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Computing and Organizations: What We Know and What We Don't Know

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ABSTRACT

In examining the literature on the impact of computers on organizations, we find it puzzling that many people are willing to speak and write as though the overall effects of computing technologies were a foregone conclusion. Many observers seem to believe that computer impacts can be determined *a priori*, by deducing from abstract principles what the effects of computers are bound to be. We argue the opposite: that evidence on these subjects is actually fragmentary and very mixed, and that *a priori* arguments are particularly inappropriate in light of the wide range and variety of variables at work in these situations. In the following pages we examine the literature on the effects of computing on the numbers and quality of jobs on management decision-making and on organizational dealings with clients and customers. We also consider various perspectives on the *causes* of organizational decisions to adopt computing in the first place. Our conlusions are similar for all of these areas: virtually none of the studies mounted to date has been capable of yielding a persuasive and comprehensive view of computer-induced social change. We need to go beyond individual case studies, to initiate a program of comparative research on representative samples of organizations.

QUALITY OF WORK The research literature on the impact of new information technologies on job content and job satisfaction provides a mass of contradictory findings. The wide range of informed opinion can best be illustrated by describing the two extreme positions: deskilling *versus* upgrading. The deskilling perspective suggests that automation is used to strip relatively-skilled jobs of their conceptual content (Braverman). Those conceptual tasks previously integrated into work are either built into computer algorithms, or are transferred to a numerically smaller number of high-level specialists. This deskilling manifests itself in two distinct ways: *intra*-occupational changes, where the skill content of a particular job decreases over time; and *inter*-occupational changes, where the number of persons in skilled jobs shrink and the number of employees in unskilled jobs rises. In the second of these cases, one empirical indicator of computer-generated deskilling is a shift in the occupational structure of the white-collar workforce. The deskilling position implies a more polarized pyramidal distribution of skill: a mass of unskilled clerical workers at the bottom and a small number of conceptual workers at the top (Driscoll). Kraft and Greenbaum have taken the analysis even further, arguing that even conceptual jobs like programming are being increasingly deskilled.

In contrast, Guiliano and others have argued that computerization and other new information technologies upgrade rather than deskill white-collar workers. The upgrading thesis suggests that automation primarily occurs in already-routinized contexts; the new technology takes the drudge work out of information processing by automating the most repetitious manual aspects, leaving humans to concentrate on conceptual and decision-making tasks. The potential victims of such upgrading are the lowest levels of clerical workers who manually manipulate data. However, this lowest stratum need not be adversely affected by automation, because the introduction of computers manifests itself in the *relative growth* of higher-level jobs and the relative shrinkage of lower positions. The *absolute number* of low-level workers need not decline, because total white-collar employment is still growing. Thus, in direct contrast to the deskilling approach, the impact of computer technology is said to be an

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increase in worker satisfaction, and a shift in occupational structure away from a pyramid shape (few skilled, many semi-or unskilled) toward a diamond shape (few top managers, many professionals and middle managers, few clericals) (Zuboff).

Many case studies of intra-occupational change describe loss of conceptual content, fragmentation, and deskilling of white-collar work after computers are introduced. However, some observers also find consolidation of tasks, and upgrading. Attewell's study of the insurance industry confirms that both upgrading and deskilling occur within occupations being computerized, but finds that upgrading predominates. Several quantitative studies of the whole economy find little evidence for *intra-occupational* deskilling since 1949, but these studies are based on government data whose quality has been disputed. Evidence on *inter-occupational* change is similarly contradictory, although most case studies report upgrading. Quantitative studies based on disputed DOT data don't find deskilling. Studies which ask workers about their experiences with computerized work are typically positive, although some report increased time pressure and increased supervision. We conclude that *both* deskilling and upgrading can occur following computerization. Theoretically, what matters is to find out what factors and situations produce these various outcomes, and the relative frequency of each effect. We propose systematic surveys to answer these questions.

EFFECTS ON EMPLOYMENT Pessimists anticipate substantial unemployment due to the labor saving effects of new information technologies. Several input/output models of European economies confirm this, albeit based upon shaky data. Certain case studies show employment losses of up to 50% in fields like metalworking. But these studies are not from representative samples of businesses and so must be treated with caution. Optimists point to earlier periods of technological change when rapid growth in productivity did *not* create unemployment. If goods become cheaper, demand grows, and total production increases. Thus, even with more productive technology one still needs as many workers as previously. This optimistic position uses the concept of "long waves" of economic boom and bust, in which the introduction of new technologies (steam power, electricity, automobiles, micro-electronics) causes sudden surges in investment, an upswing in economic activity, and increases in employment. At present, insufficient evidence exists to decide between the optimistic and pessimistic analyses. We need careful studies of representative samples of firms, documenting their employment levels at various stages of computer automation, to properly evaluate the employment impact of the new technologies.

MANAGEMENT EFFECTS Students of organizations have frequently observed that control over information is a source of power in organizations. As such, new technologies that alter the quality and availability of information are likely to shift balances of power between organizational groups: workers, supervisors, middle managers, executives (Olson and Lucas). Laudon and others viewed such processes as leading to *increased centralization* of power in computer-automated organizations. Leavitt and Whisler predicted that new information technologies would eliminate whole layers of middle management as improved information led to centralized decision making higher up the corporate heirarchy. Several case studies have supported this view; and recent research on MIS and computer mail emphasize "top down" control. However, there is some evidence for the opposite view, that the increase in communication resulting from new technologies can decentralize decision making. Blau *et al.* have found that, far from eliminating levels of management, computers are associated with an increased number of levels of line management, and with enhanced local management decision making.

In several studies of the introduction of computers in local governments, Danziger, Dutton, Kling, Kraemer, and Northrop have documented subtle shifts in power among supervisors, bureaucrats, and managers. Contextual variables were also found to be important: the effects in small municipalities were not the same as those in larger ones, for example. Robey offers a complementary view, arguing that sometimes computers don't effect the distribution of power at all, sometimes they reinforce the status quo, sometimes they aid decentralization.

If we assume that there must be a single effect of computers on management then these case studies appear contradictory. However, if we assume a range of effects is possible, then the task of future research becomes clear. We must identify those variables which can account for differential outcomes through comparative research on representative samples of organizations, examining factors such as size, industry type, degree of prior routinization of work, skill-level of workforce, and so on.

ORGANIZATIONS AND THEIR PUBLICS Changing information flows will also alter relationships between organizations and their environments—particularly the general public. Rule, Shills, and others have focused on how computers whet the appetite of organizations, especially government, for information on the people with whom they deal. Others have speculated on new kinds of informational services which may become available to the populace because of computers. Much additional research is needed in this area.

THE IMPETUS FOR INNOVATION There is a common belief that organizations adopt computer and information technologies in order to pursue goals of efficiency and cost-effectiveness. Against this view is a position first articulated by Ellul that technology is a self-sustaining force, which generates needs for itself: once a technology is available it is inevitably used, applications are found for it. Odd as this latter position sounds, there is certain evidence for it. Several writers have found that whatever the intentions of managers, computers do not necessarily save money or increase efficiency. Rather than improve activities already in place, computers may be adopted for, or give rise to qualitatively new organizational activities. The application and spread of computers can reflect power politics within organizations rather than efficiency, and so on. Such preliminary insights also suggest the need for future comparative research into the causes of the introduction of new computer-based technologies.