-level placement itself may generate some problems, a separate high-level department also helps the person in charge of data processing cope with the power and controversy the DP system creates. Placement at a high level at the outset also demonstrates that management is committed to the data processing function. While the changes in the organization created by high-level placement of the department may be resisted by management, the difficulties in *not* situating the DP system at this level can be even more severe.

Guideline 5: Document what is done.

Documentation is often neglected because its value is not immediately recognized by managers—and it is a boring task for system designers. However, it is an essential task as Ein-Dor and Segev point out:

> One of the most significant factors differentiating companies which are effective information system users from those which are not is the quality and content of their written plans. . . . The problem is that documentation is generally perceived as a dreary chore and a marginal task that may be postponed, delegated to a junior staff member, or generally ignored. . . . Though the specific form of the documentation is of no great consequence, completeness of coverage is of primary importance.[7]

Documentation helps tie the independent modules together. It is the basis for evaluating and controlling the DP effort as well as for the building of additional applications on the existing system. Documentation is also the key to continuity, especially when technology is changing rapidly and knowledgeable data systems personnel change jobs frequently.

Guideline 6: Safeguard security and privacy from the beginning.

Computerized DP systems can be as secure and protect client privacy as well as any paper and pencil system—but only if security and privacy are included in the initial design and if appropriate policies and procedures are established and followed. Smaller organizations especially have had problems since their casual manner of operation seems to carry over into the security and privacy of computerized data. Privacy is assured when proper levels of authorization, access codes, and other appropriate measures have been established. Security is a matter of physical protection of the system including adequate locks, restricted physical admittance, duplicate storage, and fire protection.

Data Processing Makes Information a Key Resource

Based on the demands for accountability in the human services, the rapid decline in computer costs, and the growth of data processing technologies, it is reasonable to expect that human services will experience rapid growth in DP activities over the next five to ten years. This growth will be more rapid than in business, since many of the technologies that took business years to develop can now be purchased as package systems. Also, the factor of cost in relation to capacity is now more feasible. The growth of DP means that an organization's information is now considered a core resource and its data processing system a model of the organization's structure, processes, and procedures.

But the fact that hardware and software are available does not mean agencies can implement DP systems without experiencing the problems that have been associated with their development in business over the last thirty years. In order to learn from the experience of business, human service decision makers must prepare themselves, their organization and the users; control the design effort; make certain there is continuity of systems knowledge among staff; plan for the modular implementation of a total system; place the system in a separate high-level department; document all efforts; and establish privacy and security measures as part of the initial plan. These are the key tasks that will inevitably make the difference between DP success or failure.

PW

The fact that hardware and software are available does not mean agencies can implement DP systems without experiencing problems.

Notes and References

1. For an elaboration of the guidelines presented here see Richard Schoech, *Computer Use in Human Services: A Guide to Information Management* (New York: Human Science Press, forthcoming).

2. Philip Ein-Dor and Eli Segev, "Organizational Context and the Success of Management Information Systems," *Management Science* 24, no. 10 (June 1978): 1067.

3. U.S., Department of Health, Education and Welfare, *Cultivating Client Information Systems*, prepared for the Office of Intergovernmental Systems by Gary E. Bowers and Margaret R. Bowers, Project SHARE Human Service Monograph Series, no. 5 (Washington, D.C., 1977), p. 38.

4. C.W. Spangle, "Impact of Distributed Systems," *Data Management* 16, no. 1 (January 1978): 17.

5. Ein-Dor and Segev, "Organizational Context," p. 1074.

6. Cyrus F. Gibson and Richard L. Nolan, "Managing the Four Stages of EDP Growth," *Harvard Business Review* 52, no. 1 (January/February 1974): 80.

7. Philip Ein-Dor and Eli Segev, *Managing Management Information Systems* (Lexington, Mass.: D.C. Heath, 1978), p. 63.

The following three papers

"Building Commitment to Technological Change"

"Evaluating Sponsor Commitment to New Technology"

"Technological Change Readiness Scale"

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EVALUATING SPONSOR COMMITMENT TO NEW TECHNOLOGY

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When an organization is faced with implementing new or upgraded information technology, a crisis situation often develops. As shown above, the Chinese have a revealing way of expressing the word CRISIS. The upper character represents danger, while the lower one conveys hidden opportunity. Managers responsible for implementing technological change within their organization have the same options the Chinese symbols suggest: dangerous negative results or positive new opportunities.

EVALUATING SPONSOR COMMITMENT TO NEW TECHNOLOGY

When a company decides to install new or upgraded information technology, (sophisticated hardware/software, office automation systems, CAD/CAM, robotics, etc.), three roles are important to understand:

- Change Sponsor—individual/group that legitimizes the introduction of technology.
- Change Agent—individual/group that is responsible for implementing the technology.
- Change Target—individual/group that must use the technology.

For a technological change of any consequence to be successfully implemented, the sponsors of that change must demonstrate strong, decisive support for the project. When a change agent is given implementation responsibilities for installing new or upgraded technology, it is vital that the agent determine who the appropriate sponsor is and what level of commitment exists. The SPONSOR COMMITMENT EVALUATION is designed to assist you (the change agent) in determining the level of sponsor commitment currently being demonstrated toward a specific change project.

INSTRUCTIONS: Listed on the following pages are eleven characteristics indicative of sponsor commitment. Circle the number under each characteristic that best describes your sponsor's point of view regarding the change you are evaluating. If more than one sponsor is involved in the change, use other symbols for each person. For example, for a second sponsor, use a box around each number; for a third sponsor, a check mark, etc.

1. DISATISFACTION

The Sponsor . . .

. . . is very dissatisfied with the present state.	. . . mildly dissatisfied but not overly disrupted by the present state.	. . . is satisfied with the way things are now.

10	9	8	7	6	5	4	3	2	1

2. VISION

The Sponsor . . .

. . . has a clear vision of of what should be changed.	. . . has a vague sense of what should change.	. . . has no idea of what should be changed.

10	9	8	7	6	5	4	3	2	1

3. The NEED for the Change

The Sponsor . . .

. . . demonstrates a strong belief that the new technology is needed.	. . . believes the technology would be useful but is not a strong advocate for its implementation.	. . . does not feel the technology is needed.

10	9	8	7	6	5	4	3	2	1

4. The RESOURCES NECESSARY for the Change

The Sponsor . . .

. . . has a thorough understanding of the organizational resources (time, money, to people, etc.) needed for a successful implementation and is able/willing to commit what is necessary to the project.	. . . is generally supportive of the technology but lacks full understanding of the resources necessary for its implementation and/or is reluctant to commit them to the project.	. . . does not really appreciate the resources necessary for implementation and/or does not perceive the technology as worth the investment.

10	9	8	7	6	5	4	3	2	1

5. The ORGANIZATIONAL IMPACT of the Change

The Sponsor . . .

. . . has a total, indepth understanding of the effect the new technology will have on the organization.	. . . understands the organizational implications of the change at a superficial level.	. . . does not really understand what the organizational implications are for use of the new technology.

10	9	8	7	6	5	4	3	2	1

5. The SCOPE of the Change

The Sponsor . . .

. . .has a thorough understanding of the size of the group to be affected by the new technology.	. . .has a vague, general sense of the number of people to be affected.	. . .believes the technology affects a great deal more or significantly fewer people than it actually does.

10 9 8 7 6 5 4 3 2 1

6. The SPONSOR'S PUBLIC ROLE in the Change

The Sponsor . . .

. . .is able and willing to demonstrate the type of public support necessary to convey strong organizational commitment to the new system.	. . .will announce support but prefers to exhibit little public commitment for the change.	. . .is unable or unwilling to have any public association with the new technology.

10 9 8 7 6 5 4 3 2 1

7. The SPONSOR'S PRIVATE ROLE in the Change

The Sponsor . . .

. . .is able and willing to meet privately with key individuals or groups in order to convey his/her strong personal support for the new technology.	. . .will casually discuss support of the technology with key personnel but is unable or unwilling to take a strong personal stand in private.	. . .is unable or unwilling to support the new technology privately with key personnel.

10 9 8 7 6 5 4 3 2 1

8. CONSEQUENCE MANAGEMENT

The Sponsor . . .

. . .is able and willing to promptly reward those who facilitate the implementation process or express displeasure with those who inhibit the technology's acceptance.	. . .will express a preference of wanting people to support the technology but will not engage in the systematic use of incentives and pressures.	. . .is unable or unwilling to use any means of positive or negative consequences to support implementation of the new technology.

10 9 8 7 6 5 4 3 2 1

10. CONSEQUENCE MANAGEMENT

The Sponsor . . .

. . . is able and willing to promptly reward those who facilitate the implementation process or express displeasure with those who inhibit acceptance of the change.	. . . will express a preference of wanting people to support the change but will not engage in the systematic use of incentives and pressures.	. . . is unable or unwilling to use any means of positive or negative consequences to support implementation of the change.

10 9 8 7 6 5 4 3 2 1

11. MONITORING ACTIVITIES

The Sponsor . . .

. . . will assure that monitoring procedures are established that will track progress or problems that occur during the implementation process.	. . . will periodically ask for reports on implementation progress but is reluctant to establish specific monitoring procedures.	. . . refuses to ask for formal/informal reports on implementation progress.

10 9 8 7 6 5 4 3 2 1

12. The IMPORTANCE OF SACRIFICE

The Sponsor . . .

. . . is fully aware that a personal, political or organizational price may be paid for implementing the change and is willing and able to support the project even if the costs are high.	. . . is only somewhat aware of the potential for sacrifice or is tentative about his/her support if the costs are too great.	. . . does not understand the prices that may need to be paid and/or is unable or unwilling to pay them.

10 9 8 7 6 5 4 3 2 1

13. SUSTAINED SUPPORT

The Sponsor. . .

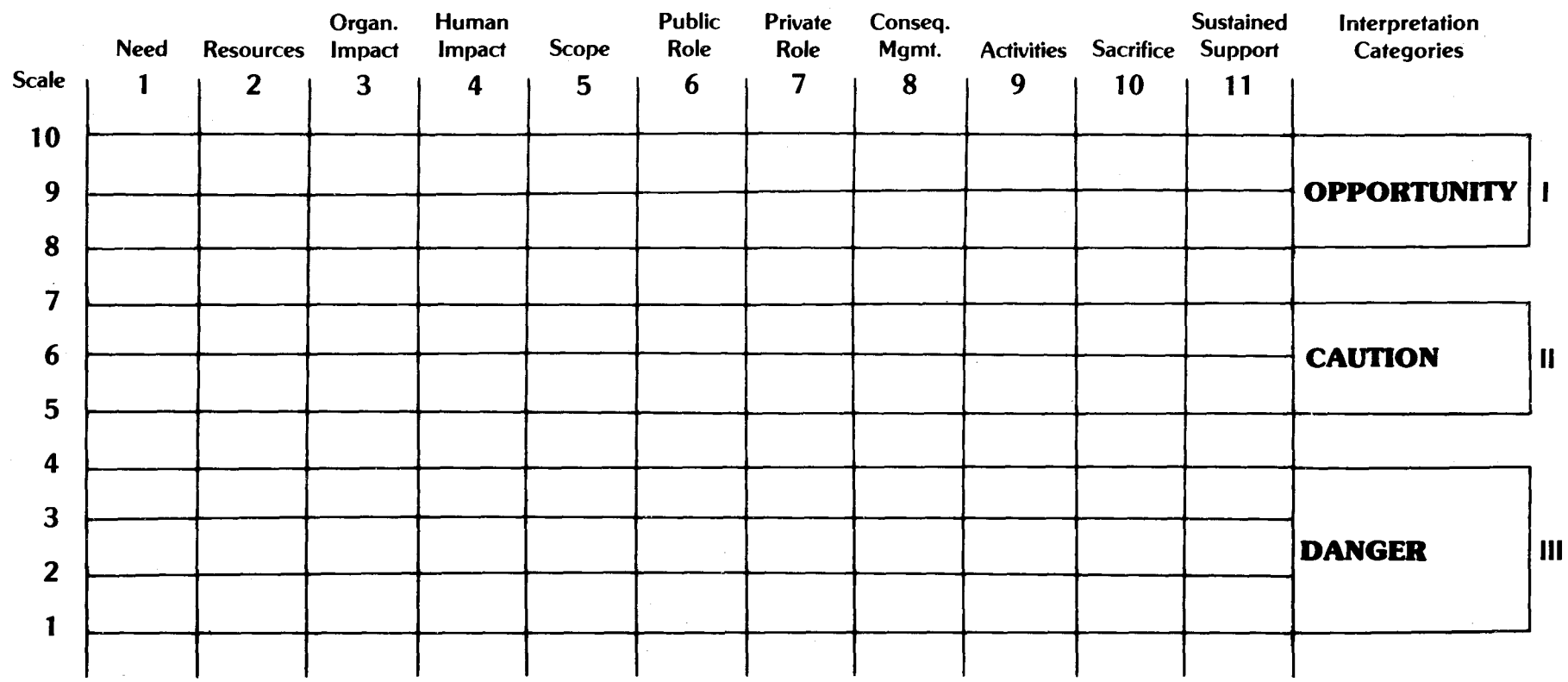
. . . demonstrates consistent, sustained support for the change and rejects any course of action with short term benefits if it is inconsistent with the implementation process.	. . . is inconsistent in his/her support of the project or the support is vulnerable to short term actions that may jeopardize long range implementation goals.	. . . is unwilling or unable to sustain strong support for the project.

10 9 8 7 6 5 4 3 2 1

SCORING

PLOT THE SCORE FOR EACH CHARACTERISTIC ON THE GRID BELOW. THEN CONNECT THE DOTS WITH A LINE.

CHARACTERISTICS



CATEGORY I — OPPORTUNITY RANGE

Any item scored in the range of a 10-8 indicates a high level of sponsor commitment and a positive prognosis for a successful implementation.

CATEGORY II — CAUTION RANGE

Any item scored in the range of 7-5 indicates a moderate level of sponsor commitment and a guarded prognosis for a successful implementation.

CATEGORY III — DANGER RANGE

Any item scored in the range of 4-1 indicates a low level of sponsor commitment and a negative prognosis for successful implementation.

SCORING IMPLICATIONS

OPPORTUNITY RANGE — Sponsorship should never be taken for granted, but scores in this range generally indicate that the sponsor commitment is at a level that is sufficient for successful change implementation. Although the overall score is positive, the agent should be careful not to ignore any items with four or less points. Items with fewer than five points are typically problem areas requiring special attention.

CAUTION RANGE — Partial or tentative support from sponsors does not always result in implementation failure, but it does increase the chances of failure, and it certainly means the change agent's task is more complicated. A sponsor commitment score in this range should alert the agent to the following possibilities:

a. The sponsor may have an intellectual commitment to the change but fail to grasp the full meaning of what is necessary for successful implementation.

b. The sponsor's support for the change could deteriorate rapidly and with little warning.

c. The agent will probably need to invest as much time and effort in sponsor education and maintenance as he/she would in the implementation of the task itself.

DANGER RANGE — Most change projects with sponsorship scores in this range fail to achieve full implementation. The only exception is when the sponsor does not consider the change to be a significant alteration of the status quo. If the change is a minor one, low sponsor support may not prove fatal to the project; however, change that is significantly disruptive or potentially threatening must always have a degree of sponsorship well above this range. Change agents with sponsorship scores in this range have three options:

1. Strengthen sponsorship — Use this instrument as an educational tool to help the sponsors better understand and value the critical nature of their role.

2. Identify alternative sponsorship — If it is not possible to strengthen the existing sponsor's support, the agent should identify some other person or group with the power to legitimize the change and secure their agreement to serve as the sponsor.

3. Prepare to fail — Without strengthened sponsorship or new sponsorship, the probability of successful implementation is low. Faced with these circumstances, the agent should consider aborting the change project or significantly altering the objectives so that new perspectives on the issues can develop. If, for political reasons, the agent is pressured into continuing the project without these alterations, preparations should be made to deal with the problems that will arise when the project fails to produce its intended results.

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TECHNOLOGICAL CHANGE READINESS SCALE

By
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When an organization is faced with implementing new or upgraded information technology, a crisis situation often develops. As shown above, the Chinese have a revealing way of expressing the word CRISIS. The upper character represents danger, while the lower one conveys hidden opportunity. Managers responsible for implementing technological change within their organization have the same options the Chinese symbols suggest: dangerous negative results or positive new opportunities.

INTRODUCTION

If automation-related change could be limited to affecting only the technology, implementation would be relatively simple. Most technological changes within the work environment, however, require employees to modify something about the way they think, feel or behave. Adding these human factors increase the complexity of the change process significantly. For this reason, successful implementation of change requires an understanding of the human as well as the technical aspects involved in the situation.

The Technological Change Readiness Scale (TCRS) is designed to serve as an aid in dealing with the human aspects of an organization's adaptation to new or upgraded information systems. As a diagnostic tool, the TCRS can be used to determine the overall acceptance level of a technological change as well as identify what resistance factors should be addressed when developing an implementation strategy. The TCRS can be used:

WHEN	WHY
• while technology is being considered or during initial planning.	• to provide early warning for potential resistance problems;
• before the change has been announced;	• to determine the employee's predisposition toward the technology;
• after the announcement has been made;	• to analyze any resistance that may develop during the implementation process;
• after project implementation is complete.	• to identify the nature of resistance problems after implementation is complete.

Although the TCRS will apply to any organizational change, it is specifically constructed to measure an organization's readiness for new automated information systems and their related components: hardware, software, office automation systems, decision support systems, computer-related instruction, CAD/CAM, robotics, etc.

INSTRUCTIONS:

1. Resistance to the use of information technology can occur while existing systems are being upgraded/expanded or when employees are introduced to technology for the first time. The term "new technology" will be used throughout the questionnaire to represent the new or upgraded system you are evaluating.

2. Resistance to new technology can come from direct users, people indirectly affected, senior, middle or lower level personnel, someone who at one time was an advocate of the new system or even the DP/MIS department itself. The term EMPLOYEES will be used throughout the questionnaire to refer to whomever (individual or group) you selected as your focus point for this analysis.

3. The TCRS is intended to generate a profile of employees' perceptions regarding the implementation of a specific technological change. When completing the questionnaire, your responses should convey what you think the employees believe to be true about the change. Each item should be answered as the employee would answer it.

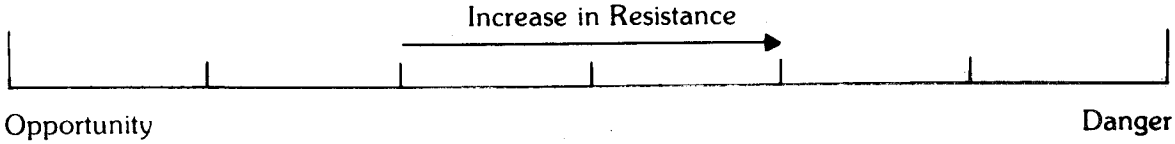
4. If the employee population you select involves more than one person, one way to answer each item is to reflect an average of all their perceptions. Another option is to focus on a small sub-group of the population that is representative of the other employees or is made up of key influential leaders. It is also possible to select one individual as your focus point. Whichever approach is used, a consistent definition of the employee population should be maintained.

5. When employees are asked to complete the scale, each person should answer in a way that reflects his/her own viewpoint or indicates what he/she perceives to be an average of all employee attitudes toward the change. Again, consistency throughout the instrument is required.

6. The TCRS is comprised of 25 statements corresponding to the 25 most common reasons why employees resist technological change. Each statement is followed by two phrases that depict opposite ends of the "readiness continuum". The statement below and to the left of each item indicates that the employees perceive themselves to be demonstrating high readiness for the change which means they are not resistant to it (this increases the opportunity for a successful implementation). The statement below and to the right of each item conveys a low readiness for the change meaning the employees are resistant to it (increasing the danger that the change will not be accepted or appropriately used.)

EMPLOYEE READINESS CONTINUUM

HIGH READINESS — **LOW READINESS**



7. **The employee's viewpoint of a particular technological change cannot be realistically evaluated by simply selecting one of the two statements in each item as representative of their perception. To provide a more accurate profile of the readiness level, answer each item by splitting ten (10) points between the two alternatives.**

EXAMPLE:

Resistance is increased when employees do not feel involved in planning the change.

Employees do feel involved in planning the change.	Employees do not feel involved in the planning.
[3]	[7]

The sample indicates a belief that the employees do not feel very involved in the planning of this change. If the employees were thought to feel more involved, the scoring might have been [6] [4]. If the employees were judged to feel totally involved, the core would have been [10] [0]. If an item seems to have no relevance in your situation, the score should be [0] [0].

RESISTANCE IS INCREASED WHEN . . .

1. . . . EMPLOYEES DO NOT SEE A NEED FOR THE TECHNOLOGICAL CHANGE. When employees do not understand or accept the rationale given for the new technology they tend to disagree that a change is needed. Resistance will also surface when people feel the existing methods/procedures are adequate and new systems are unnecessary.

Employees perceive a high need for the new technology.	Employees perceive a low need for the new technology.
☐	☐

2. . . . EMPLOYEES ARE NOT INVOLVED IN THE PLANNING. It is human nature for people to support what they help create. If employees do not believe they have a sufficient degree of input into the evaluation, selection, development or implementation of the new technology, resistance is usually increased.

Employees feel very involved in the planning.	Employees do not feel involved in the planning.
☐	☐

3. . . . THE COST OF IMPLEMENTING/USING THE NEW SYSTEM IS TOO HIGH OR THE REWARD INADEQUATE. For employees to be motivated toward accepting and appropriately using the new technology, a reward must be provided in the form of something they truly value, and it must compensate for any physical, intellectual or emotional price they perceive they will pay.

Employees believe the change has low cost or offers high rewards.	Employees believe the change has high cost or offers low rewards.
☐	☐

4. . . . VESTED INTERESTS ARE INVOLVED. A major source of resistance occurs when the new technology represents a threat to the employees' job, power, authority, responsibility, or status within the organization.

Employees believe they have not vested interest threatened by the change.	Employees believe they have strong vested interest threatened by the change.
☐	☐

RESISTANCE IS INCREASED WHEN . . .

5. . . . KEY PEOPLE IN THE ORGANIZATION ARE NOT SEEN AS REALLY ADVOCATING THE NEW SYSTEM. If employees perceive their boss or other politically important individuals/groups as not genuinely supportive of the new technology, their acceptance is difficult to secure.

Employees perceive strong political support for the technology.	Employees perceive weak or mixed political support toward the technology.
☐	☐

6. . . . EMPLOYEES LACK CONFIDENCE IN THEIR OWN CAPACITY TO ADAPT TO THE NEW TECHNOLOGY. Employees must perceive themselves as already possessing the skills and knowledge required by the technology or that they are capable of learning what is necessary.

Employees have a high level of self-confidence about adapting to the new technology.	Employees are not confident they can adapt.
☐	☐

7. . . . EMPLOYEES BELIEVE THERE WILL NOT BE ADEQUATE ORGANIZATIONAL SUPPORT FOR THE CHANGE. If the new technology requires organizational resources that employees think are inaccessible (money, information, time commitments by key managers, technical support, equipment/facilities, timely and effective training, etc.), they tend to become disenchanted and withdraw.

Employees are confident that the necessary organizational support will be provided.	Employees believe that the support will not be provided.
☐	☐

8. . . . THERE IS A LACK OF RESPECT OR TRUST FOR THE PERSON/GROUP WHO DECIDED TO INSTALL THE TECHNOLOGY. When employees view the decision maker(s) with dislike or mistrust, a lack of acceptance and enthusiasm for the change may become evident.

Employees have high respect/trust for the decision maker(s) responsible for the new technology.	Employees have low respect/trust for the decision maker(s) responsible for the new technology.
☐	☐

RESISTANCE IS INCREASED WHEN . . .

9. . . . THERE IS A LACK OF RESPECT OR TRUST FOR THE PERSON/GROUP RESPONSIBLE FOR IMPLEMENTING THE TECHNOLOGY. When employees dislike or mistrust those responsible for implementing the technology, a lack of acceptance and enthusiasm for the change may become evident.

Employees have a high respect/trust for those responsible for implementation.	Employees have low respect/trust for the implementors.
☐	☐

10. . . . THE "COMPATIBILITY" OF THE NEW TECHNOLOGY IS PERCEIVED TO BE LOW. "Compatibility" relates to how well the employees view the technology aligning with the existing organizational values or their own personal beliefs. Resistance may be at its highest when new technology is seen as inconsistent with beliefs which employees hold as fundamental to their value system or consider to be sacred.

Employees view the new technology as representing a good fit with the organization's values of their own personal beliefs.	Employees view the technology as representing a value conflict for the organization or with their individual personal beliefs.
☐	☐

11. . . . EMPLOYEES HAVE BEEN EXPOSED TO A LONG HISTORY OF MEANINGLESS AND/OR POORLY EXECUTED TECHNOLOGICAL CHANGE. If employees perceive that the organization is involved in another of its many useless and ill advised changes designed primarily to "look up to date" or to meet the needs of the MIS/DP staff, their enthusiasm for the change will be greatly diminished.

Employees are treating the change as a meaningful event warranting their attention.	Employees are treating the change as just another "change for change sake" to be ignored or tolerated.
☐	☐

12. . . . EMPLOYEES BELIEVE THE NEW TECHNOLOGY WILL HAVE A NEGATIVE IMPACT ON THEIR OPERATING BUDGETS. Due to poor planning or unexpected drops in revenues, operating budgets can be overburdened with the cost of planning, purchasing and implementing new technology.

Employees do not expect a negative impact on budgets.	Employees do expect a negative impact on budgets.
☐	☐

RESISTANCE IS INCREASED WHEN . . .

13. . . . THE STATUS QUO CANNOT BE REESTABLISHED IF THE NEW TECHNOLOGY PROVES UNACCEPTABLE. The easier it is to reverse the change and the fewer permanent consequences result from having tried the technology, the more likely it is that employees will accept the new system.

Employees feel it will be relatively easy to reverse the consequences if the new technology should not work as planned.	Employees feel it will be impossible to reverse the consequences if the technology should not work.
☐	☐

14. . . . EMPLOYEES PERCEIVE THAT THE SPEED OF MOVING INFORMATION FROM PLACE TO PLACE IS BEING ADVERSELY AFFECTED BY THE NEW TECHNOLOGY. If information flow is speeded up or slowed down too much, employees may be reluctant to accept the new system.

Employees feel the technology will help the speed of information movement.	Employees feel information movement will be adversely affected.
☐	☐

15. . . . EMPLOYEES THINK THE QUALITY OF INFORMATION IS BEING ADVERSELY AFFECTED BY THE NEW TECHNOLOGY. Resistance will occur if people believe too little, too much, unclear or unnecessary information would be generated by the new technology.

Employees believe the quality of the information generated will increase.	Employees believe the quality of information generated will decrease.
☐	☐

16. . . . EMPLOYEES FEEL THE PRIVACY AND SECURITY OF CRITICAL INFORMATION IS BEING COMPROMISED. The loss of ownership, access to or control of information can generate high degrees of resistance.

Employees do not view the new technology as a threat to information privacy/security.	Employees do view the technology as a threat to information privacy/security.
☐	☐

RESISTANCE IS INCREASED WHEN . . .

17. . . . THE CHANGE IS INTRODUCED TOO QUICKLY OR TOO SLOWLY. It is necessary to think in terms of optimal timing when planning how rapidly a new technology is introduced. The most appropriate speed of change may not correspond to the maximum speed possible.

Employees believe an appropriate amount of time is being allowed for their preparation.	Employees believe that too much or not enough time has been allowed for their preparation.
☐	☐

18. . . . WORK HABITS ARE DISRUPTED. Employees are usually resistant when they feel the technology is interfering with their established work patterns and habits.

Employees feel their work habits are not being disrupted.	Employees feel their work habits are being disrupted.
☐	☐

19. . . . KEY JOB CHARACTERISTICS ARE CHANGED. Employees will be more resistant to the technology if they perceive that it generates a decrease in: their autonomy, the level of challenge the job offers, the type of feedback they receive or the degree of importance the organization places on their job.

Employees do not feel key job characteristics will be negatively affected by the technology.	Employees do feel key job characteristics will be affected by the technology.
☐	☐

20. . . . THERE IS POOR COMMUNICATION REGARDING THE NEW TECHNOLOGY OR THE CHANGES IT REQUIRES. Even if only a few people are affected by the new technology, communication can be easily distorted. When this occurs, miscommunication can easily lead to resistance.

Employees believe little miscommunication has taken place.	Employees believe a great deal of miscommunication has taken place.
☐	☐

RESISTANCE IS INCREASED WHEN . . .

21. . . . THE EMPLOYEES PERCEIVE THAT THEIR SOCIAL CONTACT WITH CO-WORKERS WILL BE HAMPERED BY THE NEW TECHNOLOGY. Acceptance of the new technology is usually reduced if employees view the change as adversely affecting the way they relate to each other on the job or if it makes them feel isolated.

Employees believe contact with their co-workers will not be affected or will increase.	Employees believe contact with co-workers will be adversely affected.
☐	☐

22. . . . THERE IS A FEAR OF FAILURE. Using new technologies requires learning additional concepts/skills and learning usually involves making mistakes. When people are not given the freedom to make mistakes while learning they become afraid and easily discouraged.

Employees feel the freedom to fail while learning.	Employees fear they will be viewed as imcompetent or feel dumb while they are learning.
☐	☐

23. . . . EMPLOYEES FEEL THE BURDEN OF IMPLEMENTATION IS TOO MUCH TO HANDLE ALONG WITH THE OTHER PRESSURES THAT ALREADY EXIST IN THEIR JOB. This is particularly true when existing production standards are maintained while converting to the new system.

Employees feel the pressure for results is manageable.	Employees feel the pressure for results is overwhelming.
☐	☐

24. . . . EMPLOYEES EXPECT THE NEW TECHNOLOGY TO GENERATE NEGATIVE MODIFICATIONS IN THEIR PHYSICAL WORK AREA. If the work environment is altered to be too big, too small, too bright, too dull, too hot, too cold, etc. — resistance will surface.

Employees do not expect negative changes in their physical work area.	Employees do expect negative changes in their work area.
☐	☐

RESISTANCE IS INCREASED WHEN . . .

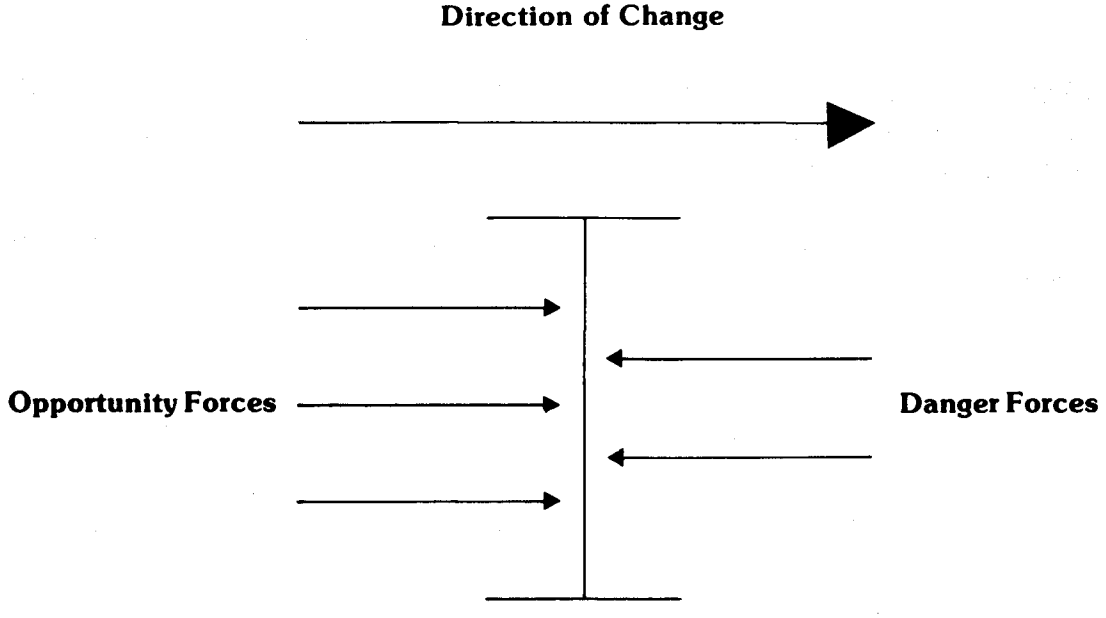
25. . . . EMPLOYEES BELIEVE THE NEW TECHNOLOGY POSES A SAFETY/HEALTH PROBLEM. Physical and emotional protection in the work environment is a growing personal as well as political issue. Resistance will occur if people do not feel that their welfare is being protected.

Employees feel safety/health hazards do not exist with the new technology.	Employees feel safety/health hazards do exist with the new technology.
☐	☐

INTERPRETATION

The success of any major technological change effort is dependent to a large extent on the "Readiness" level of the employee population. "Readiness" is defined as the degree to which employees are predisposed to support, ignore or resist the change. For the purpose of interpreting TCRS scores, "high readiness" means acceptance of the new technology is occurring, while "low readiness" means resistance to the technology is being demonstrated.

Employee perceptions that facilitate the change are called "Opportunity Forces". Those that inhibit the change process are called "Danger Forces". In any situation in which the potential for change exists, both "Opportunity" and "Danger" forces are always present. Successful technological change takes place when an imbalance occurs between these two forces in the direction of the desired results.



SCORING

Step 1. Add all the points you placed in the boxes to the right and under each of the items. This is your Danger Score.

DANGER SCORE _____

Step 2. Add all the points you placed in the boxes to the left and under each of the items. This is your Opportunity Score.

OPPORTUNITY SCORE _____

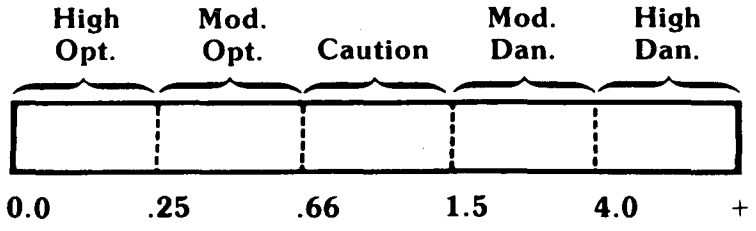
Step 3. Calculate the Employee Readiness Quotient by dividing the Opportunity Score into the Danger Score.

危機

Danger _____ ÷ Opportunity _____ = Target Readiness Quotient _____

Step 4. Place a mark on the Employee Readiness Scale to indicate the Quotient you calculated in Step 3.

EMPLOYEE READINESS SCALE



READINESS FOR TECHNOLOGICAL CHANGE

Quotient Scale	Implications
High Opportunity	The employees are demonstrating a strong readiness for the new or upgraded technology and very little resistance is in evidence. An extremely positive prognosis for success is indicated if the implementation strategy continues to provide support for the employee.
Moderate Opportunity	The employees are demonstrating a moderate readiness for the technology with some resistance evident. The prognosis is positive if the implementation strategy can compensate for some of the employee's concerns.
Caution	Successful implementation of the new technology can only occur when the Opportunity Forces outweigh the Danger Forces. When the forces are equal, as they are in this category, there exists the risk of investing a great deal of effort to accomplish very little. Each positive move is countered by an equally negative reaction. This may result in the appearance of movement when, in fact, real change is not occurring.
Moderate Danger	The employees are demonstrating a low level of readiness with considerable overt resistance. The prognosis for success is low unless the implementation strategy can modify the negative climate concerning the change.
High Danger	The employees are demonstrating virtually no readiness for the new technology and extremely high levels of resistance. The implementation strategy must totally reverse the resistant atmosphere or the prognosis for success is extremely negative.

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BUILDING COMMITMENT TO TECHNOLOGICAL CHANGE

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INTRODUCTION

How can company executive spend hundreds of hours evaluating and thousands of dollars purchasing the latest hardware and software, only to see their plans for increased productivity fade or disappear altogether once the new system is installed? If you are like many people you are saying, "I don't know, but that's exactly what's happening to us."

Reasons for the failure of new or upgraded information systems (advanced hardware or software, office automation systems, personal computers, CAD/CAM, robotics, etc.) are many and varied. Inappropriate selection of faulty hardware/software, inaccurately diagnosed user needs, or unrealistic user expectations are all common reasons given for failed attempts to implement new technology. Another complaint that is being heard more and more is that the organization was unprepared to deal with the changes created by the new system.

Installing new hardware and/or software generates a great deal of change that employees must learn to accommodate. Being creatures of habit, employees fear and resist change that disrupts the way things have always been done. It is not really the technology that they oppose as much as the way the technology changes their lives.

- new skills are required
- patterns of communication are altered
- time spans between communications are decreased
- influence, authority, and control are redefined
- roles, relationships, and responsibilities are modified
- data ownerships shift
- privacy and security concerns increase
- new organizational structures evolve

WHAT CAN MIS/DP DO?

The first step is to realize that when MIS/DP personnel implement new or upgraded information technology they are also implementing change. It is therefore important to expand the traditional role of MIS/DP beyond its technical limitation and encompass the human aspects of managing change. The role for today's MIS/DP function is not only to attend to the technical issues of automated systems, but also to help integrate these technologies into the complexities of the human work environment.

Successfully managing human reactions to technological change is a complex art form requiring a wide range of special skills and techniques. One of the more important issues that must be dealt with is how to build enough *commitment* to the new technology that support will be sustained throughout the implementation period and into full utilization of the system.

A central question for today's MIS/DP professional is "How can I build enough organization commitment to successfully implement new systems?" The intent of this article is to address this question.

Commitment to Technological Change:

- How is it developed?
- How is it lost?
- What is the MIS/DP role in the process?

WHAT IS COMMITMENT?

Commitment is a powerful yet little understood phenomenon. People are said to be committed to a specific outcome when they pursue a goal in a consistent fashion. With the passing of time and in varying situations, the committed person persists in activity that will help achieve the desired goal. The committed person will reject courses of action that may have short-term benefits if they are not consistent with a strategy for overall goal achievement. Also, the committed person understands that a price will be paid. The greater the commitment to a project, the more resources, such as time, money, endurance, and ingenuity, a person freely invests to achieve the desired outcome. Given these characteristics, it is easy to see why commitment is so important to technological change. It is the cement that provides the critical adhesion between people and the technology.

When involved in managing technological change it is important to understand three roles:

- CHANGE SPONSOR — the individual or group that legitimizes the introduction of technology.
- CHANGE AGENT — the individual or group that is responsible for implementing the technology.
- CHANGE TARGET — the individual or group that must use the technology.

The most prevalent factor contributing to failed change projects is a lack of commitment by the people in these central roles. Failure may be characterized not only by obvious symptoms such as sponsors terminating the use of a new system, but also by more subtle indicators such as apathy or disillusionment on the part of targets. In many situations a technically sound system is implemented, but the intended impact of the change falls short of the sponsor's expectations. In such cases, the operation is a success, but the patient dies.

If an organization is involved in major technological change that significantly disrupts the standard operating patterns, high levels of commitment from all three roles are essential. Change can, of course, occur without strong commitment from all three; in fact, if the sponsor's commitment is high enough, change can occur without any support whatsoever from agents or targets. Targets can simply be told to adjust or leave. The cost of implementing change in this manner is usually high, however, and is expressed through employee alienation, inappropriate use of the system, lost production, absenteeism, or grievances.

When automated systems are implemented, the work environment becomes more complex and requires more from targets than just learning to adjust. For a new system to reach its maximum potential, targets must believe in it and be committed to its full implementation.

The importance of commitment is not limited to the target role. Sponsors, even though they legitimize a change, and agents, even though they implement it, may develop serious misgivings about a new system once the project is underway. Lack of commitment from any of the participants raises serious questions about the quality and durability of the change.

HOW IS COMMITMENT TO TECHNOLOGICAL CHANGE BUILT?

Commitment building is an important component to the successful implementation of new or upgraded systems; yet most MIS/DP personnel know very little about what it is and what must be done to develop it. The "Stages of Change Commitment" (Figure I) is a cognitive map for MIS/DP representatives to use in understanding how to generate strong support to technological change.

The Model is presented as a grid with the vertical axis displaying the degrees of support for new technology and the horizontal axis indicating the passage of time. The model consists of three developmental phases *(preparation, awareness, and commitment)* with advancing stages in each phase. Each stage represents a critical juncture where commitment to the change can be threatened (represented by down-turned arrows) or facilitated (represented by advancement) to the next stage.

PREPARATION PHASE

Stage I Contact: *This is the earliest encounter a person has with the fact that a technological change has or may take place.*

For commitment to the new technology to be generated, sponsors, agents, or targets, must first pass through the contact stage. If an organization decides, for example, to convert to an automated reporting system, each of the three roles must, at some point, have a first encounter with the change. The CEO, or sponsor, may be the first to realize a change is necessary because of problems that occurred during an acquisition. It has become apparent that the inability of the newly acquired company to produce accurate year-to-date figures poses a real problem. Thus, a decision is made to replace the manual accounting procedures and purchase an automated accounting system. The controller, or agent, hears of the impending change through the VP of finance who discussed the problems with the CEO. The targets, or the accounting department supervisor and staff, had their first exposure to the new system in their staff meetings with the controller.

Methods for delivering the initial contact message may vary greatly; general announcement, staff meetings, personal contact or memo. Regardless of the approach used, the first stage in the commitment process is meant to produce an awareness that a change has already taken place or may occur in the future.

Contact efforts, however, do not always generate the intended awareness. Change agents are often frustrated when, after repeated meetings and memos regarding an impending change, one or more targets are either not prepared for the transition or react with total surprise when the change actually occurs. For this reason, the model separates contact efforts from actual awareness of the change. This distinction emphasizes the danger in assuming that the two are synonymous or that contact will automatically lead to awareness.

OUTCOMES FOR THE CONTACT STAGE ARE:

A. *unawareness* — reduces the probability that adequate preparation for commitment will occur — or
B. *awareness* — advances the preparation process.

Stage II Awareness of Change: *The person knows the change is being contemplated.*

If this stage is successful, the person in question is aware that modifications effecting operations have occurred or are possible. Awareness of the new technology, however, should not be interpreted as necessarily indicating a thorough understanding of the full impact of the change. In many cases, targets know that purchase of a new system is imminent, but this awareness may be accompanied by confusion regarding specific ramifications. Targets may be unclear about the scope, nature, depth, or even the basic rationale or intent of the change. Only if awareness develops into a general understanding of the change and its major implications, will progress toward acceptance be achieved.

OUTCOMES FOR THE AWARENESS STAGE ARE:

A. *confusion* — diminishes preparation for commitment — or
B. *understanding* — advances the process to the acceptance stage.

ACCEPTANCE PHASE

Stage III Understanding: *The person develops a view of the change.*

Once the contact effort has produced awareness and understanding, the person is, for the first time, in a position to make a judgment about the new technology. This judgment will be based on each individual's view of reality. For example, when targets develop an understanding of a proposed new system, they do so by perceiving the available information through their own cognitive, emotional, and philosophical filters. Since everyone has a unique set of filters, these judgments reveal more about the targets than about the technology itself. Through these filters evolves a positive or negative perception of the technology.

This third stage represents a threshold that is critical to the commitment process. Up to the moment a person begins to develop his/her own understanding of a change, all activities comprise the preparation phase. The preparation phase forms the foundation for later development of either support or resistance to the technology. Prior to this point, a person's activities are limited to the processing of information about the technology. A specific view of the change has not yet been formed, and thus, judgments cannot become crystalized.

Once an interpretation of the available information has created an understanding of the change, the person has crossed the "Disposition Threshold." At this point, people begin to think and act in certain ways toward the project. They enter the acceptance phase by demonstrating a positive perception of the change. Resistance is evident to the degree negative perceptions are expressed.

Life isn't black or white. Technological change of any significance usually generates both positive and negative reactions within people. The development of a disposition toward accep-

tance or resistance is a function of which viewpoint takes precedence. In some cases, new technology may be perceived as negative from one aspect, but still accepted because of a stronger more positive viewpoint. For example, if an organization decided to centralize and automate its purchasing function, some of the individual managers may have a negative view of the change. This may be caused by a belief that they would lose their power over vendors. However, as a group, these managers might accept the change as fundamentally positive because it removes their auditing responsibilities and this results in more time to devote to other activities.

The development of a predominantly negative perception of the technology is the first opportunity for true target resistance to be demonstrated. Failure to achieve earlier stages may produce *unawareness* or *confusion*, but not resistance. Only after a negative image of the change has been generated will the target privately or overtly engage in resisting activities.

Making this distinction is important because often change agents respond to unawareness or confusion as if they are symptoms of target resistance. Unawareness and confusion are signs of resistance only when they are faked and part of a resister's strategy. True resistance is the result of a negative judgment made about the change. Resistance is manifested only if enough understanding occurs to trigger a negative judgment.

The possibility of support increases if the technology is perceived in a positive fashion. A positive image of the technology causes advancement to the acceptance phase and the subsequent stages necessary for maximum commitment.

OUTCOMES FOR THE UNDERSTANDING STAGE ARE:

A. *negative perception* — decreases the level of support and provides the first opportunity for resistance — or

B. *positive perception* — increases support for and acceptance of the change.

Stage IV Positive Perception: *The person develops a positive disposition toward the change.*

Once a positive perception of the technology has been developed, the person is faced with whether or not to support implementation. Perceiving new technology as positive is one thing; deciding to commit time, energy, and other resources necessary to implement it is quite another matter. Even though sponsors may view a prospective technological change as useful and beneficial in many situations they may prefer not to implement it. Usually, in these cases, the sponsors are perceiving the technology as generally positive but not positive enough to compensate for the high logistic, economic and/or political costs of implementation.

The perceptions of change agents and targets are also important to the implementation decision. Although neither role functions as a strategic decision maker regarding the change itself, each does decide what level of support they will contribute to the implementation process. Many organizations have learned that reluctant agents and targets can significantly impede an implementation plan. User alienation, delays or missed deadlines, reduced productivity or quality, grievances, protests, and even overt sabotage are all possible symptoms of resistance to a technological change.

If a positive perception of the change is developed, the person has reached a point of action, thus moving to the final phase of the process: commitment. Action at this stage means *overtly* supporting the decision to install the technology. Commitment to action is demonstrated differently by sponsors, agents, and targets. For sponsors, commitment means they will use their organizational power to legitimize the change and assure it will take place. For agents, commitment means they will actively carry out the sponsor's implementation decision. For targets, commitment to action means willingly supporting the project and being involved in the steps necessary for full implementation.

Outcomes for the positive perception stage are:

A. a decision *not to support* installation - or

B. *installation* — a formal decision to initiate and utilize the change.

COMMITMENT PHASE

Stage V Installation: *The technical change is implemented and becomes operational.*

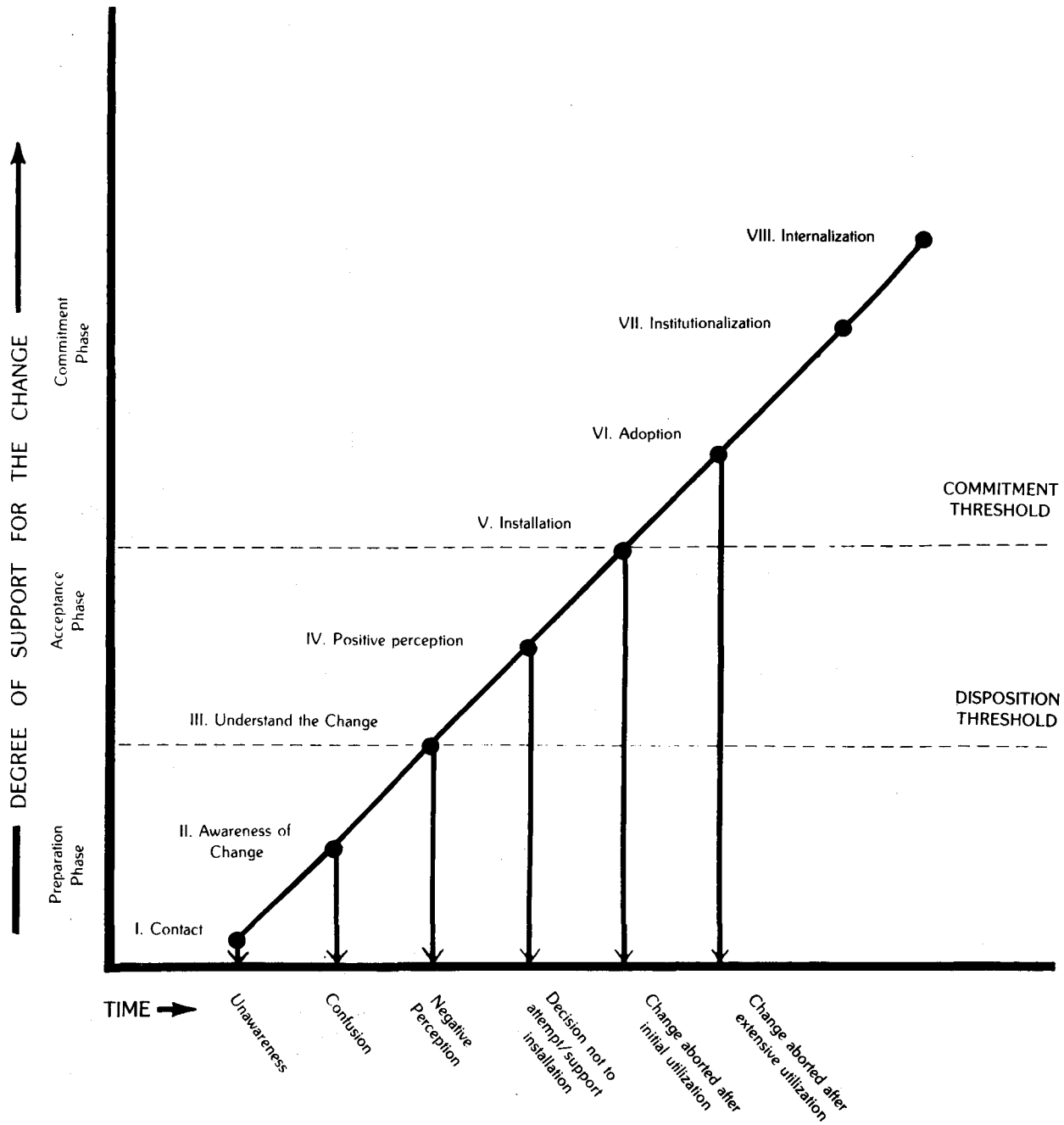
If the decision to install is acted on, a second milestone has been reached: the "Commitment Threshold." Developing a predisposition toward a change is important, but achieving enough acceptance to build commitment to action is critical in the successful implementation of new technology. Stage V is the first opportunity for true committed action to be demonstrated. As stated earlier, commitment is characterized by an investment of resources, consistency of action, and subordination of unrelated short term objectives to long-range goals. Once the decision to install the technology has been reached and acted on, the Commitment Threshold has been crossed.

The decision to install the technology is an important first sign of commitment, but does not represent the maximum support possible. Since it is virtually impossible to have a major organizational change that is completely positive in all respects, it is inevitable that sponsors, agents, and targets will, at some point learn of unanticipated problems with the technology. If these problems become too expensive or cumbersome, pessimism regarding the project will increase and may reach the "checking-out" level. Checking-out occurs when early uninformed optimism for a project turns into informed pessimism. Checking-out behavior demonstrates an increase in overt or covert resistance and a loss of commitment to the project: unmet expectations, inadequate or distorted information, faulty hardware or software, funding cuts, political problems, or reduced implementation time may cause people to exceed their tolerance for pessimism and check out from a project.

Some degree of pessimism is unavoidable; and the confidence of those involved in a project is increased as a result of resolving such problems. An environment that encourages open discussion of concerns and the generation of possible solutions tends to solve

Figure 1

Stages of Change Commitment



problems, promote ownership, and build commitment to the new technology.

A case study that illustrates how open discussion of concerns can help build commitment to change may be found in "The Human. Side of Robotics: How Workers React to a Robot" (by Argote, Goodman, and Schkade, spring, 1983 *Sloan Management Review.)* In this study they found that introducing robots in the work place caused disruption in social relationships among the workers. The acceptance of this change proved to be greater if the workers were involved in solving the problem. Thus, in regard to building commitment to change, as problems are resolved, a new more realistic level of conviction toward the change is generated. This level of support advances commitment to the adoption level.

Outcomes for the installation stage are:

A. the change is *aborted after initial utilization* — or
B. *adoption* — promotes long term use of the change.

Stage VI Adoption: *The change has now been utilized long enough to demonstrate worth and visible positive impact on the organization.*

After installation and a successful early trial period, the adoption stage is reached. The adoption stage is similar in dynamics to the installation stage. Both stages serve as testing periods for the organization to assess the cost and benefits of the new system. In both stages those involved in the implementation effort face logistic, political, and economic problems that require continuing analysis and modification of the project. In both situations, the change is aborted if previously developed commitment is eroded because of unresolved problems.

Although the dynamics of installation and adoption are similar in certain respects, the differences are important. Whereas installation is focused on initial entry problems, adoption is concerned with in-depth long-term utilization problems. The installation stage is an early attempt to use the new system to see if it works and to identify the initial human and technical repercussions. The adoption stage is a testing period that focuses on the long-term implications of the change. During installation the main question is "Will this word processing system work?" In the adoption stage the question is "Does the word processing system solve our real problems?" The shift is from "Can we do it?" to "Do we want to continue it?"

Although the level of organizational commitment necessary to reach Stage VI is impressive, a change project at this stage is clearly still in an evaluation period and can be terminated with relative ease. The following are typical reasons why new technologies are aborted after extensive experimentation:

(1) faulty technology;
(2) the identification of logistic, political, or economic problems that could be identified only after a lengthly test period;
(3) the user need that sparked earlier commitment no longer exists;
(4) people in key sponsorship or agent positions leave the organization or are no longer as active in the project as they once were.

If after extensive utilization the technology is successful, an advanced level of commitment is demonstrated by granting formal or institutional status.

Outcomes for the adoption stage are:

A. the change is *aborted after extensive utilization* — or
B. *institutionalization* — represents the highest level of organizational commitment possible.

Stage VII Institutionalization: *The change now has a long history of worth, durability, and continuity and has been formally incorporated into the routine operating procedures of the organization.*

When technology has been institutionalized, organization members no longer view it in a tentative manner. Those affected by the change are expected to utilize the new format as an integrated part of routine operations. The change is now the norm, whereas in the past, it was a deviation from it.

The length of time to move from installation through adoption to institutionalization will vary according to the organization and the sophistication of the technology, but usually a considerable amount of time is needed. During this transition period, the designers and users modify the technology and adjust to its long-range impact and requirements. As the change matures, it becomes a natural part of the organization's culture or expected pattern of behavior.

When institutionalization occurs, the organization's structure is modified to accommodate the change, and rewards and punishments are designed to perpetuate its existence. What was once a change requiring substantial sponsor legitimization has now become part of the organizational routine and is no longer in need of formal sponsorship. For example, in one organization a pilot program for automating and tracking sales records in one division has been refined and has gone on line for all divisions. This procedure is now a *required* monthly activity for all divisional managers. Strong organizational expectations have replaced the sponsoring function.

Even if the original reasons for the technology become invalid or people no longer feel it is worth the price to continue once a change is institutionalized, organizational inertia is capable of supporting it long after it has served its usefulness. Terminating an institutionalized pattern that is ingrained into the fiber of an organization is extremely difficult.

Institutionalization represents the highest degree of commitment to technology that can be demonstrated by an organization; nevertheless, it does present some limitations and problems. If a change has been institutionalized, those affected by it may be motivated to use the technology primarily in order to comply with the organizational imperative. In the above example, the new sales tracking system became institutionalized when the divisional heads were told to comply with the new format or face severe consequences.

Such compliance is achieved by motivating people to conform to organizational directives in order to attain specific rewards or avoid specific punishments, regardless of the individual's own private beliefs about the

change. Where negative targets perception exists, this compliance strategy usually has little impact on their attitude toward the change. Targets simply mimic acceptable behavior; they learn to say and do the right things. They are like the little boy whose parents demand that he eat his green beans: "You can make me eat'em, but you can't make me like'em."

Not all change requires that people believe in what they are doing; some projects require only that they do it. However, as the pace of rapid change escalates, producing more and more turbulence in the work setting, many organizations are reevaluating their belief that workers need not understand or support organizational changes. The product of such an attitude is often that change implementation can be forced, but it occurs in such a half-hearted, inefficient manner that a full return on investment for the effort is minimized or at least dimished significantly. Institutionalized change, as powerful as it is only delivers the target's behavior, not their hearts.

Stage VIII Internalization: *Organizational members are highly committed to a change because it is congruent with their personal interests, goals or value system.*

For new technology to achieve maximum support, people must be driven by an internal motivation that reflects their own beliefs and wants as well as those of the organization. Whereas the organization legislates and imposes the institutionalization of the change, employees control their own internalization.

When change has been internalized, people engage in goal-oriented activities in order to satisfy their own needs as well as those of the organization. This level of commitment goes much deeper than that at the institutionalized stage. At this last stage employees demonstrate ownership of the technology by accepting personal responsibilities for its success. The change is advocated, protected, developed and invested into a personal degree no organizational mandate could ever generate.

Enthusiasm, high-energy investment, and persistence characterizes commitment at the internalized level. This type of advocacy tends to become infectious, and often targets who have internalized a change cannot be distinguished from sponsors in their devotion to the task and their ability to engage others in the effort.

IMPLICATIONS FOR BUILDING COMMITMENT TO TECHNOLOGY

The commitment model has many implications for those involved in designing and implementing significant technological changes within their organizations. The following are five of the most crucial lessons associated with building commitment:

1. Commitment is expensive; don't order it if you cannot pay for it.

The problem with organizational commitment is its complexity and cost. Most sponsors want full support for changes they implement, but have little understanding of the sophisticated dynamics involved in their developing such commitment. Once they do comprehend the investment of time, money and energy required to generate commitment they often balk at the expense. They want the payoffs associated with high target support, but are not willing to pay the price to acquire it.

A target fully committed to implementing a technological change demonstrates a high degree of personal investment in achieving the desired goal, consistent action, and the rejection of rewards not compatible with the implementation plan. To gain this kind of advocacy at the target level requires substantial individual and organizational investments by the sponsors and agents. In order for commitment to develop with targets, they must be:

(a) provided with information as accurate and complete as is feasible;
(b) involved in the planning and execution of the change project and
(c) rewarded for their participation and assistance.

These target requirements for commitment are expensive; yet the payoff, when the technology is implemented successfully is dramatic.

2. Commitment strategies must be developed.

Typically, sponsors devote a great deal of time, money and energy in making the right decision regarding what hardware or software should be purchased and virtually no investment in building commitment to that decision. The issues raised in this article suggest that it is too risky to leave commitment building to chance.

A well-thought out strategy will maximize the possibility that those involved in the change will develop a high commitment toward successful implementation. Strategies for building commitment should not be limited to targets only. Sponsors must develop plans to assure that their agents are fully supportive, and agents often need to increase the level of sponsor support available.

All change projects do not, of course, require the same level of commitment from participants. Some projects require only that people try the new equipment or procedure; (Installation). Other projects need a more extensive testing period: (Adoption). For many change projects, the intent of the effort will be lost unless the technology becomes formally sanctioned: (Institutionalization). If the long-range goals of a change demands high levels of support, involvement, adjustment, and sacrifice from employees maximum commitment is necessary: (Internalization).

Most efforts to implement new technology have no plan for building commitment, and those that do often stop when the installation is announced (Stage V). To need internalized support from users while planning only through installation is like cutting short a golf swing at the point of contact with the ball. Adequate follow through is as important as hitting the ball correctly. To successfully manage organizational change it is critically important to generate high levels of commitment long after the change is installed.

3. Building commitment is a developmental process.

For durable commitment to evolve, the process must be viewed from a developmental perspective. The events leading to commitment are sequential in nature. *Awareness*, for example, is the result of successful *contact*. *Understanding* must occur before a *positive perception* can be generated.

Obviously, sponsors can skip some steps by simply announcing that new technology has already been purchased. When this occurs, the announcement is made, behavior dictated, and compliance achieved. Most organizational change is still handled in this fashion; however, if the change has significant implications for the targets, the likelihood of commitment being generated is low.

Forcing compliance assures the implementation of a new technology change, but often sponsors neglect to calculate the long-range cost of recurring resistance. Many times it is the way people are approached that causes resistance rather than the change itself. A common response from targets is, "We did not mind the new procedures as much as the way management handled the situation."

Short cuts to high commitment do not exist. Each stage in the process depends on successful completion, of prior stages. If internalization is desired, implementation plans and sponsor/agent behavior must be consistent with the stages presented in the model.

4. Either build commitment or prepare for the consequences.

The degree of commitment needs for successful technological change is a function of two factors:

(a) The importance of the new system to the organization's strategic goals; and
(b) the degree to which the change represents a disruption in the established patterns of employee behavior.

The importance a technological change has for an organization and the subsequent degree of disruption it will cause should determine the level of commitment required for success. The higher the importance and disruptive factors, the greater the need is for increased commitment. The relationship between these factors can be expressed in the formula R.C. = I x D:

R.C. = required commitment.
I = importance of the technology to strategic goals.
D = level of disruption to established patterns.

Although building maximum commitment is important, there are times when logistic, political, or economic reasons make the cost for commitment too high. If full commitment is not feasible, preparation for the resulting resistance is necessary. Too often sponsors and/or agents decide not to invest in building target commitment. Then they are surprised and unprepared for the inevitable resistance that occurs. Both sides of the fence cannot be played simultaneously. Sponsors and agents must either do what is necessary to build target support or decide it is not worth the cost and determine ahead of time what their response to the resistance will be.

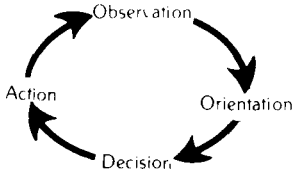
5. Human reaction to change is a function of intellectual and emotional response cycles.

People respond to change in predictable ways, as diagramed in Figure 2. Adjusting to new technology requires that an employee:

(a) OBSERVE that a change has occurred or is possible,
(b) develop an ORIENTATION toward the change by collecting information and establishing priorities,
(c) MAKE a DECISION to support or resist the change, and
(d) TAKE ACTION on that decision.

The cycle begins again when the person is attentive to the impact the action has on the situation; thus one observes new changes occuring.

Figure 2
RESPONSE CYCLE



The response cycle is not only applicable to understanding a person's total reaction to a change project, it can also explain what happens at each stage of the commitment process. For example, at Stage VI, (positive perception) a person observes the change in a positive manner, becomes oriented to what the change means by collecting information from a positive perspective, decides whether to support installation or not, takes the appropriate action, and observes what happens.

This response cycle operates at two levels. It has an intellectual and an emotional component, each usually moving through the process at a radically different pace. The intellectual capacity most people have to observe, orient, decide, act, and observe again is dramatically greater than their capacity to move through the same sequence emotionally. The result is that participants in technological change often achieve a level of intellectual commitment which far exceeds their emotional commitment. This split-level commitment can produce confusion, mixed signals, and ambiguous communications for all involved.

A classic example of this problem is evident when a sponsor moves too quickly to the institutionalization stage: a sponsor formalizes a new automated system only to find that, when installed, the change produces more human relations problems than anticipated. The sponsor is not emotionally prepared to confront all the angry employees even though he/she had been told they would resist.

MIS/DP personnel must learn to deal with both intellectual and emotional cycles of commitment, and implementation plans should account for the speed differential between the two. They must also learn to distinguish between deteriorating commitment and the mixed messages people produce when their heads have accepted the new technology, but their hearts are still struggling.

CONCLUSION: Assessing, encouraging, promoting and sustaining commitment to technological change represents a critical set of skills for the successful implementation of new technologies. Organizations that want to maximize the opportunities surrounding technological interventions should continually evaluate levels of commitment of the key people involved in the project.

People can't be programmed to commit to change; they must be assisted and nurtured as they pass through the *Preparation, Acceptance* and *Commitment Phases.* This investment in building commitment pays off with lowered levels of resistance and greater degrees of success for the new technology. This paper has outlined a model that can be used by MIS/DP personnel to build strong user commitment to new or upgraded technologies implemented in their organization.

"OVERCOMING COMPUTER RESISTANCE"

by

Arielle Emmett

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Overcoming Computer Resistance

Sure, you can lead an old horse to water. But can you get him to use a computer?

by Arielle Emmett, Associate Editor

When I came here two years ago, I was handed a Commodore computer. 'This is yours,' I was told, 'Learn how to use it.' They gave me a manual. That's one of the biggest gripes I have . . . the manual was extremely poorly written. Plenty of 'Please refer to page 218C to learn this exception, then go back to section 8 to load this and that.' Well, I have an extremely busy, pressured job. And when I don't know a computer, and someone hands me this 'magic manual' to struggle with late into the night—I just don't have the time. It's time, not resistance I'm talking about . . . . I would have liked someone to sit down and show me exactly the workings of the computer . . . . If we had had some kind of informal or formal training. But it was always, 'Dan, show me this' and 'Eleanor, show me that.' I'm sure a little kid in fourth grade would have picked it up faster than I did."

J.—a sales support manager

Here she was, the top sales manager for a leading-edge computer publication, trying to reconcile the aims of the magazine with her own struggle to learn the computer.

It was ironic, she thought. She was 50 years old, surrounded by workers half her age who were apparently having no difficulty at all feeling motivated to learn as many computing applications as possible. Already, her co-workers were characterizing her as "resistant" to the computer, tolerating her griping and slowness because of her proven abilities in other areas.

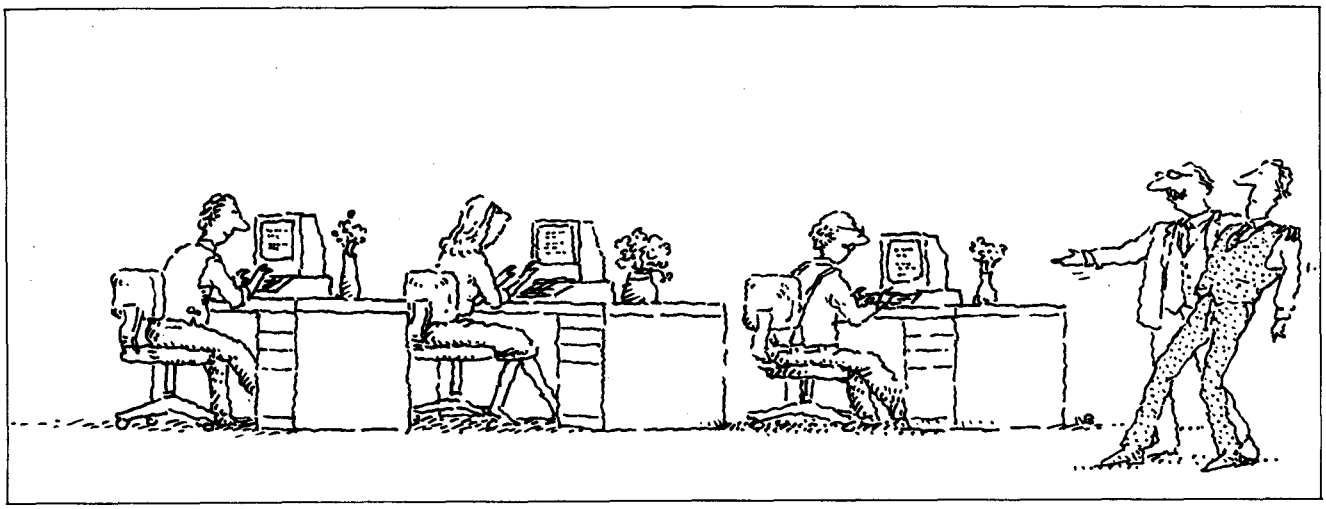
As the woman continued to speak, though, it became clear that she wasn't alone. Other workers in the office, even some younger workers, expressed similar shades of feeling: from a mild discomfort, a feeling at "odds" with all the promised miracles of the computer, to a sense of intimidation, even confusion about how to "get there from here." Like J., many seemed to be caught at an impasse between the expectations of their co-workers and superiors—namely that the personal computer was easy to learn, so "Here, do it!" and their own feelings that they weren't computer-adept and they needed more help and time to feel motivated to get to a still higher level of computing skill. "Lack of training and lack of time," J. insisted again, "versus resistance." The distinction was important for her. J. didn't dislike the computer. In fact, after two years of trying to make it do things for her, she had developed a feeling of affection for it. "I really look forward to using it . . . And I know once I get something into the computer working, it will save me loads of time. If someone had just invented two extra days of the week!" she exclaimed. "And I'd have been delighted if someone had sent me and my department an instructor to teach what we would have needed."

Computer myopia

An old saying is apt here: "The shoemaker's children go barefoot." Many times in the most advanced office environments, led by the brightest people and equipped with the most up-to-date automation tools, there's a kind of myopia about the people who must use those tools in their day-to-day work. People using personal computers are no exceptions.

What's the source of the myopia? According to a group of experts interviewed by *Personal Computing*, managers too often make the assumption that their people work—and learn—in the same ways and at approximately the same rates. They don't. A corollary to the assumption is that if managers themselves feel adept at the computer, everyone else must feel that way, too. If, conversely, managers feel inept, they may tend to foist the task on their employees without learning anything about it themselves. Either way, communication breaks down. When that happens, employees can't readily be motivated to learn the computer, much less master it according to a preset plan and schedule. True, some may attempt to learn it in a halting fashion—and indeed, there will always be workers who are sufficiently

Resistance to computerization in the workplace has begun to cost people their jobs.



self-motivated, as a matter of self-esteem, to overcome any obstacles thrown up. Others may recognize that learning the computer is simply the key to holding onto their jobs; they may be motivated, in other words, out of pure, unadulterated fear.

But the vast majority may attempt to strike some middle ground. These employees may accept the reality of computing grudgingly, and will learn just enough to get by. Perceiving that they have insufficient support from their managers, they will opt for a low to middling level of performance and productivity—an undesirable level, but one that may insure them sufficient transparency to continue on as before.

For many managers, though, middling performance may not be a viable option. A recent report by Joseph Malinconico published in *The New York Times* (Oct. 2, 1983) indicated that employee resistance to computerization in the workplace has indeed begun to cost people their jobs. One individual cited in the report, Brian Torres, who was attending free computer courses at Passaic County Community College in New Jersey, part of a statewide program to establish free computer training in all New Jersey state and community college programs, noted that he had been working in a comfortable job setting as a manager for a seafood company but had encountered difficulties in mastering the computer. "Everything was going along nicely. Everybody else was getting into computers, but I didn't want to change. I didn't think I had to," he was quoted as saying in the *Times*. Last May, though, he was let go, and now he is among some 47,000 New Jersey residents who may seek re-education in computing and other skills to get jobs.

A clear choice

Among the hundreds of thousands, and possibly millions of workers still functioning in office and manufacturing environments in which computing is the coming wave or the fixed reality, the choices seem clear: Either one accepts the reality and seeks help in mastering it, or one resists until resistance is no longer possible. From a managerial point of view, it may be far more desirable to help trusted and experienced employees master the computer rather than fire them in favor of computer operators. Helping them feel motivated to learn and improve, then, depends heavily on good communication, on creating the right conditions and setting the right examples. But no single formula works for everyone.

Does that mean, then, that so-called "resistant" people like J. can't be motivated to use the computer and to reap productive benefits? Absolutely not. But managers who thought they'd motivate all their people simply by plunking a computer down on the desk and expecting an instantly skyrocketing set of performances ought to look harder at their employees, their office environments, and themselves.

Motivation is the trickiest of computer questions. No two people react in the same way. The young, it would seem, always take to a personal computer better. The older ones, with greater experience, pressures, prejudices and more established patterns of cognition and of working, often have more trouble. But there are exceptions to that observation. Moreover, success or failure in using the personal computer may seem to be broken down, at times, along traditional lines: female versus male, manager versus employee, liberal arts graduate versus electrical engineer or computer "nerd"—although there is nothing entirely predictable about that, either.

The point is that a certain mystique has grown up around the personal computer. There is a sense that its complexity is all-American, handleable by everyone, and thus amenable only to self-teaching methods.

"The biggest motivation for using the computer is that it solves a problem."

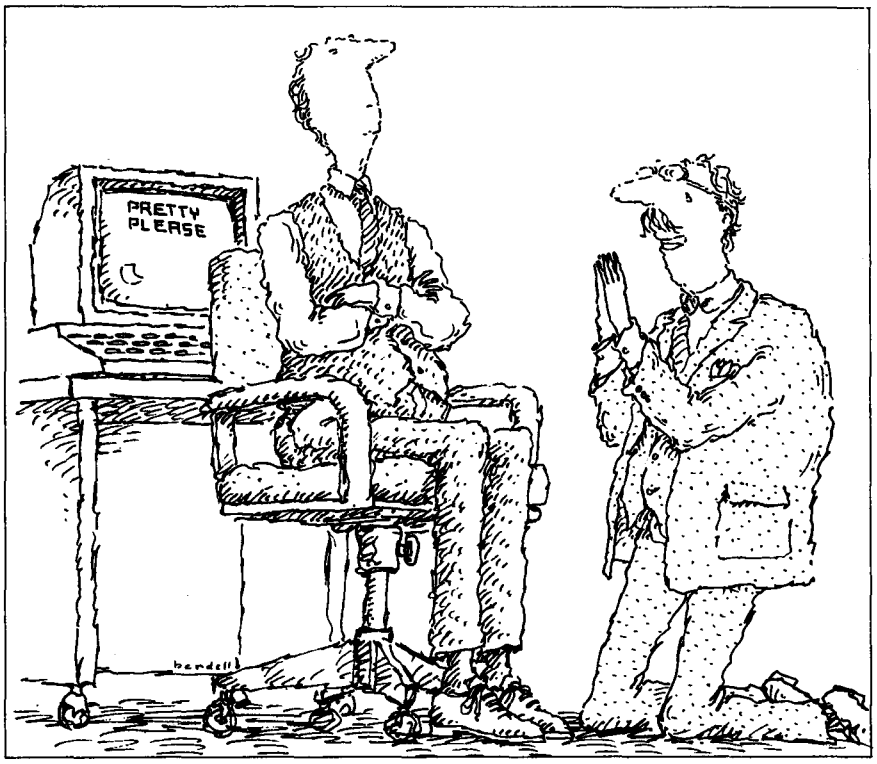
The problem with that, obviously, is that "learning" is not magical and neither is plowing through a manual. It takes work, discipline, insight, and time. For some, those conditions are impossible given the ordinary demands of their jobs. For others, those conditions amount to joy—an invitation to explore. The savvy managers know the difference between these kinds of people; they know how to create conditions—and models—to encourage every one of them, and if they don't know how, they bother to find out.

Now what about J.?

She was a tough cookie: intelligent, set in her ways—dubious, if not insecure about the computer. J. was and is part of a vast spectrum of people who want to learn the computer but expect a fair measure of pain and costly time to go along with it. Isn't that a realistic assessment for most? If it is, then how could a manager have made it easier for J. and many people like her? How can today's managers help their people actually *enjoy* the computer, and to use it for experimentation and for personal productivity?

To Maude Ackerman, a computing teacher and consultant for Entech Computer Skills Center, Inc., of Commack, L.I., the answer to motivational problems lies squarely in computer training, and in the willingness of managers to involve themselves in the process: "Nobody is afraid of anything if they're educated," she says. "If I understand what I'm doing with a computer, then I'm not afraid. But managers have to be willing to learn *along with* their personnel . . . . They can't bring it about in a forceful way, but in an inclusive way," she adds, so that the learning is shared.

To Dr. John Durrett, a human factors expert and president of Interactive Systems Laboratory (San Marcos, Texas), a research organization also offering computer training, the question of motivation is more of an interior one, a kind of "coming to know" the functional value of the computer—within the self. "The biggest motivation for using the computer is that it solves a problem," he declares. "But the people in the industry have been so enamored of their own hardware that they've neglected the real learning process. It's learning the software," he says, "and that software has to solve a problem that's relevant to you."



Personal involvement

An editorial administrator at this magazine expressed her motivation another way. She said it revolved around "personal" involvement with a computer, almost a possessive feeling of "it's mine . . . I can grow with this." She added: "The person responsible for getting me all enthusiastic and telling me about personal computing was a former editor." That kind of inspiration—a personal model to emulate—helped her get over some of the initial hurdles of learning. "It's a feeling more than words," she continued. "When you sit down, the potential is *you*—not the computer. It's limitless," she said. "And you get a feeling of pride and accomplishment each time you master a new skill."

Those feelings didn't come easily, though. Like many others thrown into a "sink-or-swim" office environment, the administrator admits her first experiences with a personal computer—entering magazine stories for the editorial production department—were frightening at best. "Frankly, I felt dumb . . . I felt I wasn't going fast enough," she said of her attempts to grasp a word-processing program.

"I had no formal training, and there *should* have been some sort of training," she said, agreeing with J. that she needed a more structured learning program than the brief, informal sessions offered by her more

"Very few managers are sending their employees to computer training."

STRATEGIES FOR MOTIVATION

[illegible] first, who will be using the computer, how it will be used, and [illegible] need to get done. Identify [illegible] then get the help you need to buy the right hardware [illegible] don't forget to include training for employees.

2. Do give training and education to [illegible] who need familiarity with computers. Especially the kind that will be the least threatening (tutorials, not programming, etc.).

3. As a manager, familiarize yourself with the uses and costs of the computer and the complexity of tasks that you want it to do for employees.

4. Involve yourself and your senior managers in the choice and the training process.

5. Encourage go-getters the opportunity to take the computer home (there's insurance).

6. Understand and plan for the learning time needed in both using the computer (gaining knowledge and skills) and for getting regular jobs done.

7. Call in outside or internal expertise to help configure your system to your specific needs. Don't just run out and buy the hardware and software.

8. If there's no time to train during working hours, give employees the opportunity to come in for Saturday or evening seminars.

9. Patience is of the essence for older employees who may fear the computer or not be interested in it.

10. If you've got that indefinable quality called "leadership," use it when introducing computers. Keep employees motivated by setting an example yourself (model emulation).

11. Make sure your employees don't bite off more than they can chew. In other words, encourage them to master one or two of the most important applications first (such as learning the accounting package, or mastering their word-processing commands) before expecting them to master more applications.

12. Get extra help in the start-up to get your amounts of data to get the system running. Start-up time in many computer systems is tremendously time-consuming, but once the data is in and the program up and running, your managers can use it to great benefit, and very quickly.

HOW NOT TO MOTIVATE YOUR EMPLOYEES

1. Stick a manual and computer in front of your employees and tell them to learn it. (You haven't, of course.)

2. Don't offer training and education. Tell your employees they sink or swim with their usage of the computer. Even better, threaten their jobs.

3. Set a time limit for learning and expect your employees to grasp all the necessary functions of the computer and do all their regular tasks at the same time.

4. Don't allow anyone to take it home or experiment with it.

5. Run out and buy the hardware, then the software because someone told you "it's cheaper to computerize" and "you'll be 'in' with the times." Don't think through your needs before you buy. Plunge.

6. Keep computerization a secret from everybody, including your top managers.

7. Identify resistant characters and punish them for their non-use of the computer.

8. Create a sterile office environment, buy one kind of computer and expect all your workers to sit in front of it for eight hours a day.

9. Assume that because you are so adept at the computer, everyone else will be, too.

10. Discourage employee cooperation and group-teaching projects.

11. Don't learn anything about the computer yourself. Attend "knowledge" seminars with no hands-on experience. Then call in "specialists" because you don't have time to teach your subordinates.

12. Give personal computers as a "reward" to your top people. Let your subordinates use other methods to do their work.

CONTROVERSIAL STRATEGIES

1. At an appointed hour, when you deem your employees are ready, subtly remove their other office tools (such as hand-held calculators, typewriters, etc.).

2. Allow employees who don't like the computer to continue with their old methods.

3. Give lectures on the "cognitive revolution." Single out employees who are fearful of the computer and try to help them "talk it out" through a rap session.

CONSIDERATIONS OF "ENVIRONMENT"

How do you create a "motivating" computer environment?

a) call in ergonomic specialists and computing expertise.

b) decide how "personal" you want to make the computer. Will you develop an employee buying program? A loan to own program?

c) look at the structure of your organization? Are you project or quality-circle oriented? Division oriented? Are there ways in which computers can help cut through bureaucracy through networking (telecommunications)? Do you need to reorganize your departments around the computer? Will you redefine jobs because of the computer?

CONSIDERATIONS OF "PEOPLE"

1. Know your worker. The worker of the 80s seeks incentives and greater involvement in the corporation.

2. Distinguish between using the computer as a "motivator" and a "satisfier." Watch out for computers as "expensive pieces of electronic candy."

3. Look at computers as part of an overall environment of incentives.

experienced co-workers.

"You can't keep pulling people off their jobs to help you," she said, with exasperation. "You've got to wait."

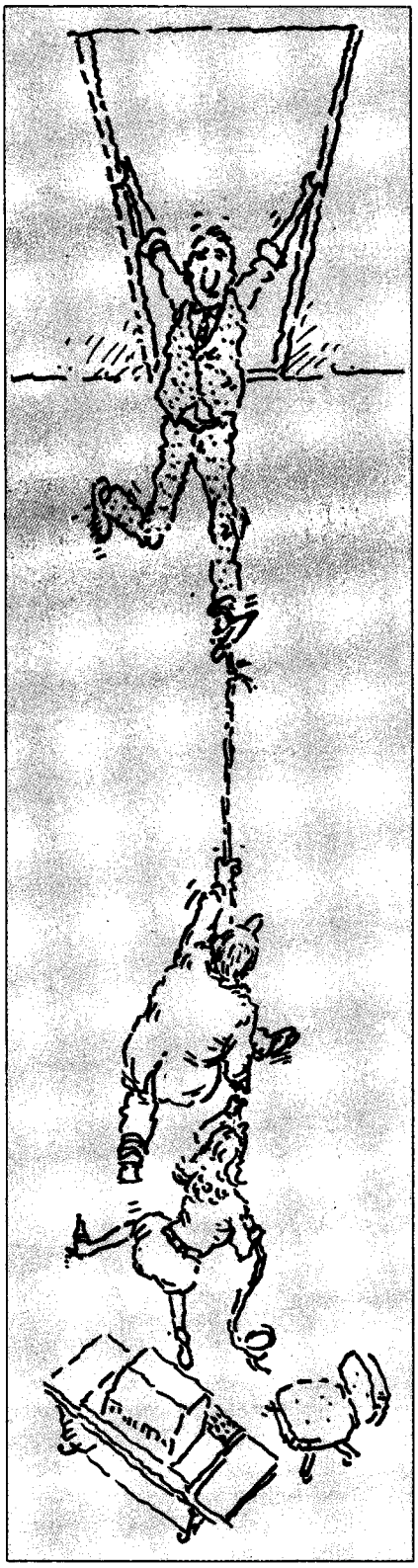
Not everyone in the office agreed with that assessment. "What about those who don't like formal training?" exclaimed one editor who used several different computers in his daily work. He was self-taught, and proud of it. "Some people feel threatened by a group or tutorial situation," he continued, arguing that attempts to streamline the learning process by placing people in a classroom setting might have just the opposite effect than intended.

No single solution

All of this, indeed, seemed true. And yet the very diversity of reported experiences underscores, again, that motivating by using a single technique or strategy won't work as well as using multiple strategies. What are these strategies?

In J.'s case, and in the case of the editorial administrator, training of a formal nature was the most obvious and neglected route toward motivation. Having a personal model to emulate—e.g., the editor who created enthusiasm by talking about the computer and using it in a wide variety of applications, also helped. But he was no substitute for learning the mechanics of various programs. To do that, a small, in-house, tutorial experience, in which a consultant or expert teacher came in to teach the workings of the computer, run and explain essential software programs, and give hands-on instruction and sufficient practice, might have been the most cost-effective and painless way to go for high-pressured workers like J. In-house training saves time and the need to transport employees to an outside class. For many, it's the most convenient training solution.

Self-starters, though, might have balked at this solution. Those who are not self-starters, but who balk at being put on the spot, wouldn't have



found a group tutorial entirely satisfactory, either. Distinguishing these differences, a perceptive manager might offer them training alternatives. For the self-starters—anyone from aggressive junior managers to administrative or clerical staff—doors could be opened to take the computer home to learn, or to experiment with on the job or after hours. "There is insurance available to take hardware out of the office," declares Entech's Maude Ackerman. "Yes, let them play around with it, let them take it home." Go-getters, whiz-kids, and the naturally curious, she suggests, can get a handle on the computer in their free time if they're really motivated to do so. That motivation usually comes from within; some see it as an extension, even a proof of their identity, and they may make their best computing decisions after hours—decisions that might affect their productivity at work.

Oddly enough, their shy, more self-conscious co-workers might also benefit from private, unpressured time with the computer—alone or in the company of a private or semi-private instructor. But here, managers may balk at their own sort of guessing game: Sometimes employees don't know, exactly, what they want or need until experience and mishap teaches them. Another problem is that no matter what kind of training solution is offered, employees still need time to learn.

"Managers don't take into account the time needed to learn all these things," Ackerman declares, adding that in many instances, employees are expected to carry their normal workload as well as learn the computer. That makes for frustration, resentment, and demotivated feelings. "The training should be on a par with the software," she asserts. "But very few managers are sending employees to school or training. They run out and make the investment in the hardware and go for a very little bit of something (by way of training), and

"Enthusiasm has to come from the top down. It can't come from the bottom up."

they say 'we'll work it out.' Six months later, we'll get a call asking for help."

Ackerman, a former school teacher, spends a great deal of her business time troubleshooting and reconfiguring poorly thought-out personal computer systems with husband Philip Ackerman, an engineer. She continues: "A consultant can really spark enthusiasm for the computer," especially when the consultant is called in early, to help identify the client's needs, what jobs the computer will do, and who will be using it. But they can't work magic on a manager who refuses to acknowledge his own fears—and ignorance—about the computer. "Managers who are really fearful of it will quickly rationalize they don't need it," she observes. Those who buy it because they want to be part of the going trend and are really afraid will be most likely to be resistant to using it themselves, she adds, but will also be likely to foist the task, unthinkingly, on employees. "There's no one blanket situation," Ackerman explains. "Some managers stay up to the wee hours of the morning learning the computer themselves" so they can help teach and support employees. Others may watch a push-button demonstration in a store and automatically assume their secretaries can do it right off the bat.

Tailored learning

One remedy Entech offers for people stuck in these situations is a tailored or "customized" program of education. Whether it's held in their Long Island offices or right on the company premises, an Entech class will be "graded," in Ackerman's words, so that the content will fit different needs and mind-sets. Managers, for example, might first take an overall, condensed version of a more technical course to get a feel for the levels of complexity involved for themselves and their employees. "Managers don't have to know all the intricacies of computer usage, but they'll have to know what their personnel will go through," Ackerman continues. "Personnel, in turn, must understand managers are going through it also. Then they'll be less hesitant and less fearful that the pressure is on them."

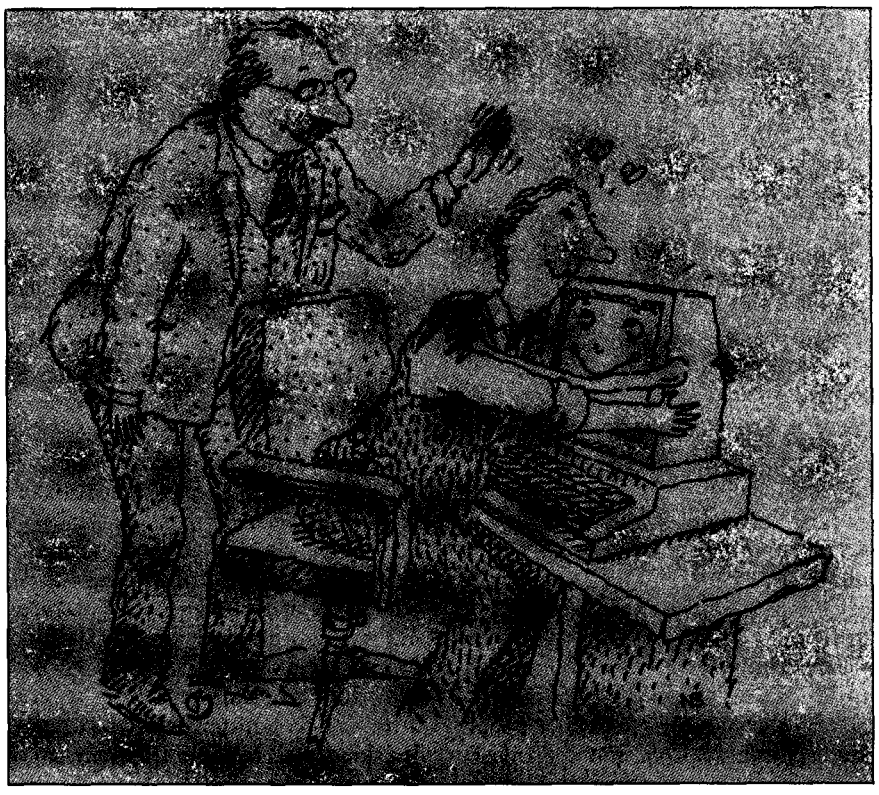
Manager support

One employer who has taken this principle very seriously, applying it to his own business, is Daniel A. Lehner, vice-president of a Valley Stream, L.I., firm called Inflight Newspapers, Inc. The firm is engaged in a number of projects, but its mainstay is an innovative system of magazine distribution to more than 200 airlines around the globe.

Roughly two years ago, when Lehner made the decision to add personal-computing capabilities to his already installed base of Data General Dasher terminals connected to the company's mainframe (the mainframe handles his distribution system as well as some accounting functions), he also decided to involve himself, directly, in computer training and to *accompany* his most trusted workers to outside seminars. One of those workers was LouEllen DeSantis, Lehner's top administrative assistant and trusted "right hand."

"One day she showed up and there it was (the computer) on her desk," Lehner remembers. "It was very important for me that my right hand share some of my enthusiasm," he says, "and it was the same for the rest of the company, too."

DeSantis, who went with Lehner to a two-day WordStar class at Raish Enterprises (Levittown, L.I.), says Lehner's concern—and the classes—helped her get over the initial fears. "I had overcome the fear of the typewriter," she says, "when I realized I had control of the typewriter. With the computer . . . I knew it was just a



"Management is out of synch with what motivates people today."

matter of getting used to it . . . . If you go step-by-step it's easy, although the first set of commands seems overwhelming."

DeSantis isn't alone, either. She's among many Inflight employees (the company numbers a total of 67) who took readily to several personal computing applications—data-base management, word processing, spreadsheets and more—partly because Lehner involved himself so directly in the training process. In fact, each time Lehner thinks of another way to use personal computing in his business, or when he wants to help his employees broaden their knowledge, he holds a Saturday seminar and teaches it himself or with his director of data processing, Peter Crobak.

"Enthusiasm," Lehner declares, "has to come from the top down. It can't come from the bottom up." A lot of managers he's observed "aren't enthusiastic enough" to trouble themselves with computing or to share the trouble and joy with employees. And that's no good for anybody's motivation, he asserts.

Key motivators

Whatever Lehner does, though—some combination of thoughtfulness, empathy for his employees, action and follow-through—apparently *is* good for motivation. In broader terms, he and managers like him may have identified certain key kinds of motivators that spark different individuals into action. These include the following:

- *The computer solves a problem for you.* Once anyone grasps that connection, learning is secondary to the goal of "problem-solving."
- *The computer is a "personal" computer.* It's mine; it's an extension of my mind; it's customized and tailored to fit me and my needs.
- *The computer makes communications easier so that a job can get done.* A computer can make people and communications more efficient.
- *A computer will save me loads of time.* Money, too, in some cases.
- *The computer may make me more saleable on the job market.* This is a matter of skills and personal identity.
- *The computer is fun.*
- *The computer extends my imagination, knowledge and skill base.* This taps into one's sense of identity, again, and is a motivator for those who are classically "achievement-oriented" or "inner-directed."

A communications device

One individual who has seized on that third motivator—the computer as a device promoting *communications*—is Paul A. Strassmann, a vice-president of systems applications at Xerox Corporation. Strassmann not only believes a personal computer can motivate workers to work better and more because it rids them of laborious or time-consuming tasks, he also reckons it's *the alternative* to other communications devices such as telephones and conventional mail. "It's changing the way we communicate," he says. Referring to nine different computing networks now available to Xerox's 110,000 employees, Strassmann adds: "At 11 o'clock at night I'm talking with people all over the world (via electronic mail).

Strassmann sees another, more abstract use of personal computers that may ultimately put the sting on top-heavy business organizations. That is, computing may cut through bureaucracy, he argues, by giving those with access to a network the ability to "communicate with all its functional elements." What it boils down to is that personal computing will make it easier for what Strassman calls "information middlemen" to get things done. Eventually, he argues, many forms of communications—talk, company procedures, policy statements, established ways of doing things (such as getting written approval for a certain task from several different corporate departments and divisions) will become the domain of the personal computer. In fact, procedures may become embedded within the computer's logic and data bases so that precious time is saved. Nothing, though, absolutely nothing by way of fancy hardware or state-of-the-art software will motivate the employee awash in a sea of company trouble, argue two experts from the prestigious New York-based marketing research organization, Yankelovich, Skelly and White, Inc. Stephen Zimney and Matthew Puleo, senior vice-president and vice-president, respectively, of the human resources group, say that management today can't look to personal computing alone to solve its organizational problems. There may be too many of them.

Management still the key

"Management and managerial training are out of synch with what motivates people today," Zimney declares. "A lot of assumptions we (managers) have about motivation don't correspond to the values, ethics and attitudes of today's worker . . . . They're crying out for leadership—not 'management,'" he says.

"Businesses come to us and ask, 'What's wrong with the way we're doing business?'" adds Puleo. "'It's worked all these years.' And we have to redirect them."

Redirecting, though, often means dismantling antiquated attitudes and vestiges of managerial "Taylorism" (the philosophy by which worker tasks are reduced, assembly-line fashion, to their most simplified, automated and dull levels), even restructuring systems of employee incentives. Both Puleo and Zimney, industrial psychologists, argue they can't do any of these things, much less advise managers on whether or not to computerize, and how, if managers don't confront the motivations of their employees head-on. "Just focusing on what makes them happy won't do it," Puleo says. Zimney adds: "You've got to know where they're coming from."

"Distinguish between motivators and satisfiers when thinking about personal computers."

Where that is, apparently, is a fairly rocky zone in the continuum of American work history. According to Zimney and Puleo, both of whom cite numerous annual work attitude surveys conducted by the Yankelovich firm (one of the most important is The Public Agenda Foundation report on "The Work Ethic and Economic Vitality," Daniel Yankelovich, chairman, pub. May, 1983)—the new workers of the 80s are tough, better educated than their parents, and guarded about the future. As children of the 50s and 60s, they've experienced the post-war boom and their parents' strict adherence to the work ethic. But living through the 60s, the decade of affluence and political turmoil, in which the focus was on "self" and the Great Society, changed them, also. And finally, they've lived through the 70s, the decade in which great economic expectations crumbled.

Finding incentives

"The 1980s will have a sense of 'I'm connected'" for the worker, Zimney says. "When work isn't 'interesting,' it means workers aren't connected to it," he explains. Indeed, workers want a greater sense of involvement in their jobs, according to recent work attitude studies, yet many are cautious about involvement and resistant to authoritarian styles of management. Ironically, the very same workers who may desire greater involvement on the job are also those who are reporting declines in their own efforts: In one study, only 22 percent reported they were performing at full capacity; nearly half (44 percent) said they expended little more energy than what was required. Once again, these reported declines in motivation to work may indeed be connected to outmoded managerial styles, the work attitude studies show. And the trend may continue if managers do not pull up short and examine the ways in which current systems of incentive and reward tend to block, rather than boost motivation.

"The most serious problem for many existing managerial incentive systems is that they serve to undercut and destroy the work ethic," declares the Public Agenda Foundation Report. It continues, " . . . One startling finding of the survey is the degree to which the American workplace has weakened the link between a jobholder's pay and his or her performance." This particular point is extremely important for those managers considering computerization, both Puleo and Zimney assert. Rather than linking real incentives in the workplace, such as promotions, better pay, and challenging work (computers may be part of the challenge) to real employee merit, many firms have instead adopted the lowest common denominator in expectations, policies, and performance. Under such policies, employees are predictably rewarded, but no one singled out. As part of that equation, companies may also hand out computers *without a thought* as to how their uses ought to be particularized —personalized—to enhance each individual worker's productivity. Even worse, many companies will distribute computers as "satisfiers"—perks and amenities that do not really function to motivate workers to work better or harder.

"Distinguish between motivators and satisfiers," Puleo asserts, "especially when you think about personal computers." Puleo is among those who believe that managers have exercised less than the full amount of discretion in bringing personal computers into their offices. Top executives, he reports, have been using them as expensive electronic "candy" —another form of perks or amenities; satisfiers, in other words—while their secretaries struggle with outmoded tools. And when personal computers are used in that way, they don't motivate, nor can managers expect their have-not employees to feel "motivated" either, Puleo suggests. Both parties have to feel there is something in it for them; motivating and computing are contractual sorts of relationships that demand patience and a certain amount of good will.

This may indeed pose a problem for the manager facing resistant employees. There are always going to be employees who will resist change no matter how delicately the manager goes about it. "People like the comfort and security of their day-to-day activities," Zimney says. That amounts to inertia and, in his words, it's tough to "reorient, change and let go" of old habits. Still, it's far more likely that managers will succeed in helping their people accomplish this task if they are insightful about computing themselves, and see it as a variety of particular solutions to particular and soluble problems—but not to every problem. "There are many managers who think (personal) computers are going to do *everything* for them," comments Entech's Maude Ackerman, and everyone knows that isn't true, she suggests. Computers don't replace secretaries. They can't wash the car or mow the lawn. They can't do complicated transactions, write brilliant reports, or manage data, without some very informed, confident, and highly skilled workers to operate them. At the same time, they *can* be useful and friendly devices to make work easier, faster, and more enjoyable; they can inform and educate, but only if the people who use them feel motivated to take advantage of these capabilities—without fear.

"Some people seize on it," says Ackerman, "And others are frightened they're going to break it." No matter what kind of people, though, they're almost always going to get their first taste of office computing because a manager decided it was time. You, the manager, may be responsible for making or breaking their experience. Their *motivation*. So think. Don't plunge. And be there for them. It's up to you.

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