ORGANIC ORGANIZATIONS AND CENTRALIZED UNITS:

USE, CONTEXTS, AND OUTCOMES OF WORD PROCESSING

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INTRODUCTION

The implementation, management, and impact of computers in organizations has received increasing attention since the first studies in the early 1960s. This growing literature first focused on mainframe computing for transaction processing, then management information systems, and recently on computer-mediated communication systems and end-user computing (Attewell & Rule, 1984; Kerr & Hiltz, 1982; Kling, 1980; Rice, 1980; Rice & Associates, 1984). Yet the use of computers for word processing has received a scant proportion of this attention. The significance of the diffusion of word processing technology (both dedicated and personal-computer-based) is due both to the much wider range of features of WP compared to those of pen, pencil, dictation or typewriter technology, and to the fact that it was the first experience that most workers had with end-user computing.

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Those prior research studies and popular accounts about WP jobs that do exist have tended to focus on issues such as (1) skill requirements, (2) job satisfaction and turnover, (3) ergonomic concerns, and (4) implementation (see, for example, Bird, 1980; Downing, 1980; Gordon, 1976; Gregory & Nussbaum, 1982; Harkness, 1978; Johnson & Rice, 1984; Machung, 1983; Sauter, Gottlieb, Jones, Dodson & Rohrer, 1985; Scott, 1982; Smith, 1984; Taylor, 1980; Westin, Schweder, Baker, & Lehman, 1985; Zimmerman, 1982).

The first and second concerns stem from the perception that because WP equipment and software have been, until recently, expensive and dedicated to one specific task, the content, product and social relations of the job have been largely decoupled from the remainder of organizational activities and standardized into separate, routinized tasks, structured in the form of word processing centers, in order to optimize managerial control and financial investments (Gregory & Nussbaum, 1982). But, so the argument goes, this increased control and technical specialization reduces the level of skill required to complete tasks and decreases task feedback, information sharing, and worker motivation (Braverman, 1974; Vallas, 1988), as operators are trained to follow directives, not their own intuition or experience. It also limits what WP operators can contribute to their organizations. The third concern about WP jobs stems from these influences as well as from potentially unhealthy aspects of working intensively with visual display terminals (VDTs).

The fourth concern is part of a strong tradition of interest in the influences on and process of organizational innovation in general and implementing information systems in particular (Kimberly & Evanisko, 1981; Lucas, 1981; Markus, 1984).

TECHNOLOGICAL DETERMINISM OR CONTEXTUALISM?

Early analyses of the impact of computers in organizations argued quite strongly that technology has a direct, unmediated effect (whether positive or negative) on users, applications, organizations and even societies (see Dunlop, 1962, or Whisler, 1970, for examples). These studies concluded that implementing mainframe computers for transaction processing directly led to increased centralization and job fragmentation. There are at least two troubling assumptions of this thesis of technological determinism. The first is that technology is an autonomous force that independently causes impacts. The second is that the same impacts should follow from the same technologies, regardless of different contexts.

However, Davis and Taylor (1979) examined the validity of technological determinism by testing the methodological soundness and consistency of results of over a 100 investigations of relationships between technological characteristics and job design, group structure, and organizational structure.

They found considerable direct evidence of flexibility in the design of technology and much reason to doubt technological determinism as an explanation of organizational structure or administrative decisions. Barley (1986), Bostrom and Heinen (1977a, 1977b), Elden et al. (1982), Kraemer, Dutton and Northrop (1981), Iacono and Kling (1987), Kling (1980), Kling and Scacchi (1980), Markus (1984), Reimann and Inzerilli (1979), Simon (1979), and Tenne and Mannheim (1977), all make generally similar points.

Other researchers outside the field of implementation or computing impacts have made the general argument that macro- and micro-level contexts must be integrated in theoretical and analytical models (James & Jones, 1976; Rousseau, 1985). They call for joint consideration of environmental, organizational, workgroup, and individual factors (Kimberly & Evanisko, 1981).

The first general hypothesis of this study, then, is that contextual factors will be significant additional or mediating influences on outcomes, over and above the influence of use of WP technology.

The major contextual organizational factors may be best represented by the extent to which an organization is "organic" or "mechanistic" (Aiken & Hage, 1971; Burns & Stalker, 1961; Pearce & David, 1983). These are two extremes of a multdimensional concept. Organic organizations are characterized by less bureaucracy, less emphasis on hierarchical status, fewer programmed procedures and more flexible policies, and greater encouragement of informal communications than are mechanistic organizations. Information sharing, job satisfaction, performance, and support for innovation are more likely in an organic organization because of increased flows of information, organizational responsiveness to change, and acceptability of workers' expertise (Dewhirst, 1971; Markus, 1984). However, there is some disagreement as to whether more organic organizations might be more successful in initiating innovation, because mechanistic organizations may be more successful in implementing innovation due to their ability to monitor, manage, and mandate such change (Lucas, 1981).

The second general hypothesis, then, is that mechanistic contexts of WP usage will be associated with (1) consideration of turnover, (2) reported sources of ergonomic problems, and (3) less successful implementation.

A major contextual variable in much of organizational research concerns organizational structure (Berger & Cummings, 1979; James & Jones, 1976; Porter & Lawler, 1965; Rousseau, 1985). As organizations develop to accomplish input, conversion, and output processes, and as organizations become more bureaucratic and technological, different functional and structural components, or division of labor, arise. This differentiation in turn creates demands for coordination, control, and integration, of different decision processes, information requirements, and managerial policies. Thus job outcomes will be influenced by organizational and workunit processes differentially in different organizational and workunit structures.

Of the many aspects of structure, this study will focus on workunit centralization. In accord with Bikson (1987), and Gutek, Bikson and Mankin (1985), we argue that structure at the workunit level is a critical contextual influence on the relationship between technology and outcomes, because this particular technology is located in the workunit, implementation takes place at the workunit, tasks are more similar within than across workunits, and considerable interpersonal (supervisory and peer) communication takes place in the workunit. Further, past research provides convincing evidence that organizational structure interacts with other organizational variables to influence attitudes and behaviors (Porter & Lawler, 1965).

The third general hypothesis, then, is that relationships of usage, contexts, and WP outcomes will be significantly moderated by whether the WP unit is centralized or decentralized.

CONCEPTS AND RATIONALES

This section discusses the theoretical bases for specific concepts used in this study to represent (1) some outcomes of using WP technology, (2) use of WP technology, and (3) mechanistic/organic contextual factors.

Outcomes

Skill Requirements, Attitudes and Turnover

Skill requirements and attitudes toward one's job associated with computerized information work in general and WP jobs in particular is quite diverse.

1. Over half of the managers of 55 office automation sites reported that task activities generally involved greater satisfaction, skill levels, and task variety, while around a quarter reported increases in pace fluctuation and stress (Gutek, Bikson & Mankin, 1984).
2. Buchanan and Boddy (1982) found that 23 WP operators and authors became *less* skilled in some ways (less concern for spacing and format, less need to know technical terms related to layout, less understanding of authors' special needs) but *more* skilled in others (constant relearning of formatting and editing codes, greater concentration, handling lost or erased files). Although pay, promotion opportunities, and control over the quality of typing increased, there was reduced "task variety, meaning and contribution, control over work scheduling and boundary tasks, feedback of results, involvement in preparation and auxiliary tasks, and communication with authors" (1982, p. 1).

3. Kalimo and Leppanen (1985) found that physiological stress levels did not, essentially, vary by job type, but VDT operators reported greater job satisfaction, and, as did photocompositors, greater competency and activity levels, than did proofreaders, due to increased task variety, feedback, and output control that the computer allowed.
4. Analyzing Department of Labor Statistics for the insurance industry, Attewell and Rule (1984) found evidence for both skill upgrading *and* downgrading in 13 job categories. In the overall economy, they found little change in job categorizations, except perhaps a narrowing of skill differences.
5. Glenn and Feldberg (1977) critiqued the "standard modernized office" in the early history of WP; that is, information work designed according to the mechanistic model of hierarchical control and task specialization. Personnel problems such as alienation, lack of motivation, "work to rule" attitudes, and poor potential for advancement were more likely in such offices than in less standardized offices.
6. One study of secretaries using WP found that nearly 50% reported increased job stimulation, excitement and variety, while approximately 60% reported that demands on their attention and accuracy increased, and their work pace was more dependent on the computer (Bradley, 1987).
7. A longitudinal study of the effect of automation on occupational classifcations showed an upgrading of skills between 1950 and 1980 (Vallas, 1988). However, survey data provided evidence of deskilling since 1980: the more automated the workplace, the less autonomous and conceptually demanding the job tends to be, and the greater subsequent alienation from work, especially for clerical workers.

One indicator of strong job dissatisfaction is turnover. Determinants of turnover include lower pay, less integration in the work group, lower communication (thus a less realistic view of and less ability to control one's job), and greater centralization, all operating through lower satisfaction and less organizational opportunity (Price, 1977). Turnover is estimated to be 38% per year among clerical workers in Washington, D.C. (Suplee, 1988).

Ergonomic Concerns

Reviewing many ergonomic studies of VDT work, Smith (1984, p. 209) concluded that "job demands, both physical and psychological, influence the type, severity and frequency of VDT operators' health complaints" (1984, p. 209). Although some studies show strong negative effects for intensive VDT users (Westin et al., 1985), the *amount* of VDT use is not nearly as strong a predictor as the *type* of VDT work (Sauter et al., 1985). Jobs with

insufficient participation, inadequate training, poor technology design and physical surroundings, job insecurity, high stress, greater role ambiguity, performance monitoring and close supervision were strongly associated with health problems (Cohen, 1983; Davis, 1984; Grandjean, 1983; Gruning, 1985; Jarrett, 1982; Wagenaar, 1985). If one's work is monitored by the system itself, workers report significantly more headaches, nausea, dizziness, exhaustion, fatigue, anxiety, anger, depression and medical problems (9-to-5, 1984; Westin et al., 1985). Variations in atmosphere (such as changing temperature and lighting) and intrusions from others (resulting in crowding and loss of privacy) are additional contributors to job stress (Sutton & Rafaeli, 1987). Thus, the primary ergonomic effects of poor working environments and technology in WP jobs are intensified by managerial policies and job design, through their influence on operators' stress and lack of control in their work (Turner, 1984).

Implementation Success

While there are many models and theories of implementation success (Lucas, 1981; Markus, 1984; Rogers, 1983; Van de Ven, 1986), this study defined implementation success as the continued adaptation and integration of WP technology, or the extent to which technology and tasks are redesigned to match extant, changing, or new organizational needs. This form of implementation success is *reinvention*, the adaptation of an innovation after it has been adopted (Rice & Rogers, 1980; Rogers, 1983). In information work, such reinvention may often be facilitated by integration of WP, management information systems, and decision support systems (Giuliano, 1982; McLeod & Bender, 1982). This approach considers the organizational system of work, technology, and people in ways that foster innovation rather than just satisfy short-term productivity criteria (Johnson & Rice, 1987).

Use of Word Processing Technology

There are at least two ways to conceptualize use of WP technology. The first is *intensive* use, the degree to which an operator's job is devoted to WP. Critics of technology argue that negative outcomes (such as job dissatisfaction, health problems) are likely to be emphasized simply through more intensive use. The second is *extensive* use, the degree to which WP technology is used in a diversity of applications. More extensive use may increase overall job demands and stress, leading to job dissatisfaction and ergonomic complaints. However, extensive use may also increase the job's variety, and provide the foundation for more innovative applications.

Contextual Factors

Organizational Context

Public or private. Porat and others argue that in the information economy, with bureaucracy comes increased demands for information processing, less accountability for work unit performance because the unit is buffered against rapid and objective criteria of profitability, and, in government agencies, a lack of flexibility in job design and mobility imposed by fixed civil service job descriptions (Machlup, 1962; Porat, 1977). Further, public organizations place greater emphasis on control over procedures and workers than do private organizations, have more elaborate formal rules, reporting arrangements and hierarchies, and are less able to respond to changing environmental or technological demands (Perry & Rainey, 1988). These mechanistic traits stifle growth, informal communication, ability to resolve conflict, and the like (James & Jones, 1976).

Concern for procedures. Mechanistic organizations have a greater difficulty in responding to change because they place a greater emphasis on control and procedures (Aiken & Hage, 1971). In turn, this greater control encourages rationalization of workers' jobs and a neglect of consequences of policies upon workers, and of their needs. Further, it constrains individual choices, resulting in low creativity, task complexity, involvement and satisfaction (James & Jones, 1976).

Work Unit Context

WP unit structure. The general concept of centralization of computing, as an organizational policy, involves not only questions of efficiency and effectiveness, but also political choices about access to resources and power. Centralization involves consolidation of control, physical location, and function (King, 1983). The specific concept of a WP center is derived from the stenograph/typing pool tradition, from the early model of centralized mainframe computing, and from principles of division of labor.

Centralization and decentralization both have their advantages and disadvantages for WP. For example, centralized WP can accommodate varying workloads, provide effective in-house training of new operators, support and implement information-sharing for innovative applications, allow economies of scale in resource allocation, and provide tailored support when the locus of complexity lies in the relationship between the operator and the technical system. Because of its ability to support communication and focus supervisory policies, centralized WP may increase the influences of supervisory behavior and work unit communication. Because of the additional internal organizational boundary, centralized WP structure may minimize the

influences of organizational-wide context factors. However, it can stifle intra-organizational diffusion of new applications, reduce operator-author interaction, encourage job fragmentation, and generate conflict about system integration (Buchanan & Boddy, 1982; Iacono & Kling, 1986; King, 1983). Critics of policies toward clerical jobs argue that centers emphasize production efficiency at the cost of human and innovative concerns (Gregory & Nussbaum, 1982). Centralization often reduces workers' opportunities for decision-making and task autonomy, leading to lower motivation and responsibility (Hackman & Lawler, 1971).

Supervisory role-modeling and leadership. Supervisory communication with, and role-modeling for, subordinates is typically associated with greater job satisfaction, lower turnover, and subordinate adoption of organizational innovations, through sharing of information about implementation activities, role-modeling of adoption behavior, establishment of norms for rewards and procedures, and discussion of task interdependency (Jablin, 1979; Kimberly & Evanisko, 1981; O'Reilly, 1977; Pincus, 1986; Salancik & Pfeffer, 1978; Snyder & Morris, 1984; Taylor & Bowers, 1972). For these reasons, it has been argued that local decisions made by supervisors about workunit division of labor and rules are more influential than organization-wide structures and policies (Kemp & Clegg, 1987).

Work group communication. Communication and information-sharing within a work group, especially in regular meetings, is associated with job satisfaction and development of innovative solutions to nonroutine problems, by providing information, support, shared perspectives, and norms for behavior and expectations (Albrecht & Ropp, 1984; Baroudi, Olson & Ives, 1986; Cummings, 1978; Ebadi & Utterback, 1984; Lawrence & Lorsch, 1969; Pincus, 1986; Rousseau, 1978; Snyder & Morris, 1984). It also reduces uncertainty about others' attitudes and behaviors, thus reducing the risk in innovative situations.

Monitoring of work. As noted above, the loss of individual worker control, and the subsequent stress, associated with close monitoring of WP jobs, has been identified as a significant moderator of the influence of technological and other contextual variables on WP job characteristics (Gregory & Nussbaum, 1982; Marx & Sherizen, 1986). It is estimated that the work of from 20% to 35% of all office employees is monitored (Grant, Higgins & Irving, 1988; Suplee, 1988).

Involvement in implementation. Involvement, or participation, in the implementation process has been argued by many researchers to be a crucial determinant of the success of an information system, and an indicator of an organic organization (Lucas, 1981; Markus, 1984). By being involved in the implementation process, potential users provide information necessary to design an appropriate system, learn about the capabilities and applications of the system, and gain psychological ownership of the innovation, thus increasing motivation and acceptance. The concept and practice of participation is highly problematic (Strauss, 1982), requires considerable resources, and may not be as effective as when top executives activate rationales for change in key actors (Nutt, 1986), but is seen as a fundamental aspect of job design (Cummings & Srivastva, 1977).

Individual Context

Education. Because 90 percent of the respondents in this study were female, gender is not a useful measure of individual context. But level of education is likely to influence a greater disposition to leave a job if increased technology use is perceived as a negative aspect of a WP job, because of the greater alternate job opportunities that exist for more educated workers. Further, higher education may have a slight influence on perceived ergonomic concerns because of a better ability to identify causes of discomfort. And higher education is generally associated with greater innovativeness (Kimberly & Evanisko, 1981; Rogers, 1983).

The specific hypotheses for the influence of WP usage and the contextual variables on the outcomes (except for skill requirements because they are analyzed qualitatively), and their results, are summarized in Table 5 below.

METHOD

Sample

The data came from two phases of a larger study on the implementation of word processing (Johnson & Rice, 1987). In phase one, 194 organizations were selected for telephone interviews. The criterion for selection was that the organization had to have adopted WP at least two years before, and had to have at least four WP terminals. WP systems were defined as shared-logic or standalone dedicated word processing equipment and software. Thus, WP in this study does not include WP applications on mainframes, multipurpose minicomputers, or personal computers. Potential candidates were identified from lists of members of WP associations, from students in professional school, and from organizational directories. Thus, the sample is not random and cannot guarantee generalizability. However, it is purposive and stratified in that organizations were selected to represent specific characteristics. Organizational contacts were either the supervisor of the WP unit, or, especially in decentralized sites, a manager responsible for decision-making about WP. The telephone interview lasted about a total of one hour, though it may have involved several calls.

In phase two, 60 of the organizations were selected for site visits. In these site visits, questionnaires were administered to WP supervisors ($N = 80$), operators ($N = 302$) and authors (those who provided material to be processed) ($N = 243$). Operators were defined as those whose primary responsibility was the processing of text on the WP systems identified above. Thus, the "operator" sample does not include personnel who may have performed some word processing as part of other jobs (e.g., secretaries, data entry personnel, technical writers) even if they used available dedicated word processing systems. Respondents took around 20 minutes to complete this questionnaire. In addition, personal interviews were conducted with representatives of each job type at each site. Analyses reported here are based primarily on the 46 to 53 organizations that had complete telephone and operator data, but they also consider some supervisory and personal interview data. The mean number of responding operators per organization was 5.7 ($s = 5.1$).

Measures

Each of the preceding concepts was operationalized as follows. Specific scale items, and their loadings on factor scales, appear in Tables 1 and 2.

Outcomes

Skill Requirements

The present research did not attempt an industrial study of deskilling in general, as exemplified by Attewell & Rule's review (1984). Rather, data from the telephone and personal interviews were analyzed for evidence of the extent to which organizations were able to find operators who could fulfill the skill requirements of WP jobs.

Job Turnover

As this study was not longitudinal in nature, and did not have access to organizational records on turnover, a mediating indicator was used. The question asked operators the extent to which they had considered leaving the organization for a job in another organization. "Intent represents the single best predictor of turnover", with a weighted average correlation of .50 with actual turnover (Steel & Ovalle, 1984, p. 673), and is typically operationalized as a single-item bi-directional variable. Such an operationalization is not ideal, of course.

Ergonomic Factors

The present study did not attempt to measure physical ailments or stress, but did ask operators about 11 potential sources of bad ergonomic effects on their jobs, comprising a single factor called "Ergon".

Table 1. Factor Loadings and Descriptive Statistics of Scales of Organizational Procedures, Innovation Communication, Ergonomic Complaints and Involvement in Implementation

Variable Set	*Loadings on Factor*	*Statistics* X	s
Organizational Procedures (ORGPROC)			
Feel watched to obey rules	.82	2.73	.89
This is a very conservative organization	.62	2.09	.76
Employees benefit from changes*	.60	2.53	.71
Eigenvalue	1.41		
Percent variance	47		
Alpha if variables added	.78		

Scales: 1 = strongly agree, 3 = disagree, 4 = strongly disagree
Note: *Scale reversed for factor analysis

Work Group Communication (COMM)			
Praise for new procedures			
from supervisor	.78	2.71	1.05
from coworkers	.75	2.63	1.03
Talk about new procedures			
with coworkers	.73	3.09	.89
with supervisor	.75	2.72	1.01
Others encourage you to experiment	.63	2.55	.99
Attend regular meetings	.44	1.78	.86
Eigenvalue	2.86		
Percent variance	48		
Alpha if variables added	.78		

Scale: 1 = no, 2 = little, 3 = some, 4 = much "involvement in decision-making about"

Involvement in Implementation (INVOLVE)			
Formatting procedures	.72	2.46	1.15
Unit productivity	.70	2.17	1.12
Choice of equipment	.64	1.58	.89
Performance appraisal criteria	.62	1.74	.99
Training work group	.62	2.02	1.08
Maintenance	.55	1.72	1.02
Eigenvalue	3.06		
Percent variance	51		
Alpha if variables added	.81		

Scale: 1 = no, 2 = little, 3 = some, 4 = much "involvement in decision-making about"

Table 1. (Cont'd)

Ergonomic Factors (ERGON)			
Air conditioning	.71	2.07	.68
Heating	.67	2.08	.68
Air quality	.66	2.02	.69
Storage space	.62	2.19	.69
Attractiveness	.61	1.92	.74
Amount of desk top space	.59	2.03	.77
Easy access to supplies	.54	1.70	.65
Height of keyboard	.53	1.55	.57
Privacy	.52	2.30	.71
Screen glare	.51	2.07	.70
Chair support	.50	1.85	.74
Light conditions	.47	1.80	.66
Easy access to people	.43	1.68	.66
Easy access to other machines	.42	1.72	.69
Noise level	.40	2.11	.72
Eigenvalue	4.60*		
Percent variance	61		
Alpha if variables added	.85		

Scale: 1 = good, 2 = okay, 3 = bad "effect of physical surroundings"

*A second factor had an eigenvalue of 1.09, explaining 14.5% of the variance. The only high loading was .53 for machine access.

Supervisory Leadership (SUPER)			
Encourages best effort	.84	3.54	.83
Offers new ideas on problems	.77	3.07	.96
Maintains high standards	.76	3.56	.73
Shows how to improve performance	.76	2.90	1.07
Encourages teamwork	.69	3.34	.94
Is friendly	.69	3.54	.75
Eigenvalue	3.82		
Percent variance	64		
Alpha if variables added	.89		

Scale: 1 = no, 2 = little, 3 = some, 4 = much "involvement in decision-making about"

Note: Iterated, varimax rotation inferred factor analysis (SPSS PA2) was used. As all but one factor analysis resulted in one significant factor, scales were constructed by the SPSS factor score routine (to suppress effect of lower-loading variables). The weighted-average FACSCORE = .2 option was used, to include cases that had less than two missing values among the variables comprising the factor scale. The only exception was the Involve scale, where the values of each variable (again, only if no more than one variable had a missing value for a particular case) were averaged, to indicate a mean scale of degree of involvement, rather than a loading of an underlying factor of "involvement." The loadings for Involve are included to show the unidimensionality of the scale.

Table 2. Correlations and Descriptive Statistics, for Weighted Individual-Level Analyses (Lower Left Matrix), and for Work Unit-Level Analyses (Upper Right Matrix)

Variables	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*
Context													
Organization													
1. Public/Private*	—	.27	−.45	.05	.19	−.01	−.20	.09	.08	−.01	—	—	−.19
2. Org. Proc. scale*	.27	—	−.12	.27	.35	.00	−.09	.13	−.24	−.13	—	—	−.27
Work Group:													
3. Unit structure*	−.45	−.12	—	.18	−.26	.16	.08	−.14	−.09	−.17	—	—	.17
4. Super scale*	.05	.27	.18	—	.10	.01	.00	−.23	−.12	.00	—	—	−.27
5. Comm. scale*	.19	.35	−.26	.10	—	−.32	.42	−.02	.04	.11	—	—	−.40
6. Monitor*	−.01	−.03	.16	.01	−.32	—	−.20	−.29	−.09	−.10	—	—	.28
7. Involve Scale	.12	−.02	.05	.03	.38	−.12	—	−.05	.06	.07	—	—	.00
Individual													
8. Education	.04	.08	−.09	−.13	.10	−.18	—	−.05	−.35	.08	—	—	−.18
Technology													
9. Percent of Day Using Terminal	.06	−.09	−.05	−.02	−.07	−.07	−.04	−.23	—	.15	—	—	.05
10. # WP services*	.01	.10	−.17	−.02	.09	−.10	.04	.06	.11	—	—	—	.15
Outcomes													
11. Consider leaving	−.29	−.32	.09	−.26	−.20	.03	.12	.04	.02	−.23	—	—	—
12. Ergon scale	−.06	−.19	.05	−.19	−.02	.05	−.03	.17	−.02	.20	.14	—	—
13. Adoption level*	—	—	—	—	—	—	—	—	—	—	—	—	—

Table 2. (Cont'd)

Value for variables	Aggregated X	Aggregated s	Individual X	Individual s
Pub/private: 1 = public; 2 = private*	1.74	.45	1.74	.44
Org. procedures scale: low = "mechanistic"; High = "organic"*	.00	.65	−.04	.98
Unit structure: 1 = center; 2 = decentralized*	1.25	.44	1.25	.43
Super scale: low = little supervisory encouragement*	−.07	.61	−.06	.94
Comm scale: low = little communicative support for innovation*	−.01	.72	.01	1.01
Monitoring by line/page/document count: 1 = yes; 2 = no*	1.53	.50	1.53	.50
Involve index: low = low mean involvement in implementation	1.96	.46	1.97	.73
Education: 1 = < h.s.; 2 = h.s.; 3 = < coll; 4 = coll; 5 = < grad; 6 = grad	3.05	.57	3.06	.88
Percent of day using terminal:	75	20	75	28
Number of WP services provided by unit:*	6.96	3.39	6.96	3.36
Consider leaving organization for job in other organization?				
1 = no, 2 = little; 3 = some; 4 = often	—	—	2.42	1.16
Ergon scale: low = good effects of physical surroundings	—	—	−.03	.81
Adoption: 1 = integration; 2 = expanding; 3 = clockwork; 4 = typewriter*	2.50	.96	—	—

Notes: N = 250 to 296 for weighted individual - level analyses; N = 46-53 for aggregated analyses.
Correlations significant at $p < .01$ are *underlined*.
*Variable measured or aggregated at organizational/workunit level.

Implementation Success

A qualitative assessment of the success of the implementation of word processing at the workunit level, in the organizations visited in phase two, resulted in four categories of increasing innovativeness or integration of the technological system into the wider organizational structure and goals (see Johnson & Rice, 1984, 1987). Though all sites contained some aspects of each category, most sites fit easily into one classification. This categorization is a qualitative assessment based upon the researchers' inspection of the case studies and personal interviews, completed before the questionnaire data were analyzed. The principal investigator and the researchers assigned to the specific site all visited the site, and discussed the categorization until agreement was reached. The four levels of implementation represent two basic systems. *Adoptive* systems are work units that adopted WP, but are using it only to perform preexisting work more efficiently. "Typewriter systems" ($N = 7$) were unsuccessful adoptive systems; WP was not used as anything more than fancy typewriters, and the unit constantly struggled for survival under the workload and organizational demands. "Clockwork systems" ($N = 17$) were successful adoptive systems; they used WP to achieve narrowly defined initial rationales such as reduction in typing or staff. They functioned in a reliable fashion, but did not develop new procedures. *Adaptive* systems are work units that not only adopted WP, but also reinvented WP to add value to, or redesign, pre-existing work. "Expanding systems" ($N = 14$) emphasized work unit adaptations; they were spurred on by a supervisor who managed organizational boundaries and encouraged localized adaptations of the technology. "High-integration Systems" ($N = 8$) emphasized organizational adaptations; they interfaced with other departments, both on technical grounds (such as with data processing for communications) and on application grounds (such as with accounting for invoice processing).

Use of Technology

Intensive use was measured by the reported percent of the workday that the operator used a VDT. Extensive use was the number of WP services that organizational interview indicated the work unit regularly provided to its clients (such as boilerplating, maintaining files, typesetting, editing materials, etc.).

Organizational Context

Type of Organization

This concept was measured by whether the organization was a public organization (nonprofit or government agency) or a private organization (such as law firm or manufacturer).

Concern for Procedures

Operators were asked three questions asked about policies toward change, beneficiaries of change, and adherence to rules.

Work Unit Context

WP Unit Structure

Centralized WP is a distinct work unit (though not always physically separate from other units) whose members are primarily dedicated to the processing of text and often organizational records, using dedicated WP systems. Centers typically have at least one supervisor who monitors performance and schedules tasks. WP jobs in centers generally have several grades within the category of WP operator or specialist. In *decentralized* WP, technology is obtained by individual offices or work units, and WP is considered another of the unit's many functions.[1]

Supervisory Role-Modeling and Leadership

The extent to which operators perceived their supervisor as providing a model for performance and innovation, in a supportive fashion, was indicated by six items taken from a standardized measure of managerial leadership (Taylor & Bowers, 1972), comprising a single factor called "Super."

Work Group Communication

The extent to which operators indicated the work group supports and talks about the development of new procedures using WP was indicated by seven items also taken from Taylor and Bowers (1972), comprising a single factor called "Comm."

Monitoring

This was measured by a single item asking operators whether performance was evaluated on the (not necessarily sole) basis of total number of lines, pages or documents produced.

Involvement in Implementation

The level of involvement was indicated by asking operators six items concerned with their participation in decisions about WP, comprising a single factor called "Involve."

Individual Context—Education

Education was measured by a six-level scale on the operator questionnaire.

Procedures

The role of skill requirements in WP jobs will be described based on personal interviews and observations.

Cross-level analyses assess the influence of variables at one level of analysis (here represented by organizational and workunit context) on variables at another level of analysis (here represented by workunit and individual outcomes). Rousseau (1978, 1985) has provided some theoretical and methodological guidelines for such analyses, which we follow here.

The dependent variables of consideration of leaving and sources of ergonomic concern occur at the individual level of analysis, so all analyses involving those outcomes will be based upon responses at the individual level. However, the cross-level effects of organizational type, organizational concern for procedures, WP unit structure, supervisory leadership, workunit communication, and monitoring, are all hypothesized to exist at the organizational or workunit level, so those variables (as indicated in the prior section on variable operationalization) were either measured at the organizational or workunit level, or aggregated for each workunit based upon the responses of the operators belonging to the same workunits. Aggregation of variables measured at the individual level simply involves using the mean for the workunit on a particular variable as the value for each individual in that workunit. Involvement, education, and intensive use were measured and maintained at the individual level.

However, because the particular number of respondents for each work unit is not theoretically related to the tested associations, and because they generate a disproportionate influence for organizations with larger responding samples, the responses must be weighted to remove this bias without inflating or deflating the sample size, and thus the significance tests. Each case, therefore, was weighted by dividing the total individual sample size (302) by the number of organizations represented in the dataset (53), and by multiplying this number by the inverse of the number of respondents associated with the respondent's organization.

The dependent variable of implementation success occurs at the workunit level, so analyses involving that outcome will use the means of responses aggregated at the workunit level (one workunit at each organization), resulting in a sample size of 46.

The technological determinism approach posits a direct association between use of technology and outcomes, so it is tested by zero-order

correlations between use of WP and outcomes. The contextual, cross-level approach posits an intervening or moderating influence of context, so (1) the influence of contextual variables will be tested by hierarchical regression (sets of organizational, work unit, and individual contexts each entered sequentially, followed by the two measures of technology usage), and (2) the moderating influence of work unit structure will be tested by separate hierarchical regressions. For analysis (2), differences between centralized and decentralized WP structures will first be identified by *t*-tests on the means of the outcome, use, and other context variables.

RESULTS

Skill Requirements

The evidence from the personal interviews tends to indicate that WP has raised overall skill requirements for WP jobs, but that organizations have had difficulty adapting to the needs of such positions. Indeed, WP jobs required more expertise than the workforce in 1980-83 provided. Forty-four percent of the organizations surveyed indicated that the availability of qualified WP operators was "poor"; 19% said it was marginally satisfactory; only 37% said it was "good." Because of the job requirements, 52% of the organizations indicated that new-hires had to have prior experience. Of those organizational representatives who responded to the question (68 of the 194), 60% indicated that temporary help with experience in WP was used to fill in while searching for qualified personnel. One conclusion of a nationwide survey of 500 companies by Kelly Services mirrors these results: "The supply of fully qualified employees will continue to lag behind demand, frustrating employers who attempt to staff automated offices solely by recruiting" (results reported in Hubbart, 1983). Sixty-four percent or our organizations reported that technology changes would lead to upgrades in some categories.

Reports of "poor" availability came mostly from government agencies in Washington D.C. (64% reported "poor" availability), insurance companies (54%), and communication technology organizations (60%). Overall, public organizations tended to report having more difficulty in finding qualified personnel (59%) than private organizations (41%) (*t*-test $p < .07$). Low job classification (governmental WP operators are GS4 or less) and accompanying low pay appear to be a primary reason for the lack of qualified people.

Agencies differed in their response to policies that keep them from paying operators more. One organization hired high school students part time. They were using equipment that was ten years old while new equipment, delivered

a year before, sat untouched. The supervisor feared her staff would be unable to learn the equipment, or, if they did, they would be hired away by private organizations. This underutilization of WP has consistently been criticized by investigations of the General Accounting Office (1979; 1982). Other agencies used secretaries to fill WP jobs on a part time basis. Secretaries, according to long-standing government personnel policies, are paid on a higher scale than are WP operators. As a contrast, another agency was acquiring word processors for use by professionals, but acquisiting them as computers. The consensus in that organization was that with computer-based office systems, most of the functions of clerical support could be replaced. An agency lawyer, for example, said that a support person would be useful to run errands, but that he and his professional staff (GS10 and above) were handling all the information and document tasks done by clericals in other organizations. He could cite savings of several million dollars that might have been spent unprofitably had he not developed customized information uses for WP machines. This is one example of reinvention.

Bivariate Results Involving WP Use

Operators reported spending three-quarters of their day using a WP terminal (intensive use) and providing an average of seven services (extensive use). Table 2 above provides the zero-order correlations among the technology use, context, and outcome items and scales, for both the weighted individual-level analyses of considerations of leaving and sources of ergonomic concerns, and for the aggregated analysis of adoption level. Extensive use of WP was significantly but weakly associated with consideration of leaving the organization ($r = .23$).

Studies cited above reported that VDT operators complain about noise level, screen glare, poor air quality, lack of privacy and storage space, the major ergonomic sources of bad job effects reported here. Analysis of the responses by category shows that a quarter to a third reported these were sources of bad effects; even if a minority, this still represents significant concern over ergonomic problems. Intensive usage had no significant association, but extensive use was significantly but weakly associated with reported bad ergonomic aspects. A more extensive set of WP services may require (a) a more customized working environment, (b) increased pressures to achieve sufficient performance in more ways, and (c) increased role ambiguity in attempting to satisfy a greater diversity of clients.

Neither measure of WP use was significantly associated with level of adoption, aggregated at the work unit.

Table 3 summarizes the differences in means of the variables by unit structure. Overall, centralized WP units were more likely to be associated with private organizations, less supervisory leadership, more group communication,

Table 3. Differences in Mean Context, Usage and Outcomes for Centralized and Decentralized Work Unit Structure, for Weighted Individual-level Variables and for Aggregated Adoption Level Variable

Variables	*Means Compared Between:* *Center*	*Decentralized*
Context:		
Public/ Private[1]	1.85	1.39**
Organizational procedures scale[2]	.04	−.13
Supervisory scale[2]	−.13	.12**
Communication scale[2]	.09	−.33**
Monitoring[2]	1.49	1.67**
Involvement mean	1.95	2.02
Education	3.10	2.91
Usage:		
Percentage of time at keyboard	75.6	72.2
Number of WP services[2]	7.3	6.0*
Outcomes:		
Ergonomics scale	−.05	.04
Consider leaving organization	2.4	2.6
Adoption level[2]	2.4	2.8

Notes: N = for weighted individual-level analyses, overall, 209 in centralized, 93 in decentralized WP work units; for specific tests, total N ranges from 233 to 300. For aggregated analysis, 46 organizational work units.

[1]Variable measured or aggregated at organizational/workunit level.

*$p < .01$.

**$p < .001$. Two-tailed t-test, unequal variance.

more monitoring of output, and a greater number of WP services provided. These mean differences are generally in line with what is expected from

"mechanistic" centralized organizational structures, except for the increased group communication.

Possible reasons for this one unexpected difference come from the site interviews. They indicated that in decentralized settings, operators and others received little systematic training or ongoing opportunities for interaction. Operators in such decentralized settings found their word processors more difficult to learn, and their training less often helped them to understand how WP systems "think". Operators in centers, however, had other full time operators sitting near them so that asking questions and sharing ideas was potentially a rich source of information. In centers, the supervisor and the co-workers focus on the equipment and how to use it better because WP is their primary work concern; further, management may be more likely to provide sufficient resources and appropriate furniture for a unit that is clearly devoted to WP. In decentralized settings, WP is just another work tool; one's immediate colleagues are less likely to be operators or exchange information about how to be more innovative with the technology.

Regression Analyses

Table 4 summarizes the multiple regressions for each of the three measured outcomes, run separately for centralized and decentralized WP units. Only significant variables in the initial full regression equations were included in the final runs reported in Table 4, except extensive use was included in both conditions of the two individual-level dependent equations, for comparison.

Respectively, 18 to 50 percent of the variance in operators' consideration of leaving their job was explained, by working in public organizations (but more so for decentralized units), less supervisory leadership in centralized units, greater organizational emphasis on procedures in decentralized units, and extensive use of WP in centralized units.

Twelve and 14 percent of the variance in reported bad effects on one's job due to physical surroundings was explained, influenced by greater organizational emphasis on procedures in centralized units, more workunit communication in decentralized units, higher education in centralized units, and extensive use of WP in centralized units.

From 11 to 32 percent of the variance in the qualitative measure of implementation success—increasing levels of reinvention of the technology to redesign work and develop new procedures for accomplishing organizational goals—was explained solely by greater workunit communication about and support for innovation, in both workunit structures.

Table 4. Regression of Consideration of Leaving Job and Complaints about Eergonomic Factors (for Weighted Individual-level Analyses) and Work Unit Adoption Level (for Aggregated Analysis), on Context and Usage Influences, for Centralized and Decentralized Word Processing Structure

	Dependent Variables		
	Weighted Individual-level		*Aggregated*
Independent Variables	*Considering Leaving Job*	*Bad Sources Ergonomic*	*Lower Adoption Level*
Private[a]			
cent.	−.16*	—	—
decent.	−33**	—	—
Less Procedures[a]			
cent.	—	−.25***	
decent.	−.39**		
More Super Leader[a]			
cent.	−.32***	—	
decent.	—	—	—
More Communication[a]			
cent.	—	—	−.36*
decent.	—	.36**	−.63*
Less Monitoring[a]			
cent.	—	—	—
decent.	—	—	—
More Involvement			
cent.	—	—	—
decent.	—	—	—
Higher Education			
cent.	—	.16***	—
decent.	—	—	—
% on terminal			
cent.	—	—	—
decent.	—	—	—
# WP services[a]			
cent.	.24***	.20**	—
decent.	.17	.14	—
R^2 (adjusted)			
cent.	.18***	.12***	.11*
decent.	.50***	.14**	.32*
Degrees of Freedom, *F*-ratio			
cent.	(3,182) = 11.2	(3,169) = 8.5	(1,33) = 5.0
decent.	(3,61) = 16.4	(2,62) = 6.1	(1,8) = 5.3

Notes: Method was forward regression procedure from SPSSX, initially run with the following sets of variables entered hierarchically: Government, Organizational Procedures; Supervisor scale, Communication scale, Monitoring, Involvement; Education; % on Terminal, # WP Services. Final run included only significant variables. Values are standardized beta weights.
* = $p < .05$;

[a] Variable measured or aggregated at organizational/workunit level.

DISCUSSION

Table 5 summarizes the hypothesized and empirical relationships among WP technology use, contextual factors, and outcomes (except skill requirements).

Table 5. Hypothesized and Empirical Relationships Among Word Processing Usage, Contextual Variables, and Outcomes, for Bivariate (Technological Determinism) and Multivariate (Contextual) Analyses

	Outcomes								
	Weighted Individual Level						*Aggregated*		
	Considering Leaving Job			*Bad Ergonomic*			*Lower Adoption Level*		
Influences	*Hyp.*	*Biv.*	*Reg.*	*Hyp.*	*Biv.*	*Reg.*	*Hyp.*	*Biv.*	*Reg.*
Organizational:									
Private org.	−			−	0	0	−	0	0
Less procedural	−	−	−	−	−	−	−	0	0
Work Unit:									
WP structure affects context effects	+		+	+		+	+		+
More supervisory	—	−	−	−	−	0	−	0	0
More communication	−	−	0	−	0	+	−	−	−
More monitoring	+	0	0	+	0	0	−	0	0
More involvement	−	0	0	−	0	0	−	0	0
Individual:									
Higher education	+	0	0	+	+	+	−	0	0
Use of Technology:									
Greater % WP use	+	0	0	+	0	0	0	0	0
More WP services	+	+	+	+	+	+	0	0	0

Notes: Hyp. = hypothesized multivariate (contextual) relationships.
Biv. = empirical bivariate relationships; test of technological determinism model.
Reg. = empirical regression relationships; test of contextual model.

Two major conclusions follow from these results and related research. First, there is no necessary predetermined association between the outcomes measured here and the *intensity* of use of WP technology in an organization. However, how *extensively* WP is used (here, measured by the number of services provided) is significantly associated with considerations of turnover and ergonomic sources of bad effects on one's job, over and above contextual influences, but only in centralized WP workunits. Second, the way WP jobs are structured and managed influences some outcomes. Managers must make "strategic choices" in organizational policies and job design when implementing technology (Child, 1972; Iacono & Kling, 1986; Olson & Turner, 1986) in order to avoid the potentially bleak consequences that are possible.

While the personal interviews provide instances of both increased and lowered skill requirements, overall there seems to be an insufficient number of skilled WP operators in many organizations. Organizational policies about job descriptions and internal mobility have a strong influence on availability and retainability of skilled operators, however. In most government agencies, WP job classifications assume low skill levels in their reward policies, so capable and motivated operators go elsewhere, causing other personnel to find ways around the policies.

The major contextual influences were organizational emphasis on procedures, the private–public nature of the organization, supervisory leadership, and workunit communication. Involvement, education, and monitoring had no or little influence in the multivariate analyses. Overall, however, the greatest contextual influence was the structuring of the WP unit; it mediated the influence of extensive technology use and most of the contextual factors. Entered into the regressions as a separate variable, it had no direct association with the outcomes; thus its influence is entirely contextual or mediating, operating through the other contextual factors.

The primary counter-intuitive result is that some contextual aspects of what are considered mechanistic organizational characteristics (here, centralization of the word processing work unit) may in fact intensify the influences on outcomes in both a positive and a negative direction. It appears that centralized WP structures may buffer workers from the influence of organizational type and procedures on consideration of turnover, but increase the influence of supervisory policies, and extensive use of technology. The reverse is true for sources of bad ergonomic outcomes: organizational procedures is a significant influence in the context of centralized WP units, but not in decentralized units, where perhaps formalized procedures and rules cannot be focussed or managed so explicitly.

Given the rapid trend toward using personal computers as word processing technology, and a move away from stand-alone dedicated word processors, there is likely to be a move away from centralized WP units. In the spirit of theories about organic organizations (Burns & Stalker, 1961), there are many advantages to such a trend. However, we have noted here that some advantages of centralized unit structures will be lost as well, unknowingly.

The other counter-intuitive result is that monitoring and involvement had no bivariate or multivariate influence on any outcome. While the measure of monitoring may well be too simplistic an indicator of monitoring, it does reflect the ways in which monitoring is discussed in the literature—an emphasis on evaluating performance according to narrow, efficiency-oriented criteria rather than on more global work outcomes such as innovation or client satisfaction. Yet the ways in which task performance information is established and shared between management and workers, and the presence of other criteria for evaluation, also significantly affect the consequences of monitoring, but our simple measure could not capture these processes. The mean value of the involvement scale was so low that it is hard to expect much influence from this kind of "involvement" anyway (Strauss, 1982). Indeed, the meta-analysis by Cotton, Vollrath, Froggatt, Lengnick-Hall, and Jennings (1988) shows that while informal participation does have significant effects on job satisfaction and performance, short-term participation such as indicated by the items measured here does not.

However, as expected, and in accordance with prior findings (Johnson & Rice, 1987), the extent to which one's workunit provides supportive and regular communication about reinvention is significantly associated with higher levels of implementation success, defined here as reinvention. Combined with the fact that the amount of intensive or extensive use was unrelated to implementation success, this result reinforces the notion that high levels of usage have no necessary conceptual relationship to some measures of the success of an information system.

The analyses reported here provide tentative evidence that how WP jobs are structured and managed are the primary factors in influencing operator consideration of turnover, sources of ergonomic problems, and work unit implementation success, and not simply the intensity of WP technology usage. The crucial aspects of these factors seem to be a managed sharing of information, encouragement of experimentation, role-modelling for innovativeness, and awareness that success is not just using the technology more often in order to increase efficiency. However, we do find a direct negative effect of extensive use in centralized WP workunits even after controlling for contextual influences. From the perspective of WP operators' jobs, technology is not the sole determining influence; contextual factors such as management and the nature of organizational policies are. From the organization's perspective, word processing is one aspect of many forms of computing that organizations must adopt, adapt, and manage if they are to succeed.

Stronger, more generalizable understandings of the use, contexts and outcomes of WP technology in particular and organizational computing in

general are likely to come with more ambitious research projects. Components of such projects would include:

1. physiological and observational measures of ergonomic problems;
2. overtime analyses of the process of structuring work units and long-term outcomes;
3. measures of job characteristics as intervening variables between technology and outcomes;
4. more explicit, archival, and multidimensional measures of turnover in particular as well as job satisfaction in general;
5. measures of performance at the individual and work unit level; and
6. experimental designs that also consider comparable nonusers.

Billings, Klimoski & Breaugh (1977) and Rousseau (1978) provide examples of such considerations. Additional approaches, such as detailed case studies, must be provided to understand how individuals interpret these factors and processes.[2] In the end, however, this and other studies of organizational computing will perhaps lead more to an appreciation of the contexts influencing the use and outcomes of organizational computing rather than to any fixed deterministic rules of relationships. Perhaps the more we know about the impacts of organizational computing, the less simplistic will be theories about, and management practices involving, such outcomes (Attewell & Rule, 1984).

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NOTES

1. There is also a third, intermediate type, *distributed* WP. Equipment is in separate locations, but is managed centrally. It may consist of a multiterminal system where entry and editing is distributed, but storage and processing is centralized. One hybrid form of WP is the "word processing team" (Krois & Benson, 1980) or a primary WP unit providing information center services to the distributed sites.

2. The larger project from which this analysis comes does present such cases and interpretations (Johnson & Rice, 1987), and the interested reader is encouraged to compare insights from these two research approaches.

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