Some neglected outcomes of organizational use of computing technology—And their implications for systems designers

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INTRODUCTION

Twenty-five years after the first commercial application of computers, it now seems possible to assess their consequences on the basis of user experience. Until recently, most assessment was done on the basis of early predictions inspired by the technological capabilities of computers. But these predictions have missed the mark considerably. Not only did the technology of computing fail to stand still, but it has been demonstrated time and again that just because a capability exists does not mean that it will be used as intended.

The predictions were dramatic: increased centralization, reduction in the number of middle managers, decreased personal autonomy on the job. But the research findings were not dramatic: few structural changes occurred in organizations using computers, usually only those reflecting the creation of EDP departments. If anything, the findings have shown that the effects of computing are "subtle, limited and complex in their patterns." This subtlety and complexity makes computer impact research difficult to do. Consequently, not much is done, especially inside organizations. One manager of management systems in a major industrial corporation recently told me: "We go through all sorts of gyrations to justify our systems development efforts—cost benefit analysis, ROI calculations and so forth. But we have yet to go back to see whether we achieved the benefits we expected. We know that the benefits are too difficult to measure and too difficult to trace back to their causes." Academic research has begun to fill the gaps in knowledge about computer impact on organizations, but the research has sadly neglected some important types of outcomes.

RESEARCH FROM THE IMPLEMENTATION SCHOOL

Two general philosophies pervade the academic literature on computing use in organizations. One stream of research focuses on the factors contributing to success or failure of computerized information systems. The second focuses on computer-induced changes for the individual employee or for the organization as a whole.

A number of researchers have tried to identify what factors influence or determine the success of information systems and management science projects. To call this rather diverse collection of operations researchers, management scientists and management information systems specialists the "implementation school" may be stretching a point. But writers such as Bean, et al., Schultz and Slevin, Lucas, Gibson, Ginzberg and Alter share a common focus, first, on individual information systems and, second, on a specific type of outcome.

Both focal points of the implementation school distinguish it from the organizational school, to be discussed shortly. The first focal point, individual information systems, is a significant asset for the implementation school, because research has shown that different types of systems applications have different outcomes and that there is something in the nature of application types which affects organizational outcomes. The organizational school, in contrast, tends to lump all types of applications together into indices of computerization for an entire organization, ignoring the previously-cited research and the fact that some parts of an organization may be unaffected by computing.

Limitations of the implementation school

The second focal point of the implementation school, however, puts significant limitations on the research of this school. This is the school's focus on one particular type of outcome, namely, what happens when the systems designer turns the system over to the user ready to be converted or used. Different researchers in the school have used different measures of this outcome: Some have used the success or failure of the system to be implemented, others have used rates of use, still others have been measured when systems designer and the facts that some parts of an organization may be unaffected by computing.
This focal point of the implementation school has led to some serious limitations on its research. The first limitation relates to time. The startup of a new or modified information system is roughly analogous to the startup of a new plant. One does not simply flip a switch and begin to use the new technology. There are false starts, glitches and occasional trips back to the drawing board. Many systems designers and users I have interviewed express the opinion that working the bugs out of a new system takes anywhere from six months to two years. One major implication of this is that the “permanent” effects of an information system in an organization may not be felt by users or observable by researchers until some six to 24 months after the system is installed, that is, after users have some experience working with it. And, because of its focus on success defined at the point in time when the system is installed or turned over to the user, the implementation school has not been able to examine outcomes of information system use.

Neglected organizational outcomes

There is another limitation resulting from the implementation school’s focus on “success of the information system.” This is the failure to recognize the organizational consequences of information systems. In the effort to construct measures of success or failure of computerized systems, defining and redefining “usage,” “utilization” and “user satisfaction,” implementation researchers have left the search for organizational outcomes to researchers who did not distinguish in form or content between payroll systems and investment analysis programs. Almost totally ignored by implementation researchers have been the outcomes which relate to social and political aspects of organization functioning.

One manifestation of this organizational “ignorance” is the implementation school’s definition of the “user.” Systems designers interested in researching the success of their systems have typically, and not unreasonably, been most concerned about the satisfaction or acceptance of the person or group who commissioned the new system and who may have also paid for it. Therefore, the client of the systems designer is often designated the user of the system. The problem comes in when there are other, hidden users of the system, maybe those who only supply data to it. Often these other users have different perceptions of the success of the system, different feelings of satisfaction with it, from the client group. Including these might radically alter the researchers’ measures of system success.

A financial information system which I have recently studied illustrates this point. This system consolidates financial data from the divisions of a large, decentralized corporation. In response to my question, “Who are the users of the system?” I was told that the main users were members of a corporate staff accounting group. Further questions revealed that divisional accountants provided the data to the system and maintained it.

“Aren’t the divisions also users of the system?” I asked.

“Well, actually, the divisions don’t use the system as much as they could. We’re disappointed that they haven’t used the variable report writing facility to generate new types of financial analyses.”

Interviews with corporate accountants identified a long list of benefits with which the new system provided them: automatically consolidated financial statements, decreased workload, faster month-end closings, standardized input from divisions, more and better management information, greater flexibility around external reporting, decreased disruption of financial activities caused by internal organizational changes. In contrast, divisional accountants found the system to be an obligation with few or no benefits to them: “Creating and maintaining the database for this system were huge jobs. Our division already had a smooth-running system for providing this information to Corporate, and it took two years to iron all the bugs out of this one. Also, it doesn’t do a thing for me. The data in it is not at a level of detail where I can use it, even if I did have a staff of programmers to help me use the report writer. So I need to maintain a dual system for my own internal reporting needs.”

This example illustrates that not all users of an information system see the system in the same way and if the people in this organization had taken a more inclusive view of users than just the corporate accounting group, they would have seen a distribution of outcomes, of costs and benefits, of satisfactions and dissatisfactions, associated with the system. This distribution is influenced by the social and political factors in the organization, factors previously neglected by most implementation researchers (with the notable exception of Gibson), who most often focus on the system itself and the psychological attributes of client-users.

RESEARCH FROM THE ORGANIZATIONAL SCHOOL

The second research stream, which I’ll call the organizational school, includes the studies of organizational theorists and sociologists like Whisler, Hoos, Kraut, Blau, Stewart, Reif, Hofer, Robey and Pfeffer. The organizational school examined the effects of computing on a full range of variables reflecting psychological and psychotechnical outcomes for individuals. The effects of computing on job task, autonomy, stress, satisfaction with work and employment patterns are some examples. But early on, the organizational school began to concentrate efforts on variables reflecting changes in the organization as a whole. And the area of impact which attracted the most attention was the effect of computing on power, authority and influence in the firm.

The first published predictions about computer impact on organizations had raised this issue. Leavitt and Whisler, in 1958, saw the potential of computing technology to store, process and analyze large quantities of data in a single place. They reasoned that access to this information would give managers the power centrally to control dispersed business activities. Managers had formerly had to delegate some of their authority, because of their limited ability to gather and digest information. The increased centralization of control...
brought about by computer use would, they believed, reduce autonomy of middle managers and lower job satisfaction. Also, many middle management positions would be eliminated, replaced by computer applications.

The wave of research which followed these predictions did not significantly support them, however. Some industries, like insurance and banking, did appear to become more centralized, but researchers are still debating the issue. What they are debating, though, is how to study it, not whether the issue is important. The major contribution of the organizational school has been to identify changes in power, influence and control as potential effects of computing use and to legitimate the area of study. It made this contribution in spite of its tendency to focus on outcomes for the organization as a whole rather than on the more clearly delimited set of organizational outcomes which result from individual computerized information systems.

Outcomes for organizational power and influence

Recently, research in the area first investigated by the organizational researchers has begun to pay off. A number of studies, which may represent the beginnings of a third major school of research, have appeared in the last several years using the focus on individual information systems of the implementation school and the focus on outcomes for organizational power and influence of the organizational school. Kling found that computer-based systems reinforce the existing distribution of power in American municipalities. They provide differential support to mayors and city managers in smaller cities and to departments in the larger cities. Bjorn-Andersen and Pedersen found that computing use in the business organizations they studied contributed to shifts in power among affected groups. By changing the basis of power of various organizational members, that is, by changing aspects like one’s position of centrality in the flow of work through the organization, one’s expert knowledge and one’s access to up-to-date information, use of computing technology has created “winners and losers in the fight for influence.”

Incidentally, Bjorn-Andersen and Pedersen noted that the early organizational research may have failed to identify these subtle changes, because the concept “centralization” is “too crude and only covering parts of the very complex interpersonal relationships potentially to be altered by the introduction of computer systems.” Pfeffer lends weight to their observation. According to Pfeffer, real changes occurring in organizational processes of power and influence may not be immediately reflected in measures of organizational structure, like degree of centralization.

CASE ILLUSTRATION—ORGANIZATION AND SYSTEM OUTCOMES

A recently published case study by Conrath and du Roure illustrates two points I have been making; first, that benefits from, and incentives for, using computing technology vary across user groups, and second, that the success or failure of the information itself is related to and perhaps secondary to organizational outcomes, such as changes in power and influence among user groups.

Conrath and du Roure’s case describes the implementation of a comprehensive logistics system in a branch of the U.S. military. The new system provided on-line access to up-to-date status information for all materiel for which the branch had responsibility. Unfortunately, the case does not tell us who initiated the system, who supported its development, and who bailed it out with an expensive redesign when it was close to failure. We are, however, told the outcomes and some details of the organizational arrangements into which the new system was introduced.

Prior to the development of the new system, all data were collected into a monthly report for senior officers. On the average, the report was a month out of date. Consequently, it was not well used in the logistics decisions of the branch. Requests for materiel were routed to junior officers, who forwarded them up the chain of command to an officer of high enough rank to handle the request. Information about the requests was obtained by telephoning those believed to possess the information.

The new system collected all relevant information automatically and made it available to junior officers through on-line terminals. No telephone calls were required to obtain information. Furthermore, the system determined the optimal way to transport materiel from one point to another, minimizing distance.

When the new system was first used, “the greatest impact was a change in the effective structure of the organization. It went from one which had been very hierarchical, very vertical, to one which was primarily horizontal. . . .” The chain of command almost seemed to be superfluous. The new system enhanced the power base of junior officers by giving them access to information. This started to erode the power bases of senior officers.

But then the reaction occurred. “The commanding officer (three-star rank) demanded that the old system be continued in parallel with the new. The roles of the more senior officers were to be maintained. The argument given was that the computer-based system was not yet sufficiently reliable. The underlying reason, however, was the effect that the information-communication system had on the perceived value of the authority structure. In fact, once the old system was re instituted, the stress on supplying all the required data to the new system was relaxed, and the new system did become less reliable. The cause-and-effect relationship, however, was the reverse of the way it was presented.”

The senior officers had discovered that the new system eroded their power base, a trend which, if continued, would have undermined their authority. The parallel system allowed them to maintain their traditional position. But if the dual system had continued very long, the technical advantages of the new system would have been lost. Someone decided that this should not happen and authorized the redesign of the system to include “a monitoring system designed to provide the perception of participation and control to the
more senior officers, but a system which was computer-based and integrated into the original information-communication system."

CONCLUSION

The organizational school discovered that changes in power and influence are one major class of computing use outcomes. Research in this tradition, however, has generally failed to consider differential effects of different computer applications. The implementation school has had almost the reverse set of strengths and weaknesses: a focus on individual applications but a failure to consider power and influence.

The focus of implementation researchers regards as the user the person or group who requested system development. This, in turn, has encouraged implementation researchers to search for black-and-white outcomes, success or failure, within a single user group. This paradigm cannot distinguish between, for example, a system which failed because users did not have the appropriate cognitive style to use it and a system which failed because the initiating user imposed it upon other users who had sufficient power to sabotage it or to get around it in some way. Surely, these two causes of system failure would lead to different prescriptions for improving the activities of systems designers.

In the second instance, the organizational outcomes of the new system, namely, an undesirable imposed change, had a secondary effect on the information system itself, namely sabotage. The failure to recognize the interaction between consequences for the organization and consequences for the information system has been a limitation of implementation research that may be hindering the improvement of system design practice.

Sabotage is one kind of interaction between organizational outcomes and system outcomes. Maintenance of parallel systems is a second. Making changes to the information system itself after installation may be a third. Requests for changes to already implemented systems sometimes reflect user reactions to changes or disruptions in their organizational practices brought about by using a new computerized information system. This is clearly what happened in the Conrath and du Roure case just cited.

If the best aspects of both schools are combined, the application focus of the implementation school and the power and influence outcomes variables of the organizational school, the neglected outcomes are brought into focus. It then becomes possible to perform what can be called computer/organizational impact analysis. In this type of analysis, one traces organizational outcomes of computing use back to their causes. Changes in power and influence among various user groups can be traced back to the interaction of new system designs with existing organizational arrangements, as in the case by Conrath and du Roure. These same organizational outcomes can then be projected forward into probable consequences for the success or failure of the information system itself.

If systems designers performed computer-organizational impact analysis before they designed and installed new systems, they might anticipate information system failures and learn to avoid them by manipulating aspects of system design and implementation with a view toward eliminating undesirable organizational outcomes.

Computer/organizational impact analysis might also help managers in organizations create desired organizational changes. Galbraith7 and Pfeffer19 have shown that computerized information systems can be used to change the structures and processes of organizations. However, the research has yet to tell us how to design computerized information systems to make these desirable organizational changes possible. Computer/organizational impact analysis may fill this gap, by shedding light on some of the neglected outcomes of computer use.

REFERENCES


