THE INTERACTION OF WORK ENVIRONMENT AND TECHNOLOGY IN THE BUDGET BRANCH OF THE UNITED STATES POSTAL SERVICE

by

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ABSTRACT

This paper looks at the interaction of budget analysts' work environment and in-use technology at the United States Postal Service from a case study approach. The author observed analysts' work environment and in-use technology during a nine month period as a member of a consulting company responsible for designing, developing, and installing a set of computer models to automate budget preparation. From the perspective of participative observation, the significant changes in roles, organizational structure, work climate and stress are examined for budget analysts and personnel directly associated with controlling in-use technology.

This thesis first provides background information detailing the basic business environment of the Postal Service. The recent reorganization act allowing the Postal Service to more fully manage its own organization is discussed. The supporting information systems which supply analysts with operations data are also described. Next, the approach to studying the interaction of environment and technology is addressed. In this section, different interaction models are briefly described.

The observations of analyst work environment and in-use technology in terms of the model follow. These observations lend support to the hypothesis that work environment and in-use technology have significant interaction. Little support is found for a technology driven link. A short discussion and summary conclude the thesis.

Thesis Supervisor: Dr. D. Eleanor Westney
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Kurt Silverman
March 20, 1984

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CHAPTER I

INTRODUCTION

Many recent studies have analyzed the impact of decision support systems from a variety of viewpoints [1,2,3]. Yet few studies have examined the forces dictating the technology to be employed and the chosen technology's feedback mechanism to the user's work environment. This paper uses a case study approach to analyze the interaction effects between in-use computer technology and the specific user's work environment. The focus is on this interaction mechanism within the context of a decision support implementation at the United States Postal Service.

MOTIVATION

It has been claimed that decision support systems (DSS) are designed to allow users to be more "effective" rather than "efficient" [3]. The distinguishing features of a DSS include:

* A highly interactive environment.
* An ability to query the system with ad hoc questions.
* An underlying set of data containing historical and end user assumptions.

Unlike transaction-oriented systems designed to perform specific tasks given data entry, DSS systems are aimed at more unstructured problems requiring a high degree of user involvement. These so-called Era 3 systems are specifically

aimed at middle and upper management where a preponderance of unstructured problem solving occurs. Given this orientation, DSS systems have been developed to "support" or assist users in many of their tasks. Supporting semi-structured problem solving implies the need for a flexible design adaptable to task specific needs.

In addition to the changing requirements of management problem solving, computer technology is experiencing a rapid rate of change. The major trends include declining hardware costs, increased software availability, and increased use of high level languages.

The specification, development and use of a DSS system is the coupling of changing management needs with changing technological problem solving tools. As such, DSS systems are not typically built and delivered but evolved over time. In many cases, a DSS represents management's first exposure to computer tools as an end user. This first hand exposure not only serves as educational experience, but puts in-use computer technology in the hands of those people who have high level authority to specify the particular evolutionary changes to their systems. Further, these new end users are quickly gaining the technical knowledge traditionally located only within the Information Systems department. Within the context of an organizational hierarchy, the increase in high level end users causes new stresses on the lines of communication as the manager of the Information

Systems department can no longer serve as the single source of technical knowledge.

This unique situation presents an opportunity to view how in-use technology and the work environment interact. Specifically, the implementation of such a DSS allows the study of how the demands of management interact with the supply of technology. A case study approach aids not only in analyzing this interaction of management needs and technological availability, but also in analyzing the effects of knowledge assimilation within a particular organization's context.

APPROACH

The approach to studying this interaction is based on participative involvement. The author was part of an outside consulting team at Consultants for Management Decisions, Inc. responsible for designing and developing automated systems to aid in the budget preparation process. Over the course of nine months the author frequently interacted with the end users in the design and development of a customized DSS to support the budgeting process which results in submission of actual and forecast data to the Office of Management and Budget of the United States Government.

The particular project orientation was specified by the controller's office. The stated goals were to allow more

timely Congressional Submissions and ad hoc analysis of this data under varying assumptions. The design goal was to provide analysts within the National Financial Planning Branch with computer models which mimic the methodology presently used to derive forecast estimates. Certain technological constraints were imposed to limit hardware and software tools to USPS internal resources.

The basic approach was separated in four distinct phases: investigation, design, development, training and installation. In the investigation phase extensive interviews were conducted not only of the user's tasks, but also of operators of supporting transaction systems. The system design phase included a vertical prototype for analysis of user acceptance. The longest phase, that of full system development, has lasted approximately six months. Finally, the training and installation phase is currently in progress and is expected to last approximately three months.

CONTEXT

While all organizations have unique environments, the United States Postal Service exhibits numerous special features. Its fundamental responsibility is noted in terms of service to the public. As a quasi-public organization, the USPS is responsible for delivering the nation's mail under its own budget. The 1970 Postal Reorganization Act, intended to de-politicize the Department of the Post Office,

created the current quasi-public Postal Service and two structures overseeing its operations -- the Postal Rate Commission and the Postal Service Board of Governors. The act specifically gave the Postal Service the authority to conduct their own bargaining negotiations. With the recent breakup of AT&T, the USPS has the largest number of bargaining employees at about 600,000.

The sheer size of Postal Service operations is somewhat staggering. In 1982 the USPS delivered over 114 billion pieces of mail, employed over 650,000 persons, and collected revenues of over 23 billion dollars on assets of approximately 20 billion dollars.

Prior to the reorganization, additional mail volume was met by corresponding increases in the workforce. Since the reorganization, the steady mail volume of growth of between 3 and 5 percent has mostly been met by productivity gains. Far from being a capital intensive operation, 85 percent of all USPS expenses stem from salaries and benefits of personnel.

Rather than being operated under the executive branch, the Postal Service is under its own management on the expense side of income statement. The rate structure cannot be changed without approval from the Board of Governors, who in turn rely on the Postal Rate Commission for rate change approval. The USPS can be likened to a regulated utility

where the goal is not a particular return on investment but rather certain levels of service.

Not suprisingly, the top staff management of the USPS has divided responsibilities among major task areas. The studied group in this project included some budget analysts within the National Financial Planning Branch.

Responsibilities of End Users

The responsibilities of the analysts in this study center around the preparation of summarized financial data to Congress. In particular, the analysts are responsible for submitting to Congress summary cost and revenue data. This packet of reports is referred to as the Congressional Submission. The submission details, on a national level, USPS financial data for the current year and yearly projections for two outyears. This submission includes the President's budget for recouping costs for special programs such as free mailings for United States Congressmen.

The development of these reports entails detailed estimation procedures for all expense items. The development of revenue estimates is predominantly the responsibility of the Rates and Classifications Department.

The procedures used for the cost estimation make use of available reporting systems including the National Consolidated Trial Balance for actual costs by line item account, and the National Payroll Hours Reporting Summary

for detailed hour and rate breakout by employee category. The analysts also use other data from various sources such as Data Resources (DRI) inflation forecasts and labor union contracts to estimate future costs. The particular methodology used in arriving at the outyear estimates is fundamentally based on the concept of equivalent workyears as the underlying driving force. This comes as no surprise as 85 percent of all expenses are directly traceable personnel costs. The remaining 15 percent of costs are modeled using applied factors for inflation, mail volume, and other pertinent factors. The analysis presupposes a labor intensive operation.

In addition to the direct responsibilities of estimating costs, the budget branch also assists in the submission of rate increase cases to the Postal Rate Commission. This entails preparing special cost estimates given different mail volume assumptions.

A third responsibility of the analysts is to be cognizant of the internal operating budget which is used for operational control purposes. Unlike the Congressional Submission budget, the operating budget is aggregated from regional budget estimates for a period of one year. The Congressional Submission budget is a two year budget with data at the national level. The operating budget is detailed for only one year, but for each accounting period and for each region. Although this budget does not become

public, the first outyear estimates are expected to be generally consistent with the Congressional Submission data. However, there is a separate branch responsible for the internal operating budget.

Due to their expertise in modeling personnel costs, the budget branch also assists Employee and Labor Relations in determining labor costs under different proposed contracts.

As a final major responsibility, the budget branch also maintains various tracking systems to monitor trends, seasonal trends and abnormalities, national line item accounts, and hourly rates by employee categories. In this capacity the analysts interact with persons in the accounting department, who in turn, interact with persons responsible for the maintenance of the supporting accounting systems.

In-use Technologies - May 1983

The analysts use a variety of technologies to assist in meeting their individual responsibilities. In this section they are briefly summarized by the amount of control the individual has over a particular technology or system. For the purposes of description, the types are arrayed into three categories: controlled, controllable, and uncontrollable but used technologies.

In terms of controlled technologies, the predominant in-use technology is that of maintaining individual manual

ledger sheets and paper filing systems for shared reports. The particular ledger sheets of each analyst exhibit a high degree of individual format while using equivalent methodologies for deriving estimates. The particular sheet layout represents the analyst's own optimization for report preparation and use of desk calculators. The one exception to this use of manual ledger sheets is the use of DigiCalc, a spreadsheet program available on an in-house PDP-11 located in the same building as the analysts. This technology is used by one analyst for the development of a small set of non-personnel costs. The degree of formalization is very high for worksheets which model personnel cost, and somewhat ad hoc for worksheets which model non-personnel expenses.

The major controllable technologies include secretarial assistance in the preparation of final reports on DECmate wordprocessors and the use of an internal paper mail system to obtain expert estimates of certain key data. This later process is referred to as the "budget call" process. Typical information obtained from this process includes actual and two outyear estimates for square feet of office space, number of post offices, and number of projected mail routes.

The majority of in-use technologies are uncontrollable for the analysts. These systems include the National Consolidated Trial Balance and the National Payroll Hours

Summary Report. These two systems utilize IBM mainframes operating under MVS/TSO in a distributed processing environment scattered over some five regional Postal Data Centers (PDC's). The Rates and Classifications Department utilizes a revenue projection model, but only some of its output is available to the analyst whose job it is to bring cost and revenue data together so as to complete the Congressional Submission budget.

The Visible Hand

The particular systems and their technology have evolved little since the introduction of the National Payroll Hours Reporting System was introduced around 1974. Analysts utilized predominantly paper-based systems to carry out their responsibilities. At the same time, the informational needs of the USPS have increased substantially over the last ten years. Upper level management is now keenly concerned with meeting productivity targets and examining various inflation and labor contract scenarios. Thus a growing imbalance between upper level management demand and analyst supply has been taking place over a decade.

The most vocalized areas of chief concern have revolved around the timeliness of budget preparation. While the workup of the Congressional Submission budget is mandated by Congress, management realizes that these "external" numbers must have a close relation to the internal operating budget.

The project to develop a decision support system for these analysts then is seen as not only decreasing the turn around time of budget preparation, but also for several other purposes.

As expressed by the controller, the development of computer-assisted models is intended to allow monthly budget preparation rather than biannual preparation. The automated system will then be available not only as a planning tool, but also as a control tool. The longer range objective is to modify the preparation process to allow estimation of plans extending to five outyears rather than two. Such a long term outlook is essential to view the effect of major capital investment and labor bargaining decisions. The new environmental pressures of competing in the information delivery industry dictate closer scrutiny of proposed projects.

The basic management goal of making a computerized system available is to take an existing set of data and budget methodologies originally required by Congress for appropriation decisions and extend them into a useful management information system for planning and control. The technical challenge of implementing such a system is to best utilize internal USPS resources to offer a set of useable computer models to selected budget analysts. A DSS normally has a great impact on the work environment of the end users. This particular DSS, with the underlying goals of increasing

budget preparation productivity and adding new levels of planning and control, will have additional effects on the work environment.

Complicating these impacts of the implementation of a DSS is secondary impact on the particular technology used. Not only are the analysts unfamiliar with the use of computer models, but the underlying information systems have evolved to support periodic paper reporting of actual data rather than ad hoc queries of historical and forecast data.

Personnel and Expertise

The staff of the budget branch includes a manager, five senior analysts, two supporting analysts, and a secretary. The manager had acquired the particular combination of age and years of service to allow his retirement by June of 1983. His roles included not only supervising the staff, but also the preparation of workyear estimation upon which analysts derived dollar cost estimates. In this capacity he assimilated information regarding new projects, upper level management productivity targets, and revenue projections. His particular expertise was considered key to the development of any computer models supporting the Congressional Submission process. He was widely credited with the development of the budget estimation process and the format of intermediate reports which served as a control mechanism for the analysts.

The senior analysts responsibilities regarding the Congressional Submission were divided by cost segment. Of the five senior analysts, three have significant budget responsiblity in terms of budget preparation. USPS expenses are divided into eighteen cost segments. Of these, one analyst performs the estimation for twelve cost segments or about 80 percent of all expenses. The estimation of each of these cost segments includes complex and detailed analysis of compensation and benefits. Within this paper, this analyst will be referred to as the "Personnel Analyst". His exposure to computers, prior to this project, has been only as a user of hardcopy computer printouts.

Another analyst is responsible for developing budget estimates for the single cost segment containing General and Administrative expenses. While the total expenses for this segment account for only two billion dollars, or less than nine percent of total expenses, the development of these budget estimates requires separate workups of twelve subsegments. His procedures are the most complex, requiring the highest degree of subjective analysis. Within this paper this analyst will be referred to as the "G and A Analyst". His exposure to computers is by far the most significant, since he has actually written a BASIC program to aid in calculating some intermediate numbers. He also has the distinction of being the youngest of the senior analysts.

A third senior analyst has responsibility for generating the income statement and balance sheet as well as a set of line items which are included in a miscellaneous segment. His chief area of expertise is in government accounting procedures. He will be referred to as the "IS/BS Analyst". His attitude to computerized systems can be characterized as one of extreme skepticism. His exposure to computer systems is only as a user of hardcopy reports. His methodology of outyear estimation is extremely subjective and difficult to routinize into formal procedures.

Two other senior analysts have a combined direct responsibility for four cost segments (two each) which account for about 11 percent of all expenses. These segments use simpler methodology as they are not chiefly concerned with personnel-related expenses. These two analysts do not keep such detailed records as the three analysts with more significant budgeting responsibilities, and they exhibit a lower degree of confidence in their respective job functions. One is a former school teacher interested in computer technology, with some experience in DigiCalc. He will be referred to as "Non-Personnel Analyst A". The other has had no prior experience with being an end user of an interactive computer system. He will be referred to as "Non-Personnel Analyst B".

The staff contains two additional analysts -- one permanent and one temporary. These positions will be

referred to as "Auxiliary Analysts A and B". The permanent auxiliary analyst is responsible for developing inflation indices for USPS line items as input to the five senior analysts. In May 1983 this person left due to disability. The second analyst was there on temporary assignment from the accounting department to fill in for the disabled analyst as well as help out on budget preparation and other ad hoc tasks.

The budget branch has replaced the Branch Manager who retired in July 1983 with a new Branch Manager in November 1983. The slot left open by the disabled auxiliary analyst has been filled, and the temporary auxiliary analyst on detail from accounting is still with the budget branch.

In terms of lines of reporting authority, the manager of the budget branch reports to the Director of the National Financial Planning Branch. He in turn reports directly to the Controller who reports to the Executive Assistant Postmaster General. Aside from the National Financial Planning Branch, the Accounting Department also reports to the Controller. Thus the underlying computer reporting systems, including the National Consolidated Trial Balance and the major users of these systems, the budget analysts, both reside under a single authority -- the Controller. In January 1983 it was the controller who initiated and funded the project to develop computer-assisted tools for the budget analysts. Figure 1 shows the organizational

hierarchy within the domain studied.

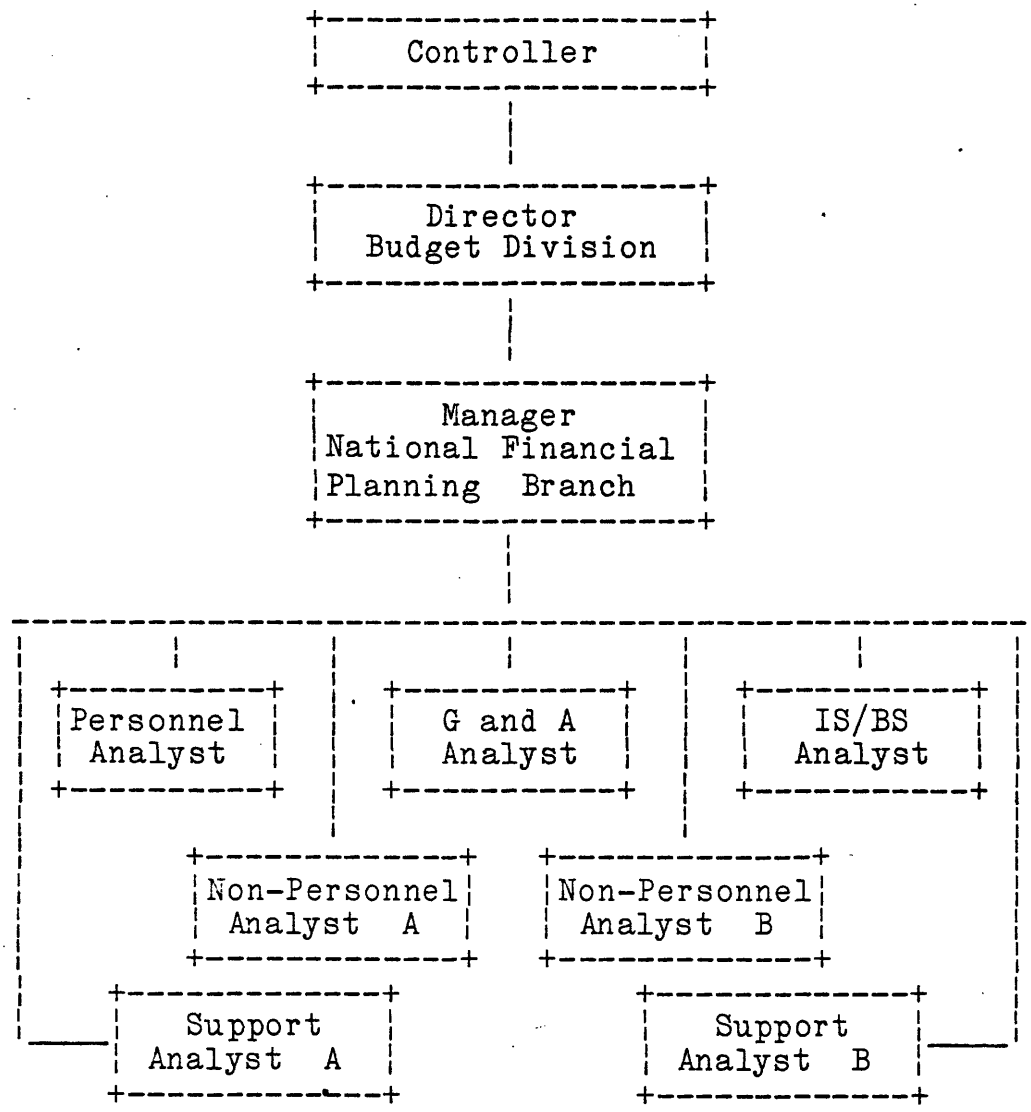

Figure 1. Organizational Chart

Aside from the direct personnel, there are also persons under contract to the controller's office charged with implementing these tools. The contractor, Consultants for Management Decisions, included a team of consultants of which the author is one. The other set of key personnel includes key persons at the USPS National Development Center

(NDC) which houses the hardware and software to be used in the new systems.

PREVIEW

Whenever demand outstrips supply there is additional stress on the organization. In the case outlined above, the stress on the budget analysts was great and continuing to increase with rising demand for rate case preparation and approaching labor negotiations. The changing characteristics of running the USPS under a less regulated environment were predominantly being felt at the topmost echelons of the Postal Service. In this special case, the Controller is in the middle of the supply-demand imbalance. He is required to supply the senior Assistant Postmaster General with management information, but his staff is barely able to cope with the required turnaround of a twice yearly analysis let alone ad hoc analysis. The Controller not only has the budget authority to enact significant change and the legitimate authority to redefine the expertise of employees on his staff, but more importantly he has the vision and patience to introduce third generation technology to help rebalance management needs with resource availability.

The implementation of new technology was constrained by several factors. The computer-assisted budget tools originally were to reside on Digital Equipment Corporation's VAX line of computers. As discussions with Consultants for

Management Decisions, Inc. progressed, it was later decided that the IBM 3033 mainframe computer located at the National Development Center in Raleigh, North Carolina be the target machine. This choice was made to take advantage of the newest Postal Data Center whose charge was in the process of being changed from predominantly generating headquarter's reports to one for Information Systems development. Aside from the PDP-11 minicomputer dedicated for wordprocessing, users at corporate headquarters had never had the opportunity to directly link to an interactive computer environment. The decision to place all budget analyst tools on the NDC mainframe implied a new set of stresses for NDC personnel as they had no prior experience in supporting novice end users in an interactive environment.

The other main constraint placed upon this project was the particular software language to be used for model development. The treasurer's office at the USPS had recently acquired a FORTRAN-based decision support language called EMPIRE.

During the time of this study, the USPS was responding to a high degree of environmental stress. Simultaneously, the USPS was in the process of institutionalizing a National Development Center for use as pilot systems projects and readying new systems to aid in management planning. While these activities would normally have a great impact on any organization, the USPS has a special history which had

created a change-resistant bureaucracy. Job slot selection and promotion has historically been on the basis of seniority. The present personnel profile exhibits a dual character. On one hand, there are personnel with considerable years of service used to a highly bureaucratic organization. Many new hires, however, have been brought into the USPS with a more entrepreneurial orientation.

The particular project of implementing computer-assisted tools in this environment required the crossing of organizational boundaries which had been in place for over a decade. The use of these tools, which are so tightly coupled to previously distinct areas of operation -- budget analysis and computer systems, represents a new era for the USPS. This study attempts to detail some of the observed aspects of these changes and relate these observations to the interaction of work environment and in-use technology.

The remainder of this paper is organized into four main sections. The next chapter discusses the approach used and the underlying model used to examine the interaction of work environment and technology. Chapter III takes a look at the observations. Chapter IV contains a discussion of the findings in light of the approach used. Finally, this paper concludes with a short summary of near future prospects for the link between work environment and technology.

CHAPTER II

APPROACH

PARTICIPATIVE CASE STUDY

The basic approach to the study of the work environment-technology link has been one of participative case study. Rather than just interviewing and observing in-place technology and the work environment, the author was part of a consulting team at Consultants for Management Decisions contracted to develop the computer models. The reader should therefore understand that the author is subject to a strong bias in his findings. While the project began in January 1983, the duration of the author's observations lasted from May 1983 to February 1984. During the January to March 1983 period, the scope and the deliverables of the project were identified and contracted. During the April and May 1983 period, the project team was assembled and the basic tasks were defined.

The period of observation, May 1983 through February 1984, included five distinct phases ranging from initial investigations to the training and installation of the computer-assisted models. The author was part of a five person team charged with the design and development of the computerized budgeting system. At the time of this writing, complete system implementation is approximately one month away.

The initial phase included lengthy interviews with the five analysts and the budget branch manager. With the exception of the "G and A Analyst", this phase lasted about two months. During this time all analysts were interviewed on site. In addition, the Controller, the Budget Branch Manager, and the "Personnel Analyst" were also interviewed off-site at Consultant's for Management Decisions offices. Basic background information was gathered as to the analyst's responsibilities and how each carried out those duties. While the subjects displayed a healthy skepticism regarding the project's chances of success, most were willing to share extensive information regarding their particular roles in the Congressional Submission process.

The next phase, lasting about one month, consisted of project design and implementation of a prototype system. At this point every effort was made to best match the analysts' needs with available technology. The project design included over seventy linked models relying on the availability of two key reporting systems resident at the National Development Center (NDC). During this phase several site visits to the NDC, as well as intensive testing of the chosen computer hardware and software, were conducted.

The third phase included investigations into auxiliary information systems needed for the budget workup including the National Consolidated Trial Balance (NCTB) and the National Payroll Hours Summary Report (NPHSR). It was

discovered at this point that responsibility for these two key systems was in the process of moving: the NCTB to the New York Postal Data Center, and the NPHSR to the Minneapolis Postal Data Center. Just as the management need for a central repository of machine-readable data was becoming stronger, the various systems were becoming more distributed. Deeper investigations into these systems uncovered their purposes and the technology used to implement and maintain these systems.

After acceptance of the project design and investigation of the auxiliary systems, the project implementation phase began at an accelerated pace. While still continuing, this phase has included frequent meetings with the various analysts to assure the accuracy and usefulness of the models to the analysts. The exact budgeting procedures were converted to computer while analysts' paper worksheets were used to check model accuracy. Numerous meetings with the controller assured that the project was on track and its goals unchanged.

The last phase, that of final training and installation, was begun in January 1984 and is expected to last through March 1984. This period has been marked by a higher degree of interaction with the analysts, preparation of training materials, and the execution of formal off-site training sessions.

ASSUMED MODEL

The underlying model used in this study is a simple socio-technical interaction model. In this model, the work environment has direct impacts on in-use technology and the in-use technology has direct impacts upon the work environment. A diagramatic view of this model is shown in figure 2.

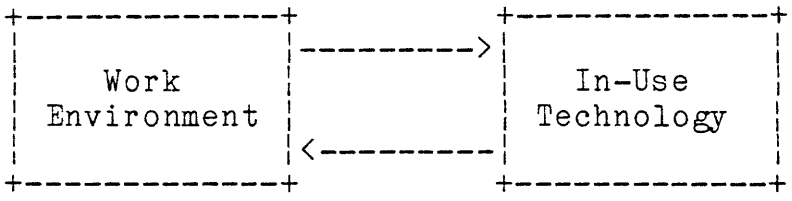

Figure 2. Assumed Interaction Model

In the context of this study, work environment refers to four aspects of the manager and analysts within the budget branch of the National Financial Planning Branch. These aspects include:

1. Individual roles and their interrelationships
2. The organizational structure
3. The organizational climate
4. The major sources of stress

In-use technology refers to the various tools and systems the manager and analysts use in the workplace. These technologies include not only paper filing systems, desk calculators and the available wordprocessing tools, but also the computerized reporting systems used to provide basic data input to the budgeting process. Due to this

broad definition, the study of in-use technology also includes persons and systems physically outside the budget branch. The same four factors of roles, organizational structure, organizational climate, and sources of stress are also studied for these in-use technologies.

The usefulness of such a simple model defined over a limited domain is its ability to allow in-depth study without the need to fully examine an organization the size of the USPS. The author, however, makes no pretense to the "correctness" of the model. It is merely a construct to allow examination of the interrelationship of these two dynamic subject areas.

OTHER MODELS

Having mentioned the basic simplicity of the assumed model, it is important to note briefly other models which include the interaction of technology and work environment. Three different models representing three different schools of thought are described. The first is a formulation from the MIS school put forth by and Tony Gorry and Micheal Scott Morton [4]. The second is from the sociological mode of analysis. Lastly, the behavioral psychology approach is discussed.

A MIS Model Formulation

The MIS school of thought generally focuses a great deal of attention on the technology itself. Recent papers

by M. Scott Morton and J. Rockart [5,6] have suggested that technology plays a central or intermediary role in the implementation of company strategy [6]. The technology thus has a filtering effect on the work environment. The concept of decision support systems has a special place in the MIS formulation as they are typically represented as the current pinnacle of application software making use of underlying transaction-oriented applications. A standard MIS model view is shown in figure 3.

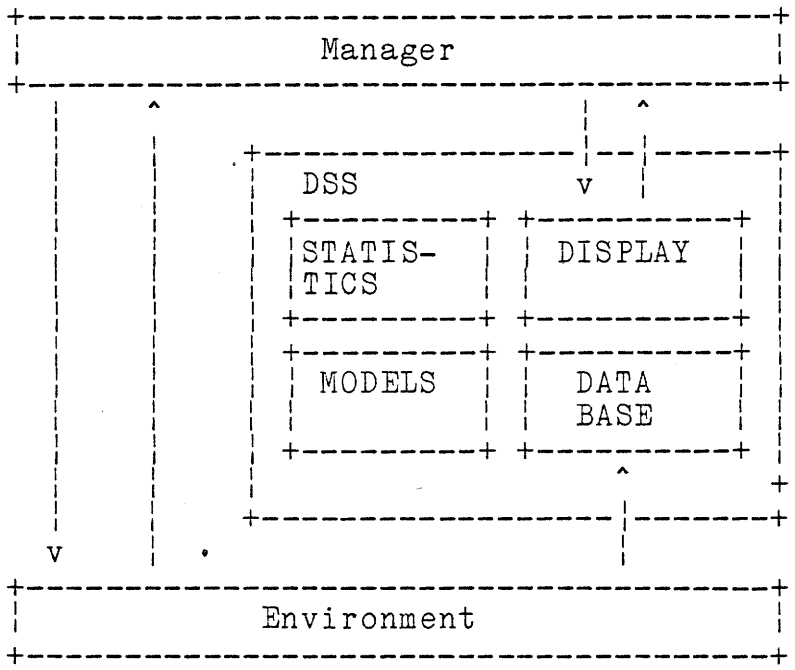

Figure 3. MIS Model of the Manager, DSS and the Environment

While this model is illustrative of the central role a decision support system plays, it does not go very far toward a more comprehensive environmental model. In addition, while putting the technology employed directly between the end user and his or her environment, the model

fails to draw any implications regarding the relative weight of the directional impacts.

Other MIS oriented researchers have proposed models centralizing information systems within a corporate framework rather than the manager and his environment [6]. These models have the advantage of incorporating additional dimensions including company strategy, technological trends, and industry conditions. A sample is shown in figure 4.

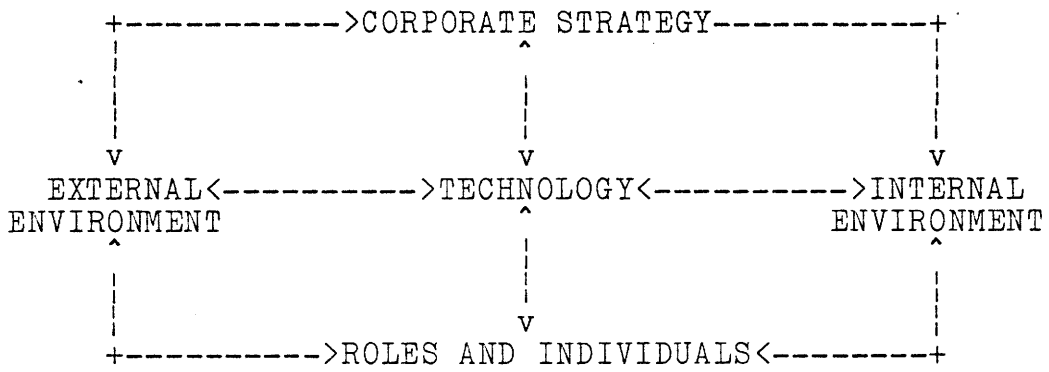

Figure 4. MIS View of Technology and the Corporation

A model of this scope, while useful for examining an entire company, would require a full investigation into all aspects of a company at many of its organizational levels.

A Sociological Model

The field of sociology has yielded a variety of conceptual models helpful in examining and understanding the link between the workplace environment and technology. A recent work by Yale sociologist Rosabeth Kanter [7] suggests that the organizational cultures can be arrayed along an

innovation stifling/innovation encouraging dimension. An individual's impact on in-use technology would therefore tend to be much greater in an innovation encouraging culture. This view suggests one should examine the in-use technology as either contributing to or detracting from an innovative environment. In the case of the USPS, there has existed a strong innovation stifling culture due to its size, public mandate, and prevalence of strong labor unions. Since the Postal Reorganization Act, the fundamental goals of the organization have been changed permanently, and this requires significant sustainable increases in productivity and entrance into new markets. Enacting the required changes, however, is in conflict with the prevailing culture of narrow job scope, stationary productivity levels, job security, and continued increases in job benefits. This model offers special insight into how difficult it is to employ new technology in a rigid culture.

A Psychological Model

While the MIS specialist puts the technology at the center of attention and the sociologist normally concentrates on the organizational culture, the psychologist is keenly interested in the individual and his or her motivation. As demonstrated by the Hawthorne experiments [8], individual performance levels normally increase in response to a higher attention level, at least for a while.

The beginning stages of the decision support model project bring with it a great deal more attention to analysts; their roles can be expected to artificially heighten motivational response. Yet the psychologists also note that among the most important factors in individual makeup is levels of esteem. The primary influences on individual self-esteem include the degree of control in the organization [8,9], which implies the degree of control over in-use technology.

MODEL RESTATEMENT

The brief discussion of other models serves to highlight the enormous simplification made in the first model specification. The expanded MIS model points to the need to explicitly recognize the pressures of the external environment and corporate strategy. The sociological model indicates that the prevailing organizational culture and forces which form it be critically observed. Lastly, the psychological perspective notes the importance of the individual players in any study of interaction involving people.

Since the perspective of this study is to observe the key interactions in the studied domain of budget analysts, these three views need to be represented. Figure 5 depicts the revised model.

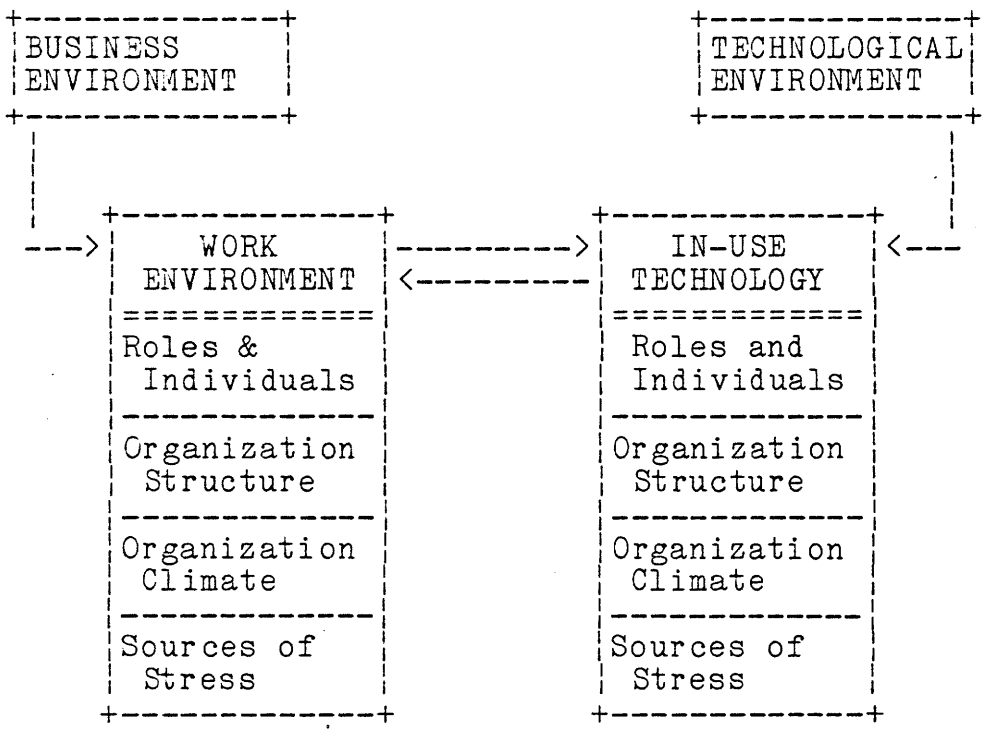

Figure 5. Revised Interaction Model

The topmost boxes attempt to make explicit the more global trends and factors which are external to the organization yet have a direct impact in forming the studied environments. The four subcategories of each environment attempt to recognize the major themes in various model perspectives.

Before exploring the findings by area, the basic orientation of the work environment and the in-use technology are briefly noted.

THE LINK FROM WORK ENVIRONMENT TO TECHNOLOGY

As described previously, the budget analysts had very little control over USPS computer technology. Without

exception, the staff in May 1983 maintained detailed ledger sheets. The basic systems they had evolved were optimized for desk calculators and paper ledger sheets. Although the mathematical procedures were equivalent, analyst ledger sheets exhibited a high degree of individuality. The similarity required of the final reports was the responsibility of the budget secretary who utilized a wordprocessor.

The branch's physical layout is quite compact and consists of a manager's office, two large adjoining offices and an open hallway. The two larger offices allowed for two desks each. While four of the senior analysts occupied these offices, one "non-personnel" analyst's desk was in the walkway with the two desks for supporting analysts. In my various visits to the budget branch, it was unusual to see the analysts roaming about. The manager, however, was frequently away from his office.

The basic job requirements of preparing reports translated into the derivation of intermediate results requiring degree of non-interruptable time and sharp pencils. The closest human link to the actual source level reporting data was with accounting personnel located less than 300 feet down the hall. Most interactions with accounting department personnel, however, were by phone. Even when a meeting occurred, it was preceded by a phone call. The basic work environment can be characterized as

quite insulated. While analysts voiced some complaints regarding the accuracy of accounting data, they did not pursue the issue aggressively. In fact, there was a general feeling that it was not their problem.

THE LINK FROM TECHNOLOGY TO WORK ENVIRONMENT

The orientation of personnel at the NDC computer center was similar to many tape-based, batch reporting data centers. Software development activities were low and program maintenance tasks ruled the day. The programmer personnel had no basic accounting or business training, yet they were responsible for generating the key financial data upon which top management relied. The response to most requests for changes was to put it with the many others in queue. If it was an emergency request, the change would be performed, with complaint, during overtime.

At the same time, personnel were bracing for enormous change in the basic orientation. The systems maintenance was in the beginning stages of being offloaded to regional Postal Data Centers. A user support staff complete with a hotline was in place. A new experimental transaction system being prototyped was gearing up and promised to offer many analysts the chance to work on an exciting project complete with the latest technology.

The physical layout included an entire three story building designed and built to USPS specifications within

the last few years. While all managers had single offices, programmers were alloted small workstations consisting of an IBM 3270-type terminal in less than 100 square foot partitioned areas. While most did not wander about, some held conversations "through" the partitions while at their stations.

The basic job requirements of typical programmers consisted of editing and submitting COBOL-based batch jobs from their workstations. The line of communication from NDC programmers to budget analysts extends upward through the NDC hierarchy to the director over to the controller and down through two levels of hierarchy. The only "direct" line of communication bewtween NDC supply and analyst demand was, therefore, only a dotted line relationship between two Assistant Postmaster Generals -- the Director of NDC and the Controller.

DEMAND PUSH

If there had been no top management demand, it is likely that these two groups, one representing budgeting expertise and the other technological expertise, would continue to have little interaction. Yet the stage has been set since 1972. Top management realized the chance to make use of the synergy of need for timely budget preparation and a new computer center released of maintenance headaches and blessed with a high degree of computing power. The controller, his immediate supervisor, and the soon to be

made head of NDC agreed to go ahead with the DSS project for the budget branch.

CHAPTER III

OBSERVATIONS

This chapter looks at the interaction of in-use technology and work environment. It contains three main sections. The first deals with the interaction in terms of a classical decision support framework introduced in Chapter I. The next section describes the analysts' work environments' primary impacts on in-use technology in terms of the four areas detailed in the revised interaction model of Chapter II. The last section details the primary impact of in-use technology on the analysts' work environment.

CLASSICAL DECISION SUPPORT

A Highly Interactive Environment

One of the basic characteristics of a decison support system is its highly interactive environment, made possible by the technology of time sharing and microcomputers. Timesharing was commercially introduced in the late 1960's by IBM for its line of mainframe computers. The high degree of interaction between one computer and many users allows a higher utilization of traditionally expensive computer hardware resources. The explosion of microcomputers since 1978 has added new awareness of the capabilities that computers can bring directly to management. As computer

technology is applied to higher executive levels, the environment must also be interruptable as well as interactive.

This requirement is brought to light by Henry Mintzberg [9] in his study of a typical manager's day which involves not only a high degree of interaction but also short attention spans characterized by many interruptions. While the NDC computer center maintains hardware capable of supporting several hundred users concurrently, it is burdened by a late 1960's operating system software MVS/TSO. In the current system configuration, response time has slowed to unacceptable levels with as few as thirty-five users. Furthermore, users are automatically logged off the system if more than ten minutes of inactivity pass -- not the degree of interruptability executive users demand. During the period of study, the manager in charge of operating system software was interviewed regarding the eventual possibility of making the VM/CMS operating system available to system users. The VM/CMS operating system is an interactive operating system capable of handling many more users than the batch-oriented MVS/TSO system [11]. His response was that it would not happen, and indeed would be highly undesirable to allow more than one operating system to be active simultaneously. Yet, he was keenly aware that the MVS/TSO system had been failing approximately once a month and this had caused non-recoverable file loss.

The desire on the part of NDC to maintain control over standard systems software has traditionally been great. With the institutionalization of NDC as the only development center, NDC personnel are in the position of mandating software technology for the five regional Postal Data Centers. The response to requests for more CPU power and secondary storage, however, has been quite positive. During the study period, NDC has added a second IBM 3033 mainframe and four top line IBM 3380 disk drive units essentially quadrupling their on-line disk capacity. In addition, NDC has been instrumental in helping to complete the COM-10 high speed communications lines connecting all regional PDC's and NDC with each other. At the same time, however, they are not favorable to adding additional remote communications lines allowing Headquarters personnel to "dial in" to NDC direct. The present configuration supports fewer than a dozen remote users calling direct from Washington, D.C. Even with the emphasis on increased networking capabilities, headquarters users may connect to NDC via high speed data grade lines only by first going through the local PDP-11.

A "high degree of interaction" includes access to user files saved on disk storage devices. As part of standard maintenance procedures, NDC occasionally reformats files to save storage space. In addition, files which have not been accessed within thirty days are automatically copied or "archived" on to tape and then deleted from the user's disk

account. These two procedures have led to considerable frustration for analysts as their attempts to update files occasionally result in unrecoverable error. Attempts simply to access files which have been archived on to tape have resulted in a wait of at least ten minutes. In a discussion with the second ranking NDC official, he displayed excitement over eventually acquiring a new "Extended Architecture" hardware add-on which allows additional virtual memory for the existing 3033 mainframes, but displayed resentment of requests to lengthen the time before archiving or curtailing file reformating.

While a DSS implies a highly interactive environment, the USPS in-use technology has been shaped by the operating needs of large, tape based, batch-oriented systems. While the raw CPU power is available to handle many simultaneous users, the in-place operating system is optimized for long batch submissions involving tape access rather than frequent disk access requests. The expected increase in end users will require additional communication lines to remote entry stations rather than more interconnections among USPS computers. Futher, the necessity of increased disk access is at odds with NDC's periodic control procedures which reformat and archive disk files.

Ability to Perform Ad Hoc Analysis

The decision support system for the analyst is designed to automate the external Congressional Budget process. As

such, it is capable of supporting a wide variety of ad hoc queries if the analyst can translate the query to changes in actual or assumption data input. The particular software language is designed to model large spreadsheets and to perform various statistical procedures on the data in the matrix. The major constraint on model development in this language is the enforced six character limit on row and column names in the model matrix. Because the budget data is conceptually structured along more than two dimensions (time, line item, bargaining status, and cost segment), it was necessary to encode row and column names using a compaction scheme. This has resulted in consistent but unfamiliar names for familiar ledger sheet line items. Hence, to perform ad hoc queries the analyst must first translate the query to data changes within the model and then translate to row/column names in the model. Indeed, the model names themselves also were encoded to allow representation of the generic type of model. Far from relieving analysts of knowing the exact procedures used in budget preparation, the customized set of models relies on gained expertise and acquired familiarity with new naming conventions in a new electronic environment. Initial training sessions showed that analysts were quite facile in adopting new, unfamiliar codes.

Lack of expertise in dealing with the specialized MVS/TSO environment has proven frustrating to these new end

users. While these electronic models represent considerable time savings for analysts, the maintenance of system files has proven to be a taxing challenge for both NDC personnel and end users.

Even in the beginning stages of learning to use a DSS, the analysts are demanding better performance from the in-use technology. While the use of a naming conventions and the step by step procedures require some learning, the central demands concern the operating systems file maintenance procedures and computer response time. The ability to perform ad hoc analysis depends on all analysts' files being maintained on disk regardless of the frequency with which they are accessed. Their frame of reference is the paper filing system where files are not periodically compacted and moved to slower access devices. The preparation of the Congressional Submission occurs twice a year. Hence files which are more than several years old may be removed from the active files. NDC's archiving of files which have not been looked at for more than thirty days reflects NDC's batch orientation. The requirement of longer storage time before archive, then, represents a demand which can only be handled by the direct communication line between NDC's Director and the Controller.

Underlying Data and Assumptions

As mentioned earlier, analysts use two primary

computer-generated reporting systems -- the National Consolidated Trial Balance (NCTB) and the National Payroll Hours Summary (NPHRS). The NCTB is a COBOL-based system which aggregates regional accounts by account number. The aggregating data center must receive tapes from the five regional Postal Data Centers. The final report is printed and a microfiche backup is made. A tape copy of the report is retained for thirty days. From time to time internal audits are performed and result in handwritten adjustments called "reclassifications". Since these reclassifications are significant, budget analysts receive them promptly as photocopied memos.

The responsibility of running this program was transferred from NDC to the New York postal data center in the second quarter of 1983. Careful examination of the resulting hardcopy reports yielded the knowledge that each report contained several different line items. If a particular account had a zero balance, it was not reported. From time to time, new account items were added as a common accounting practice. The basic data was only available in machine readable format from tape at the New York Postal Data Center. A phone interview with the person responsible for running of the system showed that he might not be sufficiently familiar with the system, possibly because he had just recently received the responsibility for it.

To perform system tests on the budget models,

historical trial balances needed to be generated and made available on disk at NDC. Fortunately, historical tapes of the regional NCTB input tape were kept at NDC. Historical trial balances were able to be recreated via the NCTB program. Results were not verifiable since the original program used to create the NCTB more than several months earlier was no longer available. As of September 1983, all historical files used in conjunction with the NCTB have been moved to the New York PDC. The lack of historical backup files emphasizes the transaction orientation of data center procedures. It can be argued that of all USPS data processing systems, the NCTB is the "king" system in that it is continually audited and other systems must "tie" to NCTB numbers. While nearly all ad hoc requests required by top management rely on the NCTB, historical information is quickly accessable only on hardcopy or microfiche backup.

The other key system tracks personnel hours and dollar costs by personnel category for close to forty line items. All NPHSR programs and files were transferred to the Minneapolis Postal Data Center by September 1983. A site visit to this PDC and extensive interviews with the persons responsible for the maintenance of this system revealed that they were quite uncomfortable with the system and had a proposal out to thoroughly revamp the system. They displayed a high degree of reticense upon discovering that important personnel at Headquarters were relying on the

general accuracy and timeliness of this report. They lacked resources and authority to revamp the system, and they were locked into low reward and low prestige jobs maintaining a system they did not fully understand. The change requests for the report were "several inches high" and no progress was being made pending a decision on their revamp proposal. Interestingly, they had very little direct interaction with Headquarters personnel. As with NDC, the line of communication was a dotted line between the PDC Director and the Controller.

Besides the two actual data reporting systems, analysts also used assumption data to derive outyear estimates. Various inflation indices obtained from Data Resources (DRI) from hardcopy reports and manually corrected for the Government fiscal year are used to inflate non-personnel line items. They are also used in conjunction with careful reading of labor contract agreements to generate unit cost factors for different employees. Since this data is generated by the analysts, it exists only on the individual ledger sheets and supporting scratch sheets. Much of the assumption data analysis was performed by the support analysts to be shared among all analysts with one large exception.

The outyear workload estimates and revenue projections were filtered to the analysts by the branch manager. It is precisely these key input assumptions which determine the

basic sign and magnitude of the final net income projections. Because 85 percent of all USPS costs are personnel related, a 10 percent change in the amount of total workyears translates into approximately an 8.5 percent change in total expenses. By contrast, a shift in inflation by 10 percent would only increase total expenses by a much smaller amount.

The procedures used to develop total workyear estimates by employee category were localized within the branch manager's personal domain. This localization of the key input assumption data served to elevate his relative power and importance in the arduous budget process. Since only the manager had access to mail volume and revenue data, he was able to analyze productivity levels (mail volume divided by workyears) and compare them to management productivity level targets. The set of models developed for the analysts left these estimation procedures as input to the budget process. This design decision was consistent with the charge developing models which mimicked the analyst worksheets, but inconsistent with the general view of decision support systems as assistants to managers. It is highly probable that the new branch manager will want to have this analytical function semi-automated and incorporated into the DSS.

Effectiveness through Assistance

The expressed goal of the project was to allow analysts

to perform their tasks more effectively. By automating the process of ledger sheet calculations, the analysts would be allowed to spend more of their time developing alternate scenarios rather than just developing a single outyear forecast. Thus the efficiency gain in using computers for number crunching and report generation allows more effective use of an analyst's time allocation. The basic argument for decision support systems lies in their capability for aiding end users to make more effective decisions. The concept of gaining effectiveness through more efficient use of time allocation is highlighted in this case as the required time to estimate expenses for a complex personnel cost segment by computer model is usually several hours, whereas the development by manual ledger sheet can take on the order of a several days to a week.

By implementing these models in a decision support language, analysts are now given the new capability of querying the model with results displayed almost instanteously. The long range plan is to change the mix of analyst time allocation to include much more time working with assumptions and answering "what if" questions rather than grinding through a maze of arithmetic on ledger sheets. The implied impact on analysts, the budget branch orientation, and even job security is somewhat reduced by emphasizing the "effectiveness" aspect rather than the efficiency gains.

Given this backdrop of the basic elements for implementing a DSS within the context of a highly bureaucratic, labor intensive operation, the impacts on in-use technology and work environment are next examined using the model outlined in Chapter II.

PRIMARY IMPACTS ON IN-USE TECHNOLOGY

Having examined some of the technology-work environment interactions in terms of classical decision support, this section looks at the impacts on in-use technology. The observations revolve around activity at NDC as it represents the center of in-use technology support. Following the model outlined in Chapter II, the impacts are examined in terms of four areas: Roles and Individuals, Organizational Structure, Climate, and Sources of Stress.

Roles and Individuals

The change at the NDC from a new data center to a development center included a new director of the facility installed in July 1983. A formal NDC presentation was made to the controller in November 1983 to communicate NDC's revised goals, level of support and current projects. The largest project developing a new transaction system was in the process of staffing over 100 systems programmer personnel as the prototype phase began. Many of these people were current NDC programmers and so opened up slots for what was predominantly COBOL program maintenance. NDC

has the distinction of being the only USPS data center to staff a support center in charge of handling customer service calls. These individuals collectively have a great deal of knowledge in COBOL transaction-based programming but are unfamiliar with high level interactive languages geared to ad hoc data and model query. Other than the director, the key management personnel remained the same throughout the period of study. These key people included the Manager of Applications Programs and a Security Officer.

As described in their presentation, the basic goal of NDC was to be a development center. Absent from the list of chief objectives was that of becoming a more service oriented data center. In particular, the NDC was priding itself on offloading all previous headquarters systems. In fact, whereas all previous development work had been performed on a Digital VAX 11/780, all new development work would be standardized on the IBM 3033. The VAX was being "exchanged" with a regional PDC for another IBM 3033. For NDC personnel this reorientation offered the IBM maintenance programmers new, more exciting tasks. The incentive for aiding a headquarters project which included a great deal of online storage, CPU utilization, and worst of all, periodic updating of data files, was small. This fact was evidenced by unusual delays in obtaining new user accounts and access to files across user accounts. In addition, the knowledge of available remote data access lines was similarly delayed.

Documentation of available software was also not readily available.

The growing need for novice end user support in a DSS language is now being felt. While the specific duties of the support staff include a HELP line, their expertise is geared to the needs of regional PDC users running tape-based batch programs with a particular IBM terminal. Budget branch end users are standardizing on a teletype remote terminal while the support staff relies heavily on software utilities which operate only with the IBM terminal. When the technical manager was asked about support for other terminals, he voiced his opinion and projection that only the IBM terminal would ever be supported at NDC. His role, of course, is to evaluate and make software utilities available.

Rather than seizing the opportunity of better supporting the diverse needs of top management, he elected to take on a more departmental stance which has the probability of dictating the future in-use technology of regional PDC's. Such an orientation has direct side effects on NDC staffing, purchasing, and outside contracting decisions. As headquarters analysts become increasingly dependent on NDC resources, they are demanding more support in terms of disk space, operating system environment and end user support expertise.

The new focus at NDC coupled with the traditional no

layoff culture has created the need for extensive job role redefinition and retraining. As part of the massive retraining effort, NDC has instituted the STRADIS methodology of system development. The institutionalization of this methodology includes a week long training seminar for all NDC programmers. The incentive for this retraining is great as the STRADIS methodology is expected to be forced upon all system development and maintenance for all regional PDC's. Unfortunately for Headquarters personnel whose needs require fast turnaround, this new methodology has a high likelihood of slowing system implementation with its new levels of required authorization and documentation. Now that NDC has completed the initial phase of offloading transaction maintenance, they have focused on a developing a new transaction system. Regardless of how this new endeavor evolves, they are entering a phase of senior management level support through hardware maintenance. This phase is currently being entered in an unmanaged way as most resources are devoted to transaction system development.

Organizational Structure

NDC experienced two organizational changes during the period of study. One was the new structure put in place to support the large system development project whose goals are to implement online transaction systems for the Post Office level. The second major change was the formation of a

training group responsible for developing classes for NDC and regional PDC's. One of their initial projects included teaching STRADIS methodology to USPS personnel. The training of the selected Post Offices for the prototype system will also be handled by this new staff.

The basic challenge which these organizational changes seek to meet is that of re-educating a staff experienced in Era 2 batch processing systems to Era 3 online data processing systems. Yet, the retraining is focusing on more detailed procedures which slow development time. At the same time, headquarters management is requiring faster development time.

The number of dotted line relationships is increasing as evidenced by the installation of a new head of NDC from Headquarters. The top managers at the USPS realize that technology will play an increasingly important role in the running of the organization.

Climate

During the period of study, the climate at NDC differed greatly depending upon the level of organization examined. The top NDC management were attempting to reorient the center to support the conflicting goals of more and stronger dotted line relationships to Headquarters and the PDC's. Technical managers were coping with the huge increase in end user demand with additional hardware and communication facilities. Programmers were busy offloading the current

batch systems while being retrained and examining career potentials in joining different projects. Many of the informal conversations concerned the timing of a new building to supply additional space. As additional persons and hardware come in, the only area in the physical facility currently being targeted for space contraction is the "job control" area used by programmers to support periodic tape maintenance.

The overall climate, then, was a mixture of excitement over new found roles and responsibilities and concern over expertise and degree of control. NDC was not only caught in the middle of expanding end user needs, but largely in charge of new policies and strategies to confront the technology issues. Clearly, NDC was in the process of being put in charge of managing the inherent conflicting needs of end users, technological change, and technology control. In terms of supporting the regional PDC's, NDC was in charge of developing a new transaction system which was slated to include additional communication networks. In terms of direct headquarters support, outside contractors were in charge of the system development but NDC was responsible for end user support. The development of the new DSS meant additional file maintenance and user account support rather then software development.

Sources of Stress

This situation of refocusing, extensive hiring and

training normally leads to a great deal of stress. The basic problem of managing the technology and management needs was compounded by the enormous rates of change in both. While management is seeking fast accurate information in a centralized database, complete with custom designed costing models, NDC is busy decentralizing internal USPS data. Further, much of the data that management requires is not even collected at the PDC level. This situation has resulted in Headquarters management developing systems and leaving their maintenance largely in the hands of inexperienced end users. In this case study, NDC is continuing to offload system responsibility while offering only passive cooperation with headquarters.

As a step in offering Headquarters personnel access to corporate data, a financial database project was inititiated using the physical computer technology of NDC but employing exclusively non-NDC personnel for its development. NDC is the natural physical site for such a database as there is no Headquarters data center. Yet the sidestepping of NDC personnel and the prospect of periodic maintenance has added to the feeling of discomfort among the programming staff. Just as they were led to believe they would have more control in establishing systems and system standards, a new key system was being developed outside their management domain. Interviews with the technical manager yielded the information that a standard high level database management

language had already been purchased by NDC but was not supported and no documentation was available. This software was considered by the manager to be used only by internal NDC staff for development purposes.

During the period, NDC had three major sources of stress. The first was the re-focusing from a COBOL maintenance organization to a developmental organization. Within their immediate domain was the control of future transaction systems to be used throughout the USPS. The second major source of stress is the reorganization and retraining necessary to support new transaction system development. The third major source of stress was that of supporting the new systems for senior management. Thus far, NDC support has been limited to issuing new user accounts and managing increased disk storage requirements. It is this final area that NDC is paying the least attention to in the short run that may be the major challenge, since it represents the conversion from technical to management orientation. In this domain, outside consultants were contracted directly from Headquarters to specify and develop the systems. Because NDC has not fully geared up to service new end users, outside consultants have also taken on the task of familiarizing new end users with basic instruction and support of computer center usage.

Most of the Financial Database contract was moved to "inhouse" personnel from a third party contractor. The need

for NDC cooperation has thus increased dramatically without directly assigning any of the NDC programming staff to the project. It is, at this time, unclear what formal reorganization will take place to aid NDC in their transition period.

PRIMARY IMPACTS ON WORK ENVIRONMENT

Roles and Individuals

In terms of roles and individuals at the budget branch, a diversity of changes were experienced. Some individuals experienced new opportunities, others felt considerable loss of confidence. Changes also occurred in the staffing department. A new branch manager and a new support analyst were hired.

The development of the decision support system has put additional pressure on each of the analysts and the new budget branch manager to learn the role of an end user.

The retiring manager was somewhat skeptical regarding the usefulness of automating portions of the budget preparation process. His understanding was that so much of the process was subjective that routinization of procedures would not be of use for any significant amount of time. His knowledge and support of the project was considered key to ultimate successful implementation by senior management. At the same time, his superiors believed that the DSS project should capture his knowledge before his retirement. With no

successor named, the retiring branch manager shared many views easily but kept the details of his procedures largely to himself.

The new manager of the budget branch was from a regional post office. He has a background which includes using microcomputers and budgeting. At present he is learning the current manual process and the new computerized budgeting system. He has recently been responsible for cutting the turnaround time on data file access among branch user accounts from over one month to several days. Within a short period of several months, the new manager has not only secured detailed information about his job , its roles and functions, but has also been responsible for greatly expediting the use of the DSS by opening up better lines of communication with NDC staff and personally learning the system at a detail level. He is clearly setting an example in the branch that informs his staff of his intention to utilize new technology. Indeed, he has already initialized the purchase of several microcomputers to be used as terminals for the DSS.

The "Personnel Analyst" was selected to be the first person to use the new budget system so as to leverage system acceptance since he is responsible for running the majority of models. The concept of the computer as an "assistant" was especially appealing to him. His new found expertise included learning to operate a typewriter-like keyboard,

computer concepts, and a new language of codes to run various models. As soon as he gained familiarity in using the models, he began to change assumptions and ask "what if" questions. He sees knowledge of this system essential for better budget turnaround and job security. The major voiced complaint of the "Personnel Analyst" is that of "not enough uninterrupted time" to devote to learning the system.

The chief concern of the "Personnel Analyst" regarding the usefulness of the system is its ability to directly link to the NPHRS. This analyst is responsible for discovery of many of the inaccuracies in the NPHSR. Yet he was unaware of the underlying system, where it originated, and what was being done to correct certain problem areas. During the course of the study he became aware of the technological and political reasons that NPHSR change requests were not being implemented. In addition, he gained experience in system design and system testing through his role as recipient of computer models. His basic concern then was depending on older systems. The concern prompted a thorough explanation of the process involved if another system was to be linked to his models. After understanding the technology better, the "Personnel Analyst" felt much more comfortable with his portion of the system. Yet in his over ten years of service, no one had explained the basic underpinnings of one of the major reporting systems which he used for budgeting.

The "G and A Analyst" is currently helping to design

his own models as he maintains the most complex spreadsheets and he has the most computer expertise. He shared duties of acting branch manager with the "IS/BS Analyst" from July to November 1983 when a new branch manager was appointed. During that period he allocated nearly all his time to the preparation of a rate case rather than the Congressional Submission process. The rate case preparation process can be viewed as a superset of the Congressional Submission process as it requires similar analysis at a national level. The requirements of scenario evaluation and fast turnaround are the driving forces which cause the two processes to be distinguishable.

The "IS/BS Analyst" overcame significant apprehension about using computer models after he discovered that allowances had been made for his own adjustments and for reclassifications. The ability to insert his "own" adjustments preserved the subjectivity of the modeling procedure, allowing the analyst to plug certain items to arrive at predetermined values for outyear estimates. Rather than prescribe exactly how the estimates were to be made, the model acted more as an assistant which allows subjective judgements to be made during the budgeting process. From a system design viewpoint, these allowances for adjustments were necessary to accomodate later changes in budgeting procedures.

Within a few hours training the "IS/BS Analyst" became

facile in using advanced features which aid in telling the user what input is required to obtain predetermined output. Once this feature of targeting input variables was known, he relaxed his fears of giving up the subjective nature of budgeting certain line items.

The two "Non-personnel Analysts" overcame a portion of their initial reticense regarding use of the system. One believed his procedures not worthy of systemitizing but agreed to use the models after discovering that allowance had been made to accomodate different projection methodologies. The other "Non-personnel Analyst" wanted his set of models expanded to allow estimation of personnel-related expenses in the same manner as the "Personnel Analyst". Their roles will likely be under the most pressure to change -- either to run the models of other analysts or to perform other types of analysis as their model set is small. The use of the DSS could very well represent for them the most role impacting changes.

A new person with a systems background has been hired to fill the slot vacated by the disabled support analyst. He is by far the youngest employee in the budget branch and is currently learning the various systems at a more detailed level to enable him to support all analysts, maintain key historical data, and serve as the interaction point between the analysts and support help at NDC. His new duties are very different from the analyst who helped to generate

government year adjusted inflation indices.

Organizational Structure

The organizational structure of the budget branch remained basically unchanged. However, the subject of reorganization was informally discussed during the period of time when it had no permanent manager. Considerable concern was voiced as to whether the "G and A Analyst", the "IS/BS Analyst" or a new person would be choosen to head the budget branch. After the period without a permanent manager extended for two months, apprehension that the accounting and budgeting divisions would be re-organized into a single unit reporting to the controller began to rise. The result of all this is a higher level of uncertainty although the basic structure itself went unchanged.

Climate

The climate has been described as "hectic" due to the concurrence of a rate case and Congressional Submission preparation. The presence of two new professionals in a branch of only six professionals has increased internal budget branch interaction. In addition, the controller has interacted significantly more with the manager and three senior analysts in order to better prepare for the upcoming rate case. Even aside from the attention gained through the DSS project, the budget branch was under top level spotlights. The occurrence of labor negotiations beginning

in April 1984 will undoubtedly add to an already high attention level. The budget branch is being subjected to a high level of scrutiny and vastly increased expectations.

Sources of Stress

The rapid increase in the need for management information and the simultaneous introduction to computers as a controllable technology are the chief sources of stress. These two forces are causing budget branch personnel to re-evaluate their roles, the organizational structure, and the climate of a non-participative, bureaucratic environment. This trend of increasing stress will most likely continue as the labor negotiations go into full swing and their experience with the available computer models grows.

The two "Non-personnel" analysts were more apprehensive in learning the computer versions of their budget responsiblities. It is possible that because they knew their simpler part in the budget development process was being automated, their role security was being threatened. One analyst had significant trouble viewing a CRT computer screen. The other analyst predicted it would take some weeks before he felt comfortable with his particular model.

Even from the short time span of the study, it is apparent that the in-use technology and work environment are interacting and heading for more interaction. NDC is in the

middle of a large transition phase in which direct headquarters support is becoming more of a priority. The installation of a new director with close ties to Headquarters is evidence of this change. At Headquarters, analysts are becoming direct end users of NDC resources and beginning to demand direct support. The installation of a new branch manager and support analyst with a systems background from outside traditional hiring areas highlights the intent of management to develop their own expertise.

The inclusion of a major part of the Financial Database effort to "inhouse" resources at headquarters yields further evidence of the trend of more interaction of technology and work environment. This effort is expanding and currently seeking additional personnel. The Financial Database project represents a determined effort by headquarters to further tighten the links between chosen technology and inhouse expertise. Rather than perform the project at NDC or even hire personnel from NDC, headquarters is staffing its own effort using NDC hardware resources but locating the effort in Washington, D. C. As this project progresses, the team members will likely interact directly with analysts as their potential end users.

CHAPTER IV

DISCUSSION

THE PACE OF CHANGE

The most salient fact observed during the study was that the pace of change both in the analyst work environment and technology was moving at an increasing rate. At the analyst site, the climate has been moving towards one which is rapidly becoming more familiar and at ease with interactive timesharing systems. The personnel changes have helped to begin to institutionalize this orientation, while at the same time send a signal to existing employees that expertise in this area is becoming a required skill. The "Personnel Analyst" has already requested an additional three days off-site training and the branch manager has acquired new administrative skills in getting his employees necessary terminals, printers, and user accounts. Simultaneously, NDC has installed a director known for his direct, informal communication channels to top Headquarters management. The physical equipment additions at NDC have also been impressive -- including a doubling of CPU power, a quadrupling of available online disk storage, and installation of fully networked PDC computers.

The extraodinary pace of change has itself created new sources of stress for these two environments as they head for increasing interaction. Much of this micro-view of

change is directly traceable to more global trends. The USPS is firmly committed to being a self-managed, non-subsidized business with full management rights to set policy and bargain with their own employees. For the budget analysts, this basic change has translated to include the following new pressures:

* Increased need to analyze budget scenarios
* Increased participation in rate cases
* More accurate analysis of USPS productivity
* Decreased time required to accomodate reclassifications and other data changes

For the more technologically oriented personnel at NDC, the pace of change in computer technology has presented outstanding pressures just to keep informed. As with the entire information services industry, NDC has had to cope with increasing software costs, a higher percentage of software dollars spent on software maintenance as opposed to development, and the difficulty of standardizing hardware and software in face of new products and vastly increased end user demand. These particluar pressures have translated into:

* Demand for a variety of ongoing development projects
* Increased end user support needs
* Need for extensive retraining of current staff
* Capability to interact with users who have a variety of experience from novice to expert at differing hierarchical levels in the organization

As mentioned in Chapter III, the major changes at NDC can be divided into three phases: unloading maintenance activities, refocussing on software development, supporting the growing demands of end users -- especially at Headquarters. Throughout the study, NDC has been unable to fully progress to the third phase. The lack of expertise in ad hoc query systems and the distance from management needs has led to managements' decision to go to outside contractors to develop model-based planning systems. More recently, the staffing of an internal database project at Headquarters with newly hired personnel underscores the fact that management critically needs management information in a short timeframe. Should NDC fail to support the new systems and end users making use of their hardware resources, Headquarters will likely reinstitute their own small data center.

THE ATTENTION EFFECT

For budget analysts, the attention was generally received favorably. While their role definitions did not change significantly, a new set of tools were being developed explicitly to aid their tasks. The "Personnel Analyst" was the most receptive. This was largely due to the fact that he viewed his procedures as mechanical. Within a month of being introduced to his modeling system, he had hopes of transferring many of the budgeting tasks to

a support analyst. The other two senior analysts were somewhat less receptive; thus cited concerns over their degree of subjectivity and control within their cost segments. The two non-personnel analysts have displayed some reticence both in teaching the consultants about their spreadsheets and learning their computer models.

One of the most important results from the increased amount of attention is the formation of new lines of communication. The controller has increased his communication with NDC. This is due partly to his role as project coordinator and partly due to the fact that he has worked extensively with the newly installed NDC director before his appointments. Hence, the main line of communication between the budget branch and NDC has become stronger in both formal and informal interpersonal communication.

The analysts have been exposed to new role models within their own branch at the most junior level with the arrival of a new, young, systems-oriented support analyst and at the most senior level with a new systems-oriented branch manager. Both have first hand familiarity with microcomputers and are firmly committed to employing computer tools to aid in budgeting. Several floors below the Financial Database project is making key datafiles with three years of history available online via NDC, complete with software allowing downloading of data to

microcomputers. They are one of the few areas at Headquarters actively seeking additional employees. The basic role model of an Assistant Postmaster General being able and encouraged to converse with another Assistant Postmaster General has long been an accepted line of informal communication. Given this relationship, the controller is serving as the main buffer between work environment and technology, but he has already set in motion an internal group at Headquarters to establish a file system to hold key information at NDC. This group is already exploring ties to the budget branch project in order to gain end user support. The legitimate authority to bring technological decisions closer to the analysts is in the process of being put in place.

SUPPORT FOR THE TECHNOLOGY DRIVEN LINK

Clearly, the impetus for the project was the demand for better and more timely management information. The chosen technology included a late 1960's operating system and software originally developed in the early 1970's. NDC personnel consisted mainly of COBOL programmers spending the majority of their time performing system maintenance. The target end users, the analysts and branch manager, had by and large little experience and exposure to online computerized budgeting systems. In addition, the required files were not initially available for disk access. Given this scenario, it would seem unlikely that technology would

have a major feedback effect to the work environment.

In this particular case, Consultants for Management Decisions played the role of a strong change agent in direct contact with both senior level management and NDC personnel. Yet, NDC personnel played a predominantly passive role offering some aid in making text files available but neglecting to open new lines of direct contact with Headquarters. While many information systems departments struggle to deal with the challenge of managing end user demand, NDC was during this period far more concerned with developing new transaction software. A continuation of this approach can only result in Headquarters staffing and maintaining its own computer center.

In the short span of the study, budget branch personnel have undergone extreme re-orientation leading towards closer ties in their demand-supply relationship so as to have more controllable technology available to meet their business needs. The inplace hierarchy has limited access to accommodate the increased needs for communication. The dotted line relationship between the controller and director of NDC is not sufficient for supporting analysts' demands.

If NDC persists in maintaining a transaction-based orientation dictating 30 day automatic archiving and file reformatting, Headquarters will be forced to either abandon plans to automate budget preparation or be forced to develop their own computer center. The critical needs of

Headquarters are clear -- senior management must have increased technological support and will hire internally and/or obtain third party vendors to achieve the desired support. The challenge for USPS Headquarters is to develop software tools to assist in budget preparation regardless of the orientation of the present computer centers. The challenge for NDC is to support both the needs of regional PDC's and Headquarters and management needs. Their task is further complicated by the fact that they have little direct experience in developing, maintaining or supporting ad hoc model-based systems. Additionally, they have little experience in direct, high-level user support.

Budget branch analysts have gained first hand exposure to customized Era 3 systems. Further, they have participated in the design and development of their own computer systems, adding to their degree of self-confidence as end users. Key hirings in the budget branch have included a support analyst and a manager with a strong systems background. Analysts' opportunities for career advancement now depend on their ability to utilize computer-assisted models. As the stage of familiarization draws to an end, these analysts are beginning to demand a less burdensome computer environment with additional capabilities. Another result of this exposure is a gained interest in the technology itself including use of particular hardware and software. The newly acquired

knowledge of how computers operate and what types of tasks they are helpful in performing is beginning to unleash end user demand from a source new to the USPS. At present, many of these demands are funneled through a third party consulting group. The internal expertise at USPS Headquarters is growing with alarming rapidity. The major role models, the controller and his immediate supervisor, both have obtained desktop micro-computers. The internal budget analysts have also acquired an IBM-compatible personal computer.

Lastly, a new group has been established to make key data files available to micros using the NDC hardware and software via a software package called AnswerDB which produces reports from MARK IV data files. These reports are transferable to micro-based programs such as Lotus 1-2-3 and dBASE II via report downloading.

The traditional separation of technological expertise and user demand is being closed with great rapidity. Further, NDC has been charged with supporting increasing end user demand rather than dictating what will be in-use technology. The power derived from knowledge is shifting away from the traditional information systems groups to internal Headquarters management as Headquarters personnel gained expertise in Era 3 systems. After some time, the information system groups at the USPS are still having difficulty managing Era 2 systems.

These dynamics pose tremendous conflicts of interest for NDC. While their expertise is concentrated in transaction systems, top level management is demanding ad hoc query systems requiring different technology -- including an interactive operating system, increased disk storage, and high level end user support. As NDC is unable to supply the necessary support, Headquarters has hired their own systems personnel. The inevitable result will be additional systems which NDC is unable to fully support, control, and maintain. Ironically, it is the functions of support and control that NDC personnel aspire to fulfill. This conflict can only be addressed through more interaction with Headquarters personnel. The installation of the new NDC director from Headquarters represents a significant step in this direction.

THE POLITICS OF OVERHEAD

The implementation of the Era 2 transaction systems in the USPS, like most organizations, represents managements' attempts to decrease overhead costs. Once in place the basic maintenance costs and technology were regulated to a comparatively low level. The implementation of Era 3 systems is more difficult to rationalize on a pure cost basis as the major benefit is better analysis rather than personnel cost savings. At present, however, the USPS is in a uniquely favorable position to justify increases in

general and administrative costs. The USPS spends only 8 percent of all expenses are spent on the entire administration and regional operations. The total bill for the operation of the Postal Data Centers is about 1 percent of all expenses. The fact that the USPS posted their highest ever net income of over 600 million dollars in 1983 allows the increase in overhead to be more acceptable. The usual problems associated with increasing overhead are generally absent from the current situation of the USPS.

MOVING FROM ERA 2 TO ERA 3

The impetus for installing Era 3 systems comes from the structural needs of running a 23 billion dollar organization. The particular location, the controller's office, brings to this large task a reasonable budget authority, a good deal of legitimate authority, and a high degree of technical knowledge. Yet, this focus on directly involving analysts with Era 3 systems causes increased organizational stress at many levels and locations within the USPS. The technology center, NDC, is placed in conflict between transaction system development and online end user support. NDC's lack of expertise in Era 3 systems is highlighted by the new hiring and third party involvement. Budget analysts are experiencing career stress. As new and better technology became available, a new manager was hired from outside the budget group. This has increased anxiety since open job slots had previously and traditionally been

filled from within.

The organizational culture of simply supporting mail delivery has given way to a decision-oriented budget group that not only reports to top management but also must pay more attention to evaluating alternatives by closely examining likely outcomes of management decisions.

Many factors point to the successful adaptation of new technologies. Indeed the USPS has successfully adapted to such new technologies as the train and the airplane. Most recently the USPS is in the process of installing a large number of optical character readers. The USPS is fully committed at the highest management levels to keep pace with technology in its operations. Today the USPS no longer defines its operations as the movement of physical objects from point A to B, but defines its business as communicating information [12, page 38].

ORGANIZATIONAL CONSTRAINTS

Although many elements are in place, the USPS faces numerous constraints in attempting to carry out its new orientation. The fact that 90 percent of its workforce are covered under bargaining agreements has solidified a culture of lifetime employment and promotion from within. To successfully implement new technologies takes new skills and knowledge -- implying a greater need for management flexibility to hire and fire. Compounding the problem of

job slot rigidity is prevalence of job role rigidity. The USPS is now requiring diverse expectations of its analysts and programming staff. Since many of these new roles require new skills, there now exists a need for more cooperation among technologically proficient NDC staff and the expertise of the budgeting staff. The organizational climate which should promote better communication is now being put into place. The first steps have included changing key personnel at NDC, adding sufficient hardware, and training budget analysts.

At present the USPS is in charge of its expenses but is only indirectly able to set its own rate structure. The budgeting activities therefore concentrate on the expense side of the income statement. As the analysts decrease the amount of time required to spend on expense budgeting, they will likely be asked to work more closely with Rates and Classifications to examine various rate and volume scenarios. This area of revenue budgeting involves more complex procedures with a wider variety of costing methodolodies available [13, pages 122-131]. It is this more complex, less structured area that the USPS needs to have its analysts spend their time analyzing.

CHAPTER V

SUMMARY

TIGHTENING THE LINKS

As evidenced by this study, the links between technology and work environment are tightening. NDC personnel are being tuned into the basic business needs of the budget branch. NDC's own perception of this trend spurred a presentation to the controller's office stressing the high level of expertise and support they bring to business decision making. The budget branch has significantly increased their basic knowledge of Era 3 systems and is beginning to demand higher levels of support from available channels. The incentives for the individuals have been underscored by the hiring of new personnel skilled in computer systems. Simultaneously, the addition of a parallel effort at Headquarters to make key data files available to analysts with access to terminals (including micro-computers) points to the seriousness of management's effort to bring technology closer to its Headquarters personnel. The individuals, organizational structure, and organizational climate seem to all be pointing towards a closer relationship of analysts and available technology.

ENVIRONMENTAL FACTORS

The USPS is entering into a new phase. Rather than just provide levels of service in moving the country's mail,

the USPS is a rate-regulated organization planning its own future. This posture in an increasingly competitive environment has led management to recognize explicitly the need for better information and analysis. The DSS project is a first step in giving management the capability to perform ad hoc analysis on national data at a detail level. The USPS is attempting to unburden itself from the narrow focus of job function without role redefinition. In the process internal budget analysts are subject to increasing stress from adapting to electronic tools, while NDC personnel are caught in transition from an accounting support role to systems development role.

END USER DEMAND

While these changes are taking effect, new end users are being added to the NDC computer network. The unleashing of their demand will be felt in the near future. The explicit plan of NDC is to support these new end users. The controller's office has already instituted a group responsible for file development, and that group has hired systems programming personnel. The level of support afforded Headquarters personnel is increasing at the end user site. How NDC manages the increase in end user demand is a question that for now must remain unanswered. The key ingredients for severe organizantional change, however, are readily apparent. The external environment dictates that a

more competitive posture be undertaken. Key change agents with entrepreneurial orientations are in place at several levels within the organization. Management demand for utilization of current technology is critical to operation of this 650,000 employee organization. At the present time, Headquarters is adding many new end users to present online sytems. Exactly what route senior management elects to take to solve the needs of tightening in-use technology and work environment is still to be worked out.

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