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**REPORT OF THE
GOVERNOR'S BLUE RIBBON COMMITTEE
ON INFORMATION POLICIES**

November 1984

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Committee Membership

Chair	John A. Rollwagen
Vice Chair	James C. Wetherbe
Members	John P. Halloran Phyllis Kahn Ray Lappegaard Thomas W. McKeown Randolph W. Peterson Mary M. Ruprecht

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Executive Summary

The Governor's Blue Ribbon Committee on Information Policies was charged with studying the status of information management in Minnesota state government and recommending policy changes to improve that management.

The committee received personal testimony from a number of commissioners of state agencies regarding their use of automated information systems. Major findings, grouped by functional impact, are:

1. Understanding and using information:
 - a. There is a need for more interagency sharing of data.
 - b. In many instances, managers are concerned more about what kind of equipment they want to buy rather than what kind of information they need.
 - c. State agencies often interact with local units of government to deliver a product or service. However, since the level of technological use varies considerably across these units, the ability to effectively provide many such services is inhibited.
2. Dealing with rapid change:
 - a. Rigid personnel policies and inflexible funding and procurement procedures imposed on agencies result in outdated systems and stifled initiative.
 - b. Adequate training is important to retaining good managerial and technical staff. Both technical expertise and managerial and business skills are needed within state agencies.
 - c. There is a need for research and development along with centralized planning for the use of technology within state government.
3. Defining responsibilities for resources:
 - a. The need exists for top management to understand the strategic role of information and technology in decision making.

- b. Financial disincentives in the current system discourage efficiency in the administration of agency programs.
 - c. There are differences of opinion about the role of the Department of Administration, particularly in the definition of service and control.
4. Acquiring and using appropriate technology:
- a. There is a need for comprehensive overhaul of outdated information processing systems in state agencies.
 - b. Related needs exist in the areas of system availability, computer capacity, and response time.

As a result of these findings, the committee concludes that a cohesive information strategy at the State level along with the requisite programs to manage information in a rapidly changing environment must be established.

The committee recommends the following changes:

1. Establish a new policy and planning function within the Department of Administration, separate from the current computer service entity, which will be responsible for defining and managing an information architecture for the State (that is, identifying and describing an effective state information structure and the technology required to support it).
2. Assign responsibility for reviewing and approving state information policy, as developed by the new policy and planning function, to a strengthened User Advisory Council.
3. Delegate, within policy guidelines, the authority for information systems resource acquisition and allocation to agency management.
4. Appropriate meaningful funds for research and development in the application of information technology.

At a time when there is significant pressure to reduce the cost of government, it is important to recognize that the average public or private sector organization is spending 40 to 50 percent of its budget on information costs. The average manager is spending half of his or her time seeking and processing information, and "clerk" has become the number one occupation in the United States.

Fortunately, opportunities abound to increase efficiency in information handling because of the phenomenal drop in the cost of information processing technology from large to personal computers. Properly managing information and computer technology has become a key productivity issue, both to decrease cost and increase service in state government.

The recommendations of this committee are designed to be consistent with Minnesota's efforts to be a leading edge, high-tech, competitive state that provides first-rate services in a cost-effective manner.

Introduction

This report presents the study conducted by the Governor's Blue Ribbon Committee on Information Policies.

The paper is organized to separate and highlight:

The **FINDINGS** which are selections and summaries from reports given the committee by state agencies;

The **CONCLUSION** the committee arrived at after studying the Findings; and

The **RECOMMENDATIONS** to the State to address the Conclusion.

Following these sections is a description of the committee's process and other reference material.

Section I

Findings

UNDERSTANDING AND UTILIZING INFORMATION

This category addresses opportunities for improving the overall effectiveness of state and local government. Technology provides the means, but the real power rests with the effective use of information. Current use of information resources is at a stage where data is not shared among agencies, technology is overemphasized at the expense of information itself, and levels of technological sophistication vary from unit to unit. The findings in this category and throughout this report represent examples, and are not all inclusive. Within the category of understanding and utilizing information, the findings illustrate problems and issues in three major areas:

Inter-Agency Coordination and Sharing of Data

The committee views the need for inter-agency coordination and sharing of data as one of the most important areas to work on. The findings indicate that it is both feasible and useful for agencies to share data. While there are some instances of data sharing, it is more the exception than the rule. Examples which support these findings include:

- The Departments of Economic Security, Education, Employee Relations, Human Services, and Natural Resources indicate that there are problems with independent systems which do not interface with related systems within and between agencies. Difficulties occur in internal management reporting, cost accounting, and personnel/payroll transactions.
- Additional problems cited by the Department of Natural Resources include the need for data standards and concerns about confidentiality. The Department of Finance expressed concern about the lack of coordination and cooperation among agencies with similar needs to build a common database. Another problem is the lack of a planning or information strategy that crosses departments.
- The Legislative Reference Library inventory, while not yet operative, is an effort to record descriptions of data so that government can find out what has been done and where new efforts should fit.

Use of Information

The committee finds that information technology is used for operational purposes, but not always used in managerial decision making. The findings suggest the following problems:

- The Departments of Finance, Public Safety, and Natural Resources cite the need for more involvement by agency users in determining information requirements.
- The Department of Transportation expressed the view that the management of information should be within the normal chain of command.

State Agencies Interaction with Local Government

The committee recognizes the need for effective interaction between state agencies and local government entities, many of which deliver state funded services. One of the issues involves the extent to which the State should provide systems support and services to local government. Findings in this area include:

- The Department of Human Services has encountered difficulty working with counties which are not computerized. Many counties are behind in the use of office automation, which contributes to errors.
- The State court system has a comprehensive statewide case-tracking system dedicated to the monitoring of court operations for decision-support purposes.
- The committee views the work of the Intergovernmental Information Services Advisory Council, thus far, as a promising basis for promoting interaction between state agencies and local governments.

DEALING WITH RAPID CHANGE

This category addresses state government's need to respond to rapid change. The nature of state government tends to hinder acceptance of and adaptation to change. This effect is evidenced by findings in three major areas:

Policies and Procedures

Given the rapid rate of technological and environmental change that is taking place, the committee views some state policies and procedures as counterproductive. While these policies and procedures are intended to improve the operation of state government, they in fact impede many technology related functions. This finding has more supporting points than any other finding in the report. The fact that many managerial decisions are made by entities outside the user agencies exemplifies the restrictive nature of certain state policies and procedures.

- The Departments of Economic Security and Employee Relations cited problems with the civil service system. Problems include recruiting procedures, rigid personnel classification, and salary structures that prohibit the State from competing in the marketplace. The Department of Economic Security has difficulty providing adequate compensation for high performance in technically-specialized areas.
- The User Advisory Council expressed concern about the excessive lead time in the biennial budget process and the subsequent effects on planning.
- The Departments of Natural Resources, Public Safety, and Revenue agree that inflexible, time-consuming procurement practices imposed upon user agencies result in delayed systems implementation, stifled initiative, and additional costs.

Expertise of Staff

The committee describes this finding in terms of both technical and managerial training. Training is important to retaining good managerial and technical staff. Balancing technical expertise with managerial and business skills will benefit state government. Support for these findings include:

- The Departments of Administration and Employee Relations agreed that there are insufficient training funds.
- The Department of Employee Relations expressed concern about the mismatch between existing technology and human skills, due in part to an aging work force.
- Several departments, including Economic Security, Education, Health, Labor and Industry, Natural Resources, and Revenue described the difficulties in retaining good technical staff.
- A generic problem introduced by the committee involves the need for two kinds of expertise: technical skill and familiarity with agency objectives and operations.

Research & Development

The committee noted that there is an absence of funding and centralized responsibility for technical experimentation. The findings indicate a need for an aggressive research and development effort coupled with meaningful planning for the use of technology within state government.

- The Departments of Natural Resources, Public Safety, and Revenue cited the absence of funding and centralized research and development functions as a problem.
- Both the committee and the User Advisory Council commented on the inhibitory nature of the revolving fund with regard to research and development funding.
- A revolving fund cannot support the front-end costs of getting the basics in place for information sharing and compatibility.
- The User Advisory Council pointed out that rate changes are subject to the Finance Department's final approval.

DEFINING RESPONSIBILITIES FOR RESOURCES

The committee found that roles and responsibilities in the area of information management are not clear. In addition, the committee found that there are disincentives for increasing productivity within government. The findings address three major areas:

Top Management Commitment to the Role of Information in Government

The core of this issue is the need for management skill necessary to understand the role information plays in decision making. Examples include:

- The Departments of Human Services and Transportation stated that because of the changing environment, there is a need for increasing efforts in the continuing education of managers.
- The Departments of Natural Resources and Transportation mentioned having success with incorporating information and technology into their senior management decision-making processes.

Incentives for Increasing Productivity

The committee discussed the existence of financial disincentives which discourage efficiency in the administration of agency programs. Points which support this finding include:

- The Department of Finance stated that there is difficulty determining output performance measures for government agencies. All the controls are applied to obtaining resources.
- The Department of Economic Security indicated that the federal government payment method for program administration includes financial disincentives for operating more productively.

Role of the Information Services Bureau

The committee found differences of opinion regarding the role of the Information Services Bureau. The issues include: service versus control and whether those functions should be separate, centralized control versus agency-driven needs, and management of decentralization. An argument for the separation of service and control is the nature of the Information Services Bureau's funding. The revolving fund makes it difficult to refuse requests for services, since this results in a loss of income.

- The Departments of Labor and Industry, Public Safety, and Revenue view the role of the Information Services Bureau as unclear.
- The User Advisory Council considers "service versus control" an issue within the State data processing community and a role clarification issue within the Department of Administration.
- The Department of Economic Security indicated that there are problems with the management of decentralization, including centralized control versus agency-driven needs.

ACQUIRING AND USING APPROPRIATE TECHNOLOGY

This category identifies areas in which the State needs to take full advantage of currently available technology. Issues in this category relate predominately to computer hardware and the use of technology to assist in decision making. Two major areas are addressed:

Outdated Systems

The committee views outdated systems as a fact which must be dealt with. There is a need for comprehensive overhaul of outdated systems, rather than a piecemeal approach. The Legislature needs to consider both cost and required systems changes when mandating that outdated systems be replaced. Problems discussed include:

- The Departments of Health, Human Services, and Revenue described problems associated with outdated systems. Some of these problems are associated with frequent revisions in legislation and rapidly changing technology, which in turn necessitate system modifications.
- The Department of Public Safety cites a significant problem in the handling of large record volumes and the use of old software.
- The Department of Human Services indicated a fragmented use of systems and gaps where no systems exist at all.

System Availability, Computer Capacity, and Response Time

The committee discussed the separation of information processing from information itself, and concerns related to the physical processing of information. The findings indicate a need for adequate computer capacity planning, as well as the need for cost-effective telecommunications services. Problems include:

- The Department of Public Safety identified two significant operational problems: computer capacity and downtime which thwart agency programs requiring quick access to information.
- The Departments of Administration and Public Safety and the State Court Administrator commented on the need for cost-effective telecommunications services.

Section II

Conclusion

The result of the committee's fact-finding and analysis is a clear picture of an organization struggling with the classic symptoms of the computer age:

- increasing information proliferation and complexity;
- rapidly accelerating changes in technology and its applications; and
- the need for a cohesive strategy and direction and the requisite programs to manage information in this new environment.

These factors, along with a growing understanding of the power of organized information as a resource, provide innumerable opportunities for major improvements in the efficiency and effectiveness of state government.

In order for the State to meet the challenges of the future, it must be in a position to:

- take advantage of new technology;
- plan and control its information resources;
- provide for integrated systems in which data is shared among various agencies and local units; and
- ensure that each agency's management of information resources is meshed with the strategic management of that individual agency.

This can best be done by:

- a focus on information itself rather than on technology;
- an emphasis on data sharing;
- support for research and development; and
- most importantly, a commitment to the development of and adherence to an information management plan.

Section III

Recommendations

ORGANIZATIONAL CHANGES

The committee's recommendations focus on creating a new leadership entity within the Department of Administration and strengthening existing organizational structures. More specifically, the committee recommends that the State:

- 1. Establish a new policy and planning function, separate from and parallel to the Information Services Bureau which provides computer and system development services. The primary responsibilities of the new function would be to develop a State information architecture and manage a planning process for State information management. The development of the information architecture will include defining the State information structure needed and the technology required to support it. The new function's funding must not depend upon income from the service arm of the Department of Administration. The funding should be provided separately from the computer services revolving fund. It is recommended that this function reside in the Department of Administration.**
- 2. Assign to the User Advisory Council the review and approval of state information policy developed by the new policy and planning function. In light of its expanded role, the User Advisory Council membership should be broadened and strengthened. Members representing the agencies should be assistant or deputy commissioners so that top management involvement is obtained. In the case of conflicts between the policy and planning function and the User Advisory Council, the Commissioner of the Department of Administration should be called upon for resolution. If conflicts arise that involve other agencies, the Commissioner of Administration should take disputes to the appropriate subcabinets for resolution.**

3. Delegate authority and responsibilities for information resource acquisition and allocation from the Department of Administration to the agencies. This delegation would be based on the policy guidelines developed by the policy and planning function and subject to the existence of departmental information management plans. This should ensure agency management involvement and accountability in decision making.
4. Appropriate meaningful, ongoing funds for research and development in the application of information technology. Research funds should be managed by the new policy and planning function with advice and approval of the User Advisory Council.

The new policy and planning function would provide central responsibility for developing the statewide strategy. The new role for the User Advisory Council would provide a vital link to the requirements and strategies of the individual state agencies, so that the statewide strategy can accurately reflect the many missions and objectives of state government. The new responsibilities for agency heads would strengthen departmental authority and decision making, so that the State is able to respond effectively to a rapidly changing information environment. The direct funding of research and development would position the State to take advantage of opportunities in technology change that lead toward increased productivity.

If this new policy and planning function is to be effective, a time frame for implementation and adequate staffing and budgets must be in place. The committee recommends that the preparation of these items be assigned to the Commissioner of Administration.

ACTION ITEMS

The proposed changes in organizational responsibilities and relationships provide a framework for the following specific actions addressing the issues raised by the findings:

Understanding and Utilizing Information

The new policy and planning function should begin a strategic information management planning process that involves the Legislature, the Governor, and agency users in defining their information needs and identifying the value of information. One objective over time would be a department-by-department plan for information management.

The new policy and planning function should lead a data resource management study to effectively identify, classify, and categorize existing and potential databases to determine:

1. ownership
2. confidentiality and security
3. the need for sharing data
4. logical placement of databases
5. relationship to agencies

Dealing with Rapid Change

The policy and planning function should lead the effort for exploring new technology. The responsibility for managing research and development should be assigned to the new policy and planning function. The User Advisory Council should review and approve research and development projects. The research and development effort should be funded through the general fund separately from the Department of Administration's service income or the computer services revolving fund.

A long-term funding strategy is required that uses a capital budgeting approach so that information systems are treated as an asset rather than an operating expense or overhead. The strategy should reflect the resources required for individual agencies to effectively develop their information systems and strategies. This funding strategy would then serve as a guideline during the biennial budget process.

The Department of Employee Relations, with the help of the Department of Administration and the User Advisory Council, should update the State personnel policies and procedures to reflect more accurately the dynamics of the information management environment. Specific areas to address include:

1. more aggressive policies to recruit and retain technical staff.
2. expand and extend classification levels to provide adequate career growth opportunities.
3. continue to examine and adjust salary structures to locate and retain qualified staff.

The Department of Administration should provide training programs for the state government's information systems professionals in order to keep technical skill levels current in a rapidly changing field.

Defining Responsibilities for Resources

The agencies should be responsible for decisions regarding procurement of resources and research and development projects. The accountability for information resource management should be moved from the Department of Administration to the agency heads, subject to policy developed by the policy and planning function and the existence of departmental information management plans.

The Department of Employee Relations along with the Department of Administration and the User Advisory Council should provide training programs for top level employees and commissioners so that they have an understanding of and a commitment to information systems and information policy issues. This is especially critical for those agencies in which data collection and management are functions central to the agency's mission.

The Departments of Employee Relations and Administration, and the User Advisory Council should establish an incentive system to reward state employees and organizations that introduce information technology into governmental tasks in ways that demonstrably increase productivity or reduce costs.

The creation of the new policy and planning function would clarify the Information Services Bureau's role, which is to provide computing and system development services. Emphasis should be continued on the Information Services Bureau's role and responsibilities as a provider of those services.

Acquiring and Using Appropriate Technology

The new policy and planning function should develop a long-term information architecture to address the following components and how they relate to the business of state government:

1. data
2. applications
3. networks
4. technology


The new policy and planning function should, together with the User Advisory Council, conduct a system life-cycle analysis in order to assess the State's systems asset base. This analysis is a preliminary to developing a life-cycle approach to replacing and maintaining information systems critical to state government.

Policies and procedures should be set up by the new policy and planning function in concert with the User Advisory Council to develop standards under which the Department of Administration's review and approval authority for information systems procurement will be delegated to individual agencies.

The new policy and planning unit should develop disaster recovery plans for state information systems.

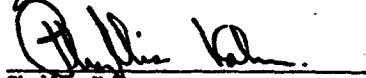
Taken as a whole, these action items represent a substantial agenda for the Department of Administration, including especially the proposed policy and planning function, for the User Advisory Council, and for all the user agencies. The committee believes strongly, however, that the payoff would quickly show in improved and more cost-effective state government at all levels. Furthermore, these steps really represent just a beginning in helping the State of Minnesota play its proper role in the rapidly emerging Information Age.

Blue Ribbon Committee on Information Policies


John A. Røllvagen, Chairman


James Wetherbe, Vice Chair


John P. Halloran


Phyllis Kahn


Ray Lappegaard


Thomas W. McKeown


Randolph W. Peterson


Mary H. Suprecht

List of Appendices

- A. Charge to the committee titled "A Governor's Task Force on Information Policies of Minnesota State Government."**
- B. Work of the Committee.**
- C. Historical Perspective.**
- D. Glossary.**

Resources

Due to their bulk, these resources are not included in this document but are available upon request. For copies of the resources, contact Mary Lou Wehling at 612-297-4071.

- A. Background statements submitted to the committee from:**

The State Planning Agency, the State Court Administrator, the Office of Science and Technology, the User Advisory Council, and the Departments of Administration, Corrections, Economic Security, Education, Employee Relations, Finance, Health, Human Services, Labor and Industry, Natural Resources, Public Safety, Revenue, and Transportation.

- B. Minutes of Committee Meetings:**

**January 17, 1984
February 21, 1984
March 20, 1984
April 17, 1984
May 15, 1984
June 19, 1984**

Appendix A

A Governor's Task Force on Information Policies of Minnesota State Government

July 28, 1983

Each of the last three decades has witnessed a significant change in the State's approach to utilizing information technologies. The 1950s saw the first steps toward centralization; merger of all computer services within the Department of Administration into one division was achieved in the 1960s; and consolidation of almost all oversight of executive branch information processing in that division of the Department of Administration — now the Information Services Bureau (ISB) — was accomplished in the 1970s.

The 1980s pose a serious challenge to state managers concerned about the use of information technologies by state government. The advent of micro processors, the increasing "intelligence" of communication networks, and the sharply accelerating cost of software development are among the technological imperatives that compel the State to closely examine how it can best manage its information resources. Yet the last major policy study of the information processing network was the Governor's Committee on State Information Systems in 1970, a seminal document in the reforms of that decade.

Since Minnesota is striving to maintain itself as a headquarters for the information industry, it is appropriate for the State to ensure that its "own house is in order." In order for the State to do so, the Governor is establishing a new "blue ribbon" task force on information policies of state government. The Governor will be seeking advice from private sector experts appointed to the task force on these issues:

- (1) Most important of all issues; how can the executive branch of state government install and sustain a reiterative planning process that assures strategic direction for management of the state's information resources?
- (2) What policies does the State need to incorporate in its resource allocation decisions so that appropriate levels of investment in information systems are tied to state government's programmatic goals?

- (3) Can the Department of Administration more effectively provide leadership and services to executive branch agencies through internal structural or procedural changes? What are alternative organizational models for relations between ISB and agencies' systems offices?
- (4) How can the State ensure that its managers know how to both utilize information resources themselves and supervise their utilization? How can the State ensure that its cadre of information system professionals is well-trained, productive, and well-oriented on broadly defined career paths?

By addressing these topics the task force will assist the State in building a critical foundation so it is in a position to meet state government's real information needs to support decision making and mandated programs. A task force will begin addressing these issues on January 2, 1984.

Appendix B

Work of the Committee

Process

Governor Rudy Perpich established the committee in January, 1984, to study information management in state government.

The committee met nine times. Meetings were held monthly on the third Tuesday of each month from 9 a.m. till noon. All meetings were hosted by Cray Research, Inc. in its corporate board room located at 608 — 2nd Avenue South, Minneapolis. The committee began meeting on January 17, 1984, and finished its work on September 18, 1984.

The committee's first meeting focused on organizational matters. The next five meetings were spent fact-finding regarding information management as practiced within state agencies. During this time the committee relied heavily upon the written responses to a set of background collection questions, and the discussion that took place at committee meetings with resource guests. Aides to the resource guests and other persons in attendance also participated in the discussions from time to time. Detailed minutes were kept of each meeting. The final three meetings were spent discussing issues, making recommendations, and preparing the report for the governor.

Committee Membership

The members of the Blue Ribbon Committee include:

- | | |
|-------------------|--|
| Chair | John A. Rollwagen
Chairman of the Board and Chief Executive Officer
Cray Research, Inc. |
| Vice Chair | James C. Wetherbe
Professor of MIS and Director of the MIS Research Center
University of Minnesota |
| Members | John P. Halloran
Principal
Nolan, Norton & Company
Phyllis Kahn
State Representative
Ray Lappegaard
Vice President
J.L. Shiely Company
Thomas W. McKeown
Executive Vice President
St. Paul Fire and Marine Insurance Company
Randolph W. Peterson
State Senator
Mary M. Ruprecht, CMC
President
Mary M. Ruprecht & Associates, Inc. |

Resource Guests

The members thank the following people for appearing before the committee as resource guests:

- | | |
|----------------------------|---|
| Nancy M. Abraham | Assistant Commissioner, Department of
Administration |
| Joseph N. Alexander | Commissioner, Department of Natural
Resources |

Sr. Mary Madonna Ashton	Commissioner, Department of Health
Barbara S. Beerhalter	Commissioner, Department of Economic Security
Richard P. Braun	Commissioner, Department of Transportation
Wushou Chou	President, ACK Computer Applications, Inc.
Gordon M. Donhowe	Commissioner, Department of Finance
Sue K. Dosal	State Court Administrator
Sandra J. Hale	Commissioner, Department of Administration
Steve Keefe	Commissioner, Department of Labor and Industry
Leonard W. Levine	Commissioner, Department of Human Services
Sally Martin	Director, Office of Science and Technology
James R. Nobles	Legislative Auditor
Judith A. Pinke	Chair, User Advisory Council
Orville B. Pung	Commissioner, Department of Corrections
Ruth E. Randall	Commissioner, Department of Education
Arthur C. Roemer	Commissioner, Department of Revenue
Nina Rothchild	Commissioner, Department of Employee Relations
George Slaughter	Chair, State Information Systems Advisory Council
Thomas Triplett	Director, State Planning Agency
Paul Tschida	Commissioner, Department of Public Safety

The committee also thanks those people who provided staff assistance:

Betty Butkovich	Department of Administration
Marv Christenson	Department of Administration
Linda Hennem	Department of Transportation
Lisa Hurley	Department of Administration
Colleen Kisch	Department of Administration
Sheldon Klugman	Department of Administration
Dave Ruch	Housing Finance Agency
Bill Scholer	Cray Research, Inc.
Mary Lou Wehling	Department of Administration

Appendix C

Historical Perspective

PRODUCTIVITY

A key responsibility for those in leadership positions in both the public and private sector is increasing productivity. Productivity means producing more with less. In the private sector productivity is key to remaining competitive and therefore viable. In the public sector productivity is key to keeping taxes at a publicly acceptable level.

During the past 200 years we have seen phenomenal achievements in the area of productivity. In 1800 it took 95 percent of the American work force to provide an adequate food supply. Today that feat is accomplished with less than 3 percent of the population. As we moved into an industrial society, 65 percent of our work force worked in factories. By 1980, that 65 percent was reduced to less than 25 percent. In both agriculture and factory work, there have been phenomenal achievements in productivity.

Dominant occupations in the United States up until this point can be categorized as farmer followed by factory worker. What is the dominant occupation today? Clerk or knowledge worker. We have moved into the information society. The average cost of running public or private organizations is 40 to 50 percent information cost. Therefore it logically follows that if we are going to increase personnel and organizational productivity, a key issue is to focus on information processing productivity.

Increasing Productivity

Increasing productivity is difficult when the resources used to increase productivity are costing more. For example, people cost more, capital costs more, energy costs more, real estate costs more, construction costs more. Everything costs more — with one exception — and that exception is computers and information.

Beyond the reduced cost of information, is a uniqueness to information as a productivity increasing resource that differentiates it from other resources. It is the only resource that is truly shareable. That is, more than one person can use the same information concurrently. That cannot be done with a budget, a staff, square footage, or piece of equipment. With computer technology, an elaborate database or piece of software can be developed and then shared among many users.

Information and Productivity

But how exactly does information increase productivity? Information increases productivity in several basic ways.

- Information systems reduce operating expenses by reducing the clerical cost of processing transactions.
- Information systems increase managerial productivity by improving the quality and timeliness of decision making. Research conducted at the University of Minnesota indicates the biggest problem most managers face is that they don't have the information they need to make important decisions.
- Information systems allow the left hand to know what the right hand is doing within an organization. The increasing complexity and diversity of organizations have made it very difficult to efficiently coordinate activities.
- Information systems increase productivity by facilitating technology transfer. An elaborate piece of software can be developed which can help solve managerial problems such as budgeting. Though it may cost thousands or millions of dollars to develop the piece of software, a copy of it can be provided to other managers for just a few dollars. This facilitates the permeation of new concepts and productivity tools instead of having everyone reinvent the wheel.
- Good information systems reduce redundant data collection and storage. Instead of having each agency manually collect and store information, data can be collected at the most logical place and then shared with other agencies that need access to the data. Ninety-nine percent of all data collected for computers is still keyed in at enormous expense.

- Information systems play a critical role in providing feedback to the organization on its performance and organizational units, and employees within on their performance. A key dimension in increasing productivity is providing meaningful feedback on performance to evaluate areas where productivity improvements are needed.

Given that 40 to 50 percent of the cost of running an organization such as the State of Minnesota is information cost and that there is a need to get an increase in productivity at a time when everything is costing more except computers, it is clearly imperative that the State of Minnesota take advantage of computers and information systems as a key productivity leverage.

STAGES OF GROWTH

In spite of the enormous productivity potential provided by computer and information systems, the results of computer-based information systems in most organizations have fallen substantially below management's original expectations. Most information systems projects have failed to deliver what was promised for the cost and/or in the time frame expected.

A partial, but unfortunate, indicator of the failure of many computing efforts is the high turnover of information systems managers — as high as 40 to 50 percent in 1972. Further contributions to management's disenchantment with the computing effort is the increasingly high cost associated with it. Prior to 1960, computer-based information systems were virtually nonexistent in most organizations. Today, large organizations frequently spend millions of dollars annually on this technology.

Difficulties in Planning and Control

Perhaps the most common management criterion for evaluating the success or failure of any organizational effort is the degree of variation between planned performance and actual performance. Ironically, the computing effort has been conspicuously void of planning and control activities in many organizations.

In view of the overwhelming impact of computers on organizations, it is alarming to see them undergo less management scrutiny than other functions. However, closer analysis into the uniqueness of computing provides some insight into management's reluctance and/or inability to cope with planning and controlling the computing effort. Computing as an organizational activity is complicated due to the following factors:

- The computing resource is integrated into virtually every dimension of modern organizations in both explicit and obscure ways. Indeed, it has become increasingly difficult to define exactly where computing activities begin and other activities leave off.**
- The computer resource has a complex set of supply/demand characteristics:**
 - The ratio of fixed to variable cost is high.**
 - Computer hardware usually offers economies of scale.**
 - Incremental computing capacity often must be acquired in large blocks.**
 - Needs for information services grow rapidly in complexity and sheer size.**
 - Processing tends to be cyclical.**
 - One computer system is frequently unable to serve all of the diverse demands that a large organization can place on it.**
 - Processing priorities are highly variable, depending on the application, the users, and the timing.**
- Computing technology is extremely dynamic and is changing at an accelerating rate. The economic and technical feasibility of new computer applications is continually improving, resulting in a proliferation of additional computer applications. The personal computer phenomena now makes it possible for virtually every employee to have a computer.**
- Staffing creates considerable uncertainty. Personnel requirements are often as dynamic as the computing industry itself. Skills and experience that were highly valued ten years ago may be obsolete and even potentially damaging today.**

Six Stages of EDP Growth

Considerable enlightenment into both the impact of computer-based information systems and the need for improved organizing, planning, and control has resulted from research efforts headed by Richard Nolan. He and his colleagues' research findings indicate that organizations go through the six stages of EDP growth as portrayed in Exhibit 1 and discussed below.

Stage 1: Initiation. In this stage, the computer is introduced within the organization. Users are encouraged to use the system but, due to unfamiliarity, do not yet flock to request applications. The applications that are developed are simple, and typically of an accounting orientation. During this stage, the Information System (I/S) organization is often centralized because they, like the users, must also learn the new technology.

Stage 2: Contagion. Soon the users become superficially enthusiastic about the computer and request the development of all sorts of applications. Computer services are often "free" to them since computing expenses are often carried as an overhead expense during this stage, and new developments are encouraged. Pressure is exerted by I/S staff to expand computer hardware and the computer staff during this stage to keep up with the demand for services. The budget in the data processing department rises rapidly. The management of the computer department can be characterized as lax, since little planning is done and much control is lacking.

Stage 3: Control. The organization has entered the control stage when management becomes very concerned about the level of benefits being received from computer applications versus the cost of the data processing function. When this occurs, a halt is called to budget expansion. The total I/S budget is either held constant or the growth rate is sharply reduced. The focus is on giving the department the type of professional management found in other parts of the organization. Planning and control systems are initiated. Emphasis is placed upon documenting existing applications and moving them toward middle management and away from a focus on strictly operational functions. It is also during this stage that an attempt is made to make the users accountable for their computer use by introducing chargeout-systems.

Stage 4: Integration. The integration stage is characterized by an attempt to take advantage of new technology, typically database, by integrating existing systems. This usually requires reworking or retrofitting earlier systems to be integrated. This is a substantial effort. During this stage, the I/S function is set up to service users much as a utility. There is, according to Nolan, a significant transition point in an organization's computer use once this stage is reached.

Stage 5: Data Administration. In the data administration stage, the database technology is in place and a data administration function is created to plan and control the use of an organization's data. By this time, users are effectively accountable for computer resource use and the emphasis is upon common, integrated systems in which data is shared among various functions in the organization. Users are often extensively into end-user computing through personal computing at this point also.

Stage 6: Maturity. When an organization reaches maturity (and few have), they have truly integrated the computer into their managerial processes. At this time, the data resource is meshed with the strategic planning process of the organization. Applications mirror the information flows of the organization. Finally, joint-user and data processing accountability exist regarding the allocation of computing resources within the organization.

Overview of the Six Stages

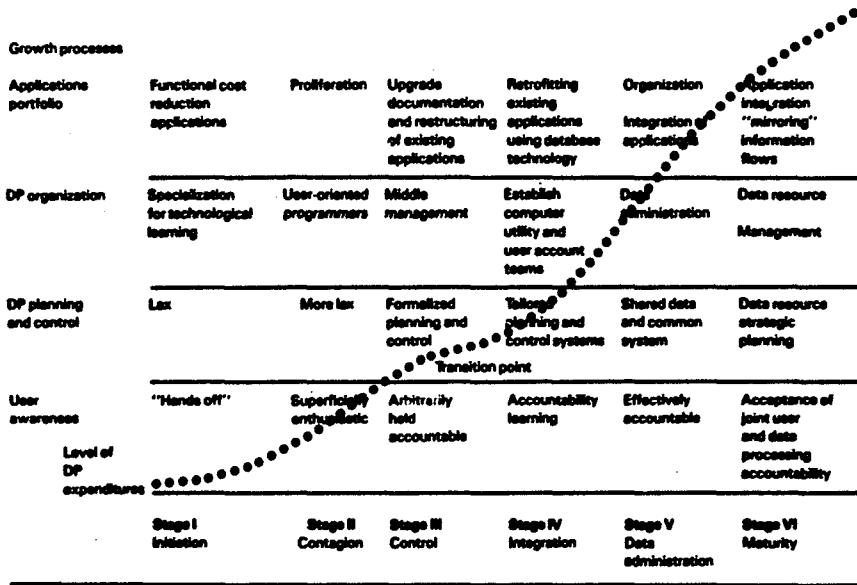
Nolan's stage hypothesis has a number of uses as a conceptual framework. One way of using the framework is to classify organizations in the aggregate into stages. By doing this, one can see how organizations have passed through the stages. The initiation of business computing, for example, took place in the late 1950s and the early 1960s. Contagion occurred from the early 1960s up to the late 1960s, say 1968-69. The control stage was entered by about the last 1960s and lasted until at least the mid 1970s for many organizations. Some organizations are still in this stage. Many firms, however, have integrated applications and have become oriented toward database technology, which marks entry into the next stage. Stage 4 occurred in the mid 1970s and is still underway in most of these firms. Firms entering the data administration stage most often did so in the late 1970s. There are some aspects of a few organizations that currently represent maturity, but it would be difficult

to point to any organization and say that they were totally mature in all aspects of data processing. These time periods for the stages of U.S. organizations are included in the schematic of Nolan's framework (see Exhibit 1). The time periods are generalizations and there are still Stage 2 firms, Stage 3 firms, and so on.

Another use of the Nolan framework is to go into an organization, gather data about its computer use, and identify how the computer use in the organization fits into the framework. This type of exercise is very useful as a precursor to an information systems planning activity. It is important to understand the current status of the I/S organization before embarking on ambitious new plans.

Organizations may be identified as to what stage they are in by several sub-categories including: (1) their applications portfolio (how they are using the computing); (2) their type of data processing organization; (3) how they do their data processing planning and control; and (4) the way users fit into the applications development process and their responsibility regarding the allocation of computer resources. It is thus possible to say that a firm is in Stage 3 on one aspect and Stage 4 on another. Few organizations would be at the same level of sophistication on all subparts of the framework.

Exhibit I
Six stages of data processing growth



Richard L. Nolan, "Managing the Crises in Data Processing," *Harvard Business Review*, March-April, 1979, p. 117.

Appendix D

Glossary

Application refers to the art of putting something to use.

Architecture is the basic structure which provides a framework for further design.

Data symbolically represents reality.

Information is the end result of processed data.

Resource pertains to something that can be depended upon for support or help.

Systems interconnect related parts or mechanisms.

Technology is the use of sophisticated tools for achieving practical purposes.