1988

# COMPUTER SYSTEMS AS INSTITUTIONS: SOCIAL DIMENSIONS OF COMPUTING IN ORGANIZATIONS

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## ABSTRACT

This paper introduces terminology and develops a framework for incorporating and emphasizing important social and political choices that become part of the history of Computer-Based Information Systems (CBIS) and are embedded in the social structure which supports its development and use. These social and political elements of a CBIS are not just discrete elements in an environment. They can be organized in specific ways which may enhance usability and performance and, paradoxically, constrain implementations and post-implementations.

It is argued argue that CBIS, developed from complex, interdependent social and technical choices are better conceptualized as institutions than as tools. The distinction between tools and institutions is important for several reasons: the usability of CBIS is the critical factor, not the technology itself; CBIS that are well-used and have stable social structures are more difficult to replace than those with less social structure and fewer participants; and CBIS vary from one social setting to another according to the ways in which they are organized and embedded in organized social systems.

## 1. INTRODUCTION

Many information systems analysts and organizational theorists focus on the capabilities of computer-based information systems (CBIS) when analyzing their benefits and limitations. CBIS are characterized as tools for attaining work group or organizational outcomes such as productivity-enhancement, increased efficiency, worker control or strategic advantage.

Discourse which foregrounds the instrumental value of CBIS is rich and varied. Some analysts narrowly define CBIS as tools to support specific information processing tasks. Other analysts focus on social and political impacts of CBIS implementation and use. Political analysts view CBIS as tools which bring power payoffs such as enhanced decision-making abilities or changes in the distribution of power and influence among different types of staff. Marxists argue that managers use CBIS to increase their control over work processes and decrease worker control (Braverman 1974). While each of these accounts varies in the degree to which social relations are relevant factors, they all assume that specific organizational interest groups will be able to control the deployment of the technologies in their physical work setting and attain the outcomes they intend (Galbraith 1977; Poppel 1985; Simon 1977).

However, we know from empirical studies of actual outcomes of implementing CBIS into organizations that anticipated benefits do not materialize easily. In extreme cases, a CBIS fails to meet the preferences of many or most users and falls into disuse (Brewer 1973; Dery 1981). In other cases, CBIS are not used as they were intended by their designers (Markus 1983). While implementation research has found no single cause for success or failure, MIS analysts usually point to discrete organizational or technical elements as critical factors: inadequate management, lack of management support, user resistance, or complex systems (Laudon and Laudon 1988).

Some researchers have recognized that control over many aspects of implementation processes is much more difficult to maintain than was previously assumed. One strategy for managing difficult implementations is the identification of risk factors and probablistic assessments of success. Another strategy is to broaden the meaning of implementation to include "the entire process of organizational change surrounding the introduction of a new information system" (Laudon and Laudon 1988, p. 625). A broader definition can contribute to increased recognition of the importance of user participation in implementation processes.

In this paper, we argue that the analytic spotlight should be moved away from discrete elements of computerization processes to the patterns which structure the environment and are part of an organized social system. Many of the elements of the social system are non-cognitive and taken for granted. Over time, they become deeply embedded in the social fabric and resistant to change.

For example, the U.S. Air Force and the U.S. Navy may never be able to effectively share a common command and control system regardless of the technologies involved or the adequacy of management since they are committed

to very different battle strategies and strongly prefer their own equipment (Kling 1987). The traditional differences between these two armed service units will probably constrain any substantial use of a common system.

## 2. EXPLANATIONS FOR IMPLEMENTATION FAILURE

Public policy literature points to one kind of organized social system which acts as a constraining mechanism in bureaucratic organizations: *standard operating procedures* (SOP). SOPs act as obstacles to change because they are deeply embedded in an organization and difficult to control (Edwards 1980). Public policy analysts argue that when a new policy requires change in an organization's SOPs, there is less likelihood that it will be implemented as its designers intended. One example is the Social Security Administration (SSA), which was accustomed to evaluating individual claims and saw itself as a payment program. When Medicare became law, the SSA acquired new responsibilities for health care containment. Since they had little interest or expertise in the planning and budgeting of health care, they focused on claims denials in response to unnecessary or uncovered health care. Even after criticism from the Senate Finance Committee and the adoption of a more active role in cost containment, they still limited their activities to those which fit their SOPs.

In MIS, the study of political dimensions in systems implementations incorporates some elements of organized social systems (Keen 1981). The focus is on power shifts and the redistribution of power and influence in organizations (Danziger et al. 1982; Markus 1983). These analyses, however, are based on several questionable assumptions:

- that the distribution of power is always a zero-sum game--some participants always end up losers while others end up winners;
- that the outcomes of power differentials among lateral work groups or lateral classes of participants will be similar to the outcomes of power differentials between managers and workers;
- that individual participants can know a priori what the outcomes of a future system implementation and its use will mean for them not just individually but as a group; and
- these participants can turn individual cognition of the outcomes into group political action, such as resistance.

The socio-technical design approach emphasizes yet another comprehensive organized social system. Its guiding insight is that computerization is simultaneously a social and technical intervention (Johansen and Baker 1984; Mumford 1982; Pava 1983). Much of the literature on socio-technical design is concerned with identifying a participatory social process whereby those who will use a new technology have some influence over the design process. The choices implemented through the design process, or the environment which embodies them, are not usually predetermined by the technology. For example, some organizations have adopted word processors and simultaneously centralized their machine operators into word processing centers. There is no feature of word processing machines that requires that a center be set up; the equipment can easily be decentralized and often is. Regardless of which choices are made, end-users must deal with the social dimensions of the computing environment as well as with the particular computer-based technologies.

While we fundamentally agree with the socio-technical approach, we differ in several important ways.

1) We emphasize continuous user participation in the post-implementation phase of CBIS use, not just during the original implementation (Kling and Iacono 1984b).

2) We emphasize a broader spectrum of participants by including the influence of resource controllers and decision-makers.

3) We focus less on design choices that may be implemented in software and more on the social and technical choices implemented in computerized work environments (Kling and Iacono forthcoming).

4) Our approach is less normative than analytical, although we can provide some direction for future design and development.

We argue that CBIS developed from complex, interdependent social and technical choices are better conceptualized from a social-structural perspective than from a rational-technical or rational-political perspective (Pfeffer 1982). From a social-structural point of view, CBIS can be characterized as institutions with organized social systems rather than as discrete entities that can be easily controlled. Resistance to implementations does not have to result from conscious political actions, but it can be the product of the inertia of structure. In fact, this view recognizes that most organizational actors are in the dark about decision-making and what actions they could actually take to effect change. A social-structural view of resistance can include political actions taken by some organizational actors but it does not require awareness a priori of what the outcomes may be.

We will characterize perceptions of CBIS as tools and as institutions in some detail below. At this point, it is simplest to define an institution as social arrangements

which persist and are taken for granted, even when they do not work well and some powerful group members want to make changes. Perceptions of CBIS as tools, on the other hand, contain visions of flexible social arrangements which can be easily changed or replaced by most any group member. While there is no unified body of analysis which advocates understanding CBIS solely from an instrumental perspective, these characterizations pervade much of the literature to some degree.

## 3. THE SOCIAL ORGANIZATION OF COMPUTING

In this paper, we introduce some terminology and develop a framework for incorporating and emphasizing important social and political choices that become part of the history of a CBIS and are embedded in the social structure which support its development and use. These social and political elements of a CBIS are not separate discrete elements in the environment. Rather they can be organized in specific ways which may enhance usability and performance and, paradoxically, constrain implementations and post-implementations.

We do not know all of the social factors that comprise a highly usable and stable CBIS environment. We have conducted a case study which illustrates the difficulties one organization's members faced when confronted with an important CBIS conversion project. Even when participants took major steps to correct discrete problems, they could not effectively complete the conversion during a two-year period. Since no single set of elements could effectively explain the failure, we examined the particular way in which the elements were organized.

We conceptualize these patterns as the social organization of computing. We define "social organization of computing" as the choices about computing (both social and technical) which become embedded in work environments and which are experienced by the users as part of the social practices in their everyday work world. For example, a word processing technician who works in a word processing center will have very different work experiences than a secretary using the very same word processing equipment in an end-user department.

How people experience computing will vary from one computerized work setting to another according to several major variables: implementation strategy, management style, type of computing equipment, major uses of computing, occupations of the users, history of computing in the work group, extensiveness of computing equipment and use, and the adequacy of resources and infrastructure to support the environment. Combinations of these variables will produce both intended and unintended consequences. In addition, the computing practices of the work group may seem irrational to outsiders who have no awareness of the social world within which those particular people work.

We characterize the social organization of computing in a particular setting as arising out of three major determinants:

1. **Political**
   - Who controls new developments of the CBIS and controls the purchase and deployment of associated computing equipment (Danziger et al. 1982; Kling and Iacono 1984b; Markus 1983).
   - Any systematic criteria which characterize patterns of control and access to computing resources such as status, participation in particular coalitions, access to special revenues, etc.
   - The deployment of the organization's slack resources.
2. **Social**
   - The actual distribution of equipment and data across work groups, physical locations, and time (Kling and Iacono forthcoming).
   - Patterns of control and discipline in working with the CBIS and associated computing equipment (Kling and Iacono 1984a; Lawler and Rhode 1976).
   - Organizational practices about training users, computer staff and support staff (Kling and Iacono forthcoming).
   - Skills of computing staff, users, and support staff.
3. **Historical**
   - the sequence of its past social and technical configurations and the sequence of its potential future configurations (Kling and Iacono 1984b).
   - the commitments made in the past which may limit the range of future configurations.

The configurations that develop in any given work setting are not purely instrumental or motivated by efficiency concerns. Each configuration has social and political meanings for CBIS users. Status differences between professionals and clerks may be reflected in the quality of the work stations in their offices. Practices that give managers newer or larger capacity work stations in private offices while clerical workers share older machines in open bull-pens are rooted more in traditional social practices than conscious efforts to increase productivity or efficiency in the office.

Before we present our case, we will contrast characterizations of the social organization of computing as tools and

institutions. The comparison will highlight some of the ways in which social and political elements can be organized. This paper does not test the framework; rather it identifies a framework and interprets it through the case study. This paper raises many questions which merit future investigation.

## 4. TOOL AND INSTITUTIONAL CONCEPTS

Organizational theorists use the concepts tool and institution to characterize types of organizations and their social roles. We use the concepts to analyze major differences in characterizations of the social organization of computing in organizations.

Selznick (1957) distinguished between an efficiency-guided administration of rational means-oriented organizations and the value-laden responsive process of institutionalization. For Selznick, institutions strive for permanence, while means-oriented organizations serve a particular purpose and people can dispense with them once the purpose is fulfilled.

Top managers and other participants often have trouble rapidly improving CBIS which are troublesome. From a tool view, such difficulties would be surprising since "skill and will" should be sufficient. Larger scale CBIS have important institutional dimensions which limit the abilities of key actors to transform some of the abstract information processing capabilities of CBIS into concrete systems which serve their interests. The development of specialized computing arrangements facilitates routine behaviors but constrains novel behaviors. This specialization and routinization stabilizes social arrangements, but also impedes organizational actors who seek large-scale changes.

The SSA payments system provides an illustration of institutional inflexibility. It produces about 40 million checks per month and was developed in the 1950s in Autocoder. It remained relatively intact through the early 1980s. The SSA has tried to overhaul the payments system at least three times in the last fifteen years without success, although a new Systems Modernization Plan that may be completed in the 1990s is in progress. Even though some new laws were passed during the late 1970s (e.g, eligibility requirements) which changed the way in which payments are legally distributed, none of these laws had actually been implemented in software for at least five years.[1]

The distinction between tools and institutions is important for several reasons (see Figure 1):

1. The actual useability of technologies in specific social settings is the critical factor in assessing social benefits (its institutional character), not the potential capabilities of the technology as it may be used by individuals.

2. CBIS that are well-used and have stable social structures for supporting and using them (those that resemble institutions) will be much more difficult to change or replace than those with less social structure and fewer participants (CBIS that resemble tools).

3. CBIS vary from one social setting to another, even when they are identical "off the shelf" systems.

| | TOOL | INSTITUTION |
|---|---|---|
| SOCIAL: | Local and Simple Negotiating Context | Complex and Overlapping Negotiating Contexts |
| POLITICAL: | Local Control and Self Interest | Shared Control and Interest Groups |
| HISTORICAL: | Freedom of the Present Gives Hope for the Future | Commitments of the Past Constrain the Future |

**Figure 1. Three Determinants of the Social Organization of Computing**

When analysts emphasize the information-processing capabilities of a computer-based technology, they are foregrounding its "toolness" or instrumental value for particular social units, e.g., faster access to information for individuals, better turn around times for a work group, or a competitive edge for organizations.

When analysts emphasize the social and political choices that organizational actors have made over time, they are foregrounding its institutional character. An institutional concept incorporates the perspectives of various interest groups as their choices become embedded in the social structures around the CBIS. Long after some interest groups have lost power or influence in the organization, their interests and visions may still be embedded in the way things are done. Some of the important elements in understanding the differences between tool and institutional organizations of computing are described below.

### 4.1 Social Determinants

The image of a CBIS as a tool is associated with tremendous personal freedom. The assumption is that individuals are free to use a CBIS as they prefer without constraints from other sources. The social context of use appears at first glance relatively simple with few agencies requiring compliance to their demands or negotiation with peers. In actual practice, such simple work settings are relatively rare. Issues of social order, power, and

social control emerge where more than one person is interested in the resource and its potential benefits.

Institutional analyses emphasize the social use of CBIS and social control over the computing arrangements. When work groups share an information processing resource, such as a CBIS, the resource managers are likely to have negotiated particular arrangements with different groups at different times. These arrangements cross-constrain shared resources. Over time, large changes become potentially more costly and difficult, since commitments in the past may limit the range of future configurations.

Moreover, different user groups often share some interdependent work schedules and routines. The interdependence of work routines implies that the contribution of some component, policy or practice hinges on its dependency upon other components, policies and work-group practices. For example, when a fast machine replaces a much slower machine, one expects speedier handling of information. However, increased demand on the new machine may result in some groups of users waiting in line for access (Schwartz 1975). Their lost waiting time may exceed the gains of speedier computing. Thus, improvements in some components of an ensemble of computing technologies do not necessarily improve overall performance.

### 4.2 Political Determinants

When CBIS are characterized as tools, there is an underlying assumption that computer-based technologies have no inherent politics: they are consistent with any social order. The assumption is that CBIS implementations can support and enable almost any value system or organizational goals. It is rarely acknowledged that conflicts might ensue from computerization. Typically, it is implied that conflicts will be reduced. Some analysts explicitly claim that computerized organizations will be less authoritarian and more cooperative than their less automated counterparts (Simon 1977). In most of the accounts of office automation, staff are cheerfully efficient and conflicts are minor (Giuliano 1982; Strassman 1977). The theme that computing fosters cooperation and rationality glosses over deep social and value conflicts that social change due to computerization may precipitate. In practice, organizational participants can have major battles about what kind of computing equipment to acquire, how to organize access to it, and the standards to regulate its use (Kling and Iacono 1984b; Kling and Scacchi 1982).

When CBIS are characterized as institutions, politics play an important role. Powerful groups can attempt to influence the developments of a CBIS even when they can not control the outcomes they desire (Kling and Iacono 1984b). DP departments will specialize their work over time as they routinely fulfill the computing preferences of particular groups over the preferences of other groups. They are likely to hire new staff who primarily share their world views in preferring particular application domains (e.g., finance), languages (e.g., COBOL), equipment vendors (e.g, IBM), etc. However, specialization and routinization will reduce the ability of DP to engage in non-routine work activities at a later time. Consequently, an engineering department which seeks computing support for computational programs written in Pascal which runs under Unix on a DEC-Vax will usually find systemic difficulties in obtaining meaningful service from a DP shop which develops financial applications on large mainframes under VM in COBOL. (The reverse is also likely: the finance staff would have difficulty in obtaining high quality data processing service from an engineering oriented computing staff who prefer different kinds of applications, programming languages, and machines.)

The inflexibility of organized computing arrangements impedes those who desire large-scale changes. When routines become outmoded and no longer useful to the organization, many users may push for large-scale changes in the computing arrangements. The organizational routines which facilitated efficient activities and stable environments in the past may prevent the changes which the organization believes are critical to its continuing survival. We call this kind of organized rigidity *social-structural resistance*. Rather than focusing blame for failed implementations on end-users who are characterized as either uncooperative or politically astute, the focus is on the choices made in the past and embedded in the social fabric.

### 4.3 Historical Determinants

When CBIS are characterized as tools, attention is focused on a future of technological perfection and peak performance. If there are problems of productivity today, they can be resolved through the continual acquisition of advanced technologies. It is assumed that problems will be resolved when the company goes "on-line" or when everyone has their own work station. Minor attention is given to strategies for organizing the use of current technologies or to other strategies for social change. A focus on the future helps deflect attention from problems of the present, and also offers hope of salvation. Like people who purchase a new car or stereo with every model change, the heroes of this vision invest heavily and endlessly. When there are problems, attention is focused on new or better technologies, not the limitations of the current context of use.

Institutional analyses focus on the developmental trajectories of CBIS. Institutions develop a character based on the interests they have served in the past, their organizing ideologies, and the world views which bind their participants together. Incremental changes in computing ar-

rangements usually improve the fit between the system and its organization, decreasing the probability that powerful actors could easily replace it. Participants organize their work lives around the belief that activities which have become routinized will persist. They come to depend on existing social and technical arrangements for working and for achieving personal goals. For these users, and for other important actors in the organization, a CBIS can become indispensable.

To illustrate the defining characteristics of tool and institutional concepts, we present a case study which examines computing arrangements in one complex organization.

## 5. THE CASE OF PRINTCO

Summary case data from one manufacturing organization, PRINTCO, is presented here to illustrate the differences between tool and institutional concepts of the social organization of computing.[2] Our data from PRINTCO are based on 44 detailed interviews which were conducted over an eighteen-month period with 40 respondents in a variety of roles, departments and levels of authority. All respondents were either users or resource controllers of the Material Requirements Planning (MRP) system, the core module of the manufacturing computing system in the organization.

PRINTCO is a medium-sized manufacturing firm (about 800 employees) which designs, makes and markets three types of medium-speed dot matrix line printers for the mini computer and small business computer marketplace. PRINTCO began shipping printers in 1975 and maintained a fairly constant demand of 12,000 to 15,000 printers a year during the late 1970s despite market fluctuations. During the 1980s, the firm has undergone tremendous growth to become a major producer of dot matrix line printers.

Key actors built and began operating a simple MRP system in 1977. They wanted better control over their investments in purchased parts so that parts would be there when needed but not so far in advance that costly inventory would build up. The system did what they originally expected, but as the firm grew they began having increased expectations. They began looking for more sophisticated software to handle additional manufacturing computing tasks such as capacity planning and planned orders. An informal committee found a package that satisfied their preferences. However, it ran on a Data General minicomputer, a DG S350 Eclipse, rather than on their IBM System 34.

The conversion began in 1980. DP staff believed that it would take one year. After 18 months, staff had not completed the conversion. Apparently unsolvable problems plagued the project. The hardware vendors provided PRINTCO with telephone support, but little assistance on site. DP had problems hiring more programmers with the necessary skills to work on the conversion. Many of the original systems lacked documentation which further complicated the conversion project. Programmers had patched the MRP system over the years and some had left the company. Current DP staff feared making large scale changes because they were unsure about how some of the modules interacted.

MRP users around the firm complained about DP because they had waited a long time for a payoff. The DP staff's morale was low. They had invested tremendous effort and resources, but no longer believed they could convert to the new MRP system.

The senior vice president of manufacturing saw an impending crisis. He formed a data processing steering committee to guide and direct the DP manager. The steering committee gave the DP manager specific schedules, but he failed to meet them.

The steering committee hired a new DP manager after a six-month search in which they found few acceptable candidates. His technical background was weak, but his managerial skills were stronger. He promptly ended the conversion project. Members of the steering committee had become resigned to sell the hardware and lose their investment in the software. The new DP manager and the committee decided to continue working with their existing IBM System 34, enhancing the MRP system as best they could and possibly leasing another System 34, if necessary. DP upgraded the existing disk and added memory. Additional ports enabled thirteen people to log on simultaneously. The new DP manager established short-term and long-term priorities for departmental work at the steering committee's direction. In addition, the committee required and approved written user requests for new programming tasks.

Unfortunately, the new DP manager did not follow the direction of the steering committee and tried to mobilize support for purchasing a more sophisticated computer (an IBM System 38). The steering committee saw little progress on the enhancements of the MRP system. After ten months, the steering committee fired the new DP manager.

Because of the long and arduous work invested in hiring the prior DP manager, the steering committee decided not to search outside the firm for a third DP manager. Instead they promoted the manager of engineering services to the role of Operations Director, a new title for the DP manager. Almost immediately, they decided to buy an IBM 4331[3] and found MRP software to satisfy their preferences. They started a new conversion project. The preferences of manufacturing staff mobilized the original conversion effort. DP staff avoided requests from other user departments during this time. Staff in other

departments began searching for other ways to satisfy their computing needs.

Several departments obtained DEC LSI-11 micro computers from test equipment cast off by other departments. They upgraded them into usable computing equipment with the help of their own skilled staff. Because of problems in DP, no one had paid much attention to the proliferation of micro computing. Soon six to ten LSI-11s were scattered around the firm. One staff member in the test equipment area became the informal "expert" in operating, programming and using the micro computers.

PRINTCO had hired consultants and new programmers to help in the conversion to MRP II on the IBM 4331. DP staff began working on other projects so that other users would stop complaining. DP had become a larger, more successful organization.

## 6. AN INSTITUTIONAL ANALYSIS OF A CONVERSION FAILURE

We have identified several major problems in PRINTCO's failure to convert from MRP I to MRP II. These problems are the product of key actors foregrounding the potential information processing benefits of the new technologies to the extent that they ignored the social structure of their current computing environment. They were not simply replacing one MRP system for another, they were also attempting to change the organization of social relations which surrounded computing in their firm. Although their computing environment was small and somewhat informal, it was usable and stable, i.e., it was highly organized.

How can we characterize the social organization of computing at PRINTCO when they first began their conversion? We have selected episodes which illustrate the political, social and historical determinants of the social organization of computing.

### 6.1 Social Determinants

**Work Prioritization Schemes of Support Staff.** The first DP manager had served as a one-man DP shop during PRINTCO's earliest days. He spent most of his energy programming even after he added several more staff. Requests came into DP informally. The ordering of projects and distribution of programming time often depended on informal contacts between programmers and users. Short- term, routine projects received the most attention from staff and long-term, non-routine projects received little attention or effort. The conversion from MRP I to MRP II was a novel effort which did not fit the routine established work patterns of this small DP shop.

Since the implementation of the original MRP system, the data processing department had become specialized in altering reports from existing systems written in RPG-II. The DP staff became skilled in producing the routine MRP reports for manufacturing and occasional reports for finance. The programmers were demand driven and spent their time responding to constant requests for major and minor enhancements. These enhancements were relatively simple, concrete, predictable, and generated immediate results, compared with converting the MRP system.

The programmers and end-users worked together in very simple face-to-face negotiating contexts. Programmers would comply with these requests on a first-come, first-served basis with no planning or prioritization schemes other than what the programmer felt s/he could do first.

After the second DP manager was hired and the conversion project ended, the new manager instituted some prioritization schemes for ordering programming work based on the decisions of the members of the steering committee. The manager gave work to the programmers according to their skill and availability, not according to their informal ties or rapport with end-users. It was hoped that these changes would move the DP department from a simple operation to one that could handle more complex work tasks and larger projects.

**Skills of Computing Staff.** The MRP II software was purchased from an outside vendor because none of the DP staff had adequate software development skills. Development skills had been unnecessary in the past since they had worked only on maintaining their present CBIS, the MRP system and some finance systems. They had never before attempted to hire new staff with specific software development skills. PRINTCO's managers presumed that their DP staff had all the skills necessary for most computing tasks or could easily acquire them. They had not realized that the skills and work routines of the department had become very specialized and limited.

PRINTCO's programmers had learned to program on the job in RPG-II. The new MRP II software for the conversion project was technically more sophisticated than the old MRP I software. The staff had purchased the new software to satisfy MRP user needs in manufacturing. The new software would not run on the IBM mini computer that the DP staff understood. Powerful manufacturing managers decided to purchase the hardware on which the new software would run. However, none of the programmers had ever used BASIC, the programming language of the new environment. They attended several BASIC programming classes but their learning curve was slow. Key actors tried to hire people who could program in both BASIC and RPG-II to expedite the conversion. However, they could not locate and hire new programmers with programming skills in both languages.

**Laissez Faire Attitudes.** Key actors at PRINTCO had developed a laissez faire attitude toward the DP staff and the resources they might need to develop an adequate social organization of computing for the conversion. Once monies were allocated to equipment purchases, powerful actors stopped paying attention to the course of developments. The original DP manager had never been a powerful organizational actor who could fight for the resources he might have needed.

Other staff in the organization, especially staff in engineering, had to develop their own computing environments. Many of these staff had the skills to develop an adequate infrastructure of support for their own work groups even though they had very little money to spend on equipment. Since they were effectively excluded from discussions about the conversion project, both at the early stages and later when the steering committee was organized, the firm never took advantage of the skills and expertise that had developed around computing in the engineering departments.

### 6.2 Historical Determinants

**Specialization.** The most powerful organizational actors were located in manufacturing and finance. They attempted to control the direction of DP and were the best served customers of DP.

Programming support and computing operations became specialized around these services running a small set of CBIS and making minor enhancements. The existing MRP was custom tailored to PRINTCO's manufacturing operations, and the staff wanted to preserve all of its virtues while adding the new capabilities of MRP-II.

**Past Commitments.** The organization of computing commitments led to problems with the MRP conversion. Any implementation of a product bought outside the firm would have to be custom tailored to match the virtues of MRP-I. It was effectively impossible to conceptualize an MRP-II without accounting for existing commitments to MRP-I and the capabilities of the DP staff.

### 6.3 Political Determinants

Before starting the conversion project, key manufacturing staff members focused on equipment decisions and negotiating the purchase. They based their decisions on the preferences of users in manufacturing who wanted a sophisticated on-line MRP system. The informal selection committee invested time and energy into selecting equipment. Once the equipment was purchased, they returned to their own routine work. After a year had gone by, some managers started asking critical questions about the conversion.

They discovered that there were more problems than progress. The conversion effort was expensive and showed no results. The laissez faire attitude of the company toward DP had not proved successful. Key actors who had originally thought of their new MRP system as a tool for manufacturing staff attempted to gain control over many aspects of the computing environment. They formalized their own membership in a steering committee. Within the framework of the committee, they began to focus on changes in the social organization of computing that might enhance and support the conversion.

Some staff, especially staff in engineering, were not involved in the conversion nor were they brought onto the steering committee when it was created. They began to revolt and sought their own microcomputers. These staff viewed their micros as tools which helped them develop small scale CBIS independently of the ineffective DP shop. The "micro-revolution" lasted a year before control over computing equipment and programming was recentralized under DP.

During the conversion project, two computing environments were developing independent of each other. Each required investments of time and money from the organization. Each was left to run its own course with little support and few resources.

## 7. DISCUSSION

We have argued that the characterizations of CBIS in organizations can vary from ones that highlight the information processing capabilities to those that focus more on the organization of the social systems in which CBIS are embedded. While the former emphasizes rational use and the ability to direct and control outcomes, most complex organizations have computing arrangements that more closely resemble institutions. As institutions, the use and control of the CBIS are shared among interest groups with different preferences, stakes, and historical commitments. The social structure of the institution adds complexity and inertia to the attainment of expected outcomes.

At PRINTCO, key actors made the decision to purchase a new MRP system based on its technical capabilities and potential benefits to users in the manufacturing department. Their computing environment had many organized work practices, commitments, specializations and routines which they did not take into account when they made the decision.

Routine work specializes the social organization of computing. Staff at PRINTCO specialized in producing manufacturing computing reports. They performed these activities well. A combination of specific skill levels, the organization of their work prioritization schemes, and commitments to certain users in manufacturing led to

computing arrangements which supported their routine work but did not support software development. Even if they had made efforts to attract software developers by offering higher salaries than they paid their staff programmers, they may have not been able to find or attract such staff because of the commitments they had made to specific combinations of technologies.

Like the SOPs which develop in bureaucratic organizations, highly organized computing environments help staff stabilize and routinize their work environments. While PRINTCO is only one case, we believe that it illustrates an important paradox: the more successful a current implementation is in terms of stability and usefulness, the more problematic it may become when change is preferred by organizational actors or it is required for organizational competitiveness.

Even when CBIS are fairly primitive and social relations are informal, as it was at PRINTCO at the time of the conversion, elements of the computing environment had became highly organized and taken for granted. Critical social dimensions that could have been taken into account by organizational actors include the skills and work expectations of computing staff, the work prioritization schemes that had developed between computer staff and end-users, who controls new developments in the computing environment and the deployment of resources, organizational practices about training users and computer staff, the degree of specialization in terms of computing software and hardware, and past commitments to the specific work groups which effectively exclude other groups from decision making.

We argue that computing arrangements that resemble institutions will arise wherever there is shared control and interest groups vying for the resources of a CBIS. While tool-like organizations are more rare, we have encountered them in small work groups that are separate from the mainstream activities of their organization. It is not just a matter of decentralized computing arrangements but work that is decoupled from the major work of the organization. Analyses that foreground the "toolness" of computing technologies are more useful for understanding how certain technologies can be used and organized under more ideal conditions (Cash and Konsynski 1985; Mautz, Merten and Severance 1983). An institutional analysis is critical for understanding how CBIS are likely to be used in more complex work settings where constraints and limitations are part of the everyday work world. One can begin to see the likely advantages and problems of particular computerization strategies in these work settings.

## 8. ACKNOWLEDGEMENTS

The authors acknowledge the helpful comments of Kenneth Laudon, Maria Porcella, Rob Rittenhouse and Jon Turner. They helped sharpen our ideas in an earlier version of this manuscript. For this version, helpful comments from Professor Srinivasan and several anonymous referees are gratefully acknowledged. This research was supported this research under grant #81-17719 and DCR-850-8484

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## 10. ENDNOTES

1. Walter Doughtery of IBM, Yorktown Heights, reported this situation in a lecture to the Department of Information and Computer Science, University of California, Irvine, October 27, 1983.

2. For a chronology of system developments at PRINTCO, please refer to Kling and Iacono (1984b).

3. The IBM 4331 was larger than the System 38 which the steering committee rejected. It was a potential platform for a substantially more sophisticated computing environment.