



The relationships among computer skills, job performance, and job satisfaction of Montana Extension agents  
by Carol Ann Gibson Flaherty

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in  
Technology Education  
Montana State University  
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**Abstract:**

This study shows that some computer skills and environmental variables were associated with Montana State University Extension agents' job performance, as reported in job appraisals, and job satisfaction, as defined by the Work Itself scale of the Job Descriptive Index.

Gender, salary, and having a modem conveniently available were significant predictors of job performance in two multiple regression models. For salary, the relationship logically could be argued to be circular, with job performance having led to higher salary as well as salary having predicted job performance.

Using spreadsheets, electronic mail, and on-line information sources, as well as an agent's judgment of whether s/he had a good enough computer were significant predictors of job satisfaction in two multiple regression models. It should be pointed out that it was not increasing skill with spreadsheets, email and information searching but less skill that was associated with higher job satisfaction.

However, the existence of significant results masks the fact that the data is spread very thinly among the variables. Even the stepwise multiple regression models did not come close to the common recommendation that a study should have 30 observations for each independent variable. The significant relationships shown by the models should be considered a starting point for further study.

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Bozeman, Montana

October 1994

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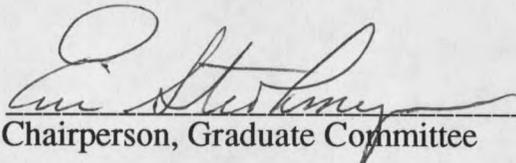
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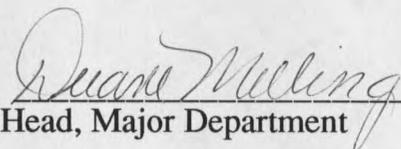
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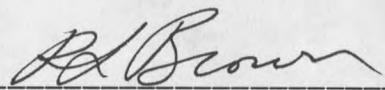
  
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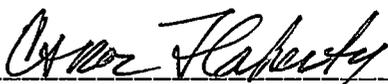
  
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## ACKNOWLEDGEMENTS

Many thanks to my parents, John D. Gibson and Myrtle F. Clark Gibson, who encouraged a questioning attitude and provided the first answers, and to my husband, Robert J. Flaherty, for his help and encouragement.

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## ABSTRACT

This study shows that some computer skills and environmental variables were associated with Montana State University Extension agents' job performance, as reported in job appraisals, and job satisfaction, as defined by the Work Itself scale of the Job Descriptive Index.

Gender, salary, and having a modem conveniently available were significant predictors of job performance in two multiple regression models. For salary, the relationship logically could be argued to be circular, with job performance having led to higher salary as well as salary having predicted job performance.

Using spreadsheets, electronic mail, and on-line information sources, as well as an agent's judgment of whether s/he had a good enough computer were significant predictors of job satisfaction in two multiple regression models. It should be pointed out that it was not *increasing* skill with spreadsheets, email and information searching but *less* skill that was associated with higher job satisfaction.

However, the existence of significant results masks the fact that the data is spread very thinly among the variables. Even the stepwise multiple regression models did not come close to the common recommendation that a study should have 30 observations for each independent variable. The significant relationships shown by the models should be considered a starting point for further study.

## CHAPTER 1

### THE PROBLEM

#### Introduction

Computer skills are a relatively new addition to the skill mix of Montana county Extension agents. Agents, who are Montana State University-Bozeman (MSU) faculty, fulfill many roles, but generally are grouped into a category based on a more in-depth knowledge of a specific discipline, such as agriculture or nutrition. For many agents, computer use was added to their job long after other duties and uses of their time had been established. Even for agents recently hired by the Extension Service, there were no specific computer skills required, though computer expertise was one among many skills considered during the hiring process (Ekegren, personal communication, November 1993).

Although specific computer skills are not required for the job, informally computer skills have been emphasized within both the MSU Extension Service and the national Cooperative Extension Service. In the past two years, all Montana State University Extension county faculty have become interconnected by modems from their county offices to the MSU mainframe computer and its electronic mail communications system. This, in turn, links county faculty to the Internet and potentially millions of people and information systems world-wide. This is consistent with the 1991 United States Department of Agriculture

(USDA) Future Application of Communication Technology Committee (FACT) report's first recommendation, which was that computers' primary use be as communications devices. The report said:

. . . the Extension System should strive for one computer/workstation for each Extension professional. We envision the primary purpose of these computers as communications devices. Therefore, we recommend that each computer in the Extension System be networked to the services of the National Science Foundation Network (NSFnet). At a very minimum, each Extension professional should have electronic mail service delivered directly to his/her desk top. (p. 18)

Opportunities for using computers in a county Extension agent's work were extensive even before agents were linked by modems in 1992. Since the mid-1980s, MSU Extension economists have made spreadsheets available in a variety of software configurations to help agricultural agents and producers track and analyze economic alternatives (Duane Griffith, MSU Extension economist, personal communication, June 6, 1994). Computer assistance by Extension specialists has been offered since roughly the same time (Ibid.). Those specialists have offered seminars on the use of computers for various roles.

However, in contrast to the FACT report's emphasis on computers as personal communication tools, in the fall of 1993 many MSU county faculty did not regularly access their own electronic mail. Discussions with county faculty indicated that it was often secretaries who retrieved electronic mail and passed it along to its intended recipient. Thus, the potential of email to convey a sense of personal connection to others may have been limited. This lack of personal computer connection to the larger MSU Extension system and international Internet system could put these faculty at a disadvantage. If so, this disadvantage could be manifested both professionally and personally. Professionally, if county

faculty do not regularly use a computer for email, they may not develop the skill to use telecommunications for other purposes, such as to augment local information resources. Personally, telecommunications may lose some of its ability to help people feel like a part of a team when the connection is mediated by a secretary or other staff member. Telecommunications is a frugal medium, making up in speed, breadth, and efficiency for what it lacks in facial expression, tone of voice, physical posture and the wealth of nonverbal clues associated with an in-person discussion. If you take away some of its speed and efficiency by having an intermediary retrieve email, print it, and add it to a stack of mail without even the benefit of identifying letterheads, you may lose the bulk of electronic mail's advantages.

Telecommunications' advantages could be especially important to field faculty who work hundreds of miles from the MSU-Bozeman campus and whose peers are scattered geographically. Electronic mail's speed and efficiency could increase communication among agents or between an agent and campus-based specialist. It also would offer the potential of using additional electronic information resources, such as distant databases. The human "networking," plus increased information access could add to both agents' job performance and job satisfaction. If telecommunications does not add to job performance or job satisfaction, it may indicate that county faculty priorities differ from those espoused by the federal Extension Service system in its FACT report.

### Problem

The problem was to determine the relationships between MSU Extension county agents' use of computers and job performance and between their use of computers and job satisfaction.

### Need for the Study

Many Extension county faculty have been using computers for several years, achieving varying levels of expertise. Most Montana Extension Service county faculty were linked to the campus via modems in the fall of 1992, though some had used telecommunications before that. Once modem connections were established, electronic information sources, such as the AGRICOLA (Agricultural On-Line Access) and Educational Resources Information Center (ERIC) databases and others accessible via the Internet, became available. To access ERIC or AGRICOLA, an agent would use a modem to call a toll-free phone number provided by the MSU Renne Library. Alternatively, the agent could place a toll call to the campus mainframe computer and, through it and its connection to Internet, access these or other information sources.

The extent of county faculty use of computers and their use of it as a communications tool is unknown. The findings of this study could help Extension administrators evaluate whether use of computers and telecommunications are reflected appropriately in job performance evaluations. If computer skills are involved with job performance or job satisfaction, this

information could be more formally applied to agent selection. It also could be used to motivate agents who have been reluctant to adopt computers and telecommunications, thereby speeding implementation of the recommendations of the USDA's FACT committee. If computer skills are not associated with job performance, the information could be used as a starting point for either re-evaluating current job performance measures or re-evaluating the applicability to Montana of the FACT report's assumptions. In addition, identifying whether sophisticated computer use and telecommunications is associated with increased job satisfaction might help administrators use these tools to reduce faculty attrition.

#### Limitations

This study was limited to full-time MSU Extension county faculty who were on staff for a year or more as of October 1, 1993 and were not on extended leave at the time of the study in November 1993. Agents had had access to telecommunications for the entire year covered by their annual performance review, which administrators completed between November 1993 and February 1994.

#### Assumptions

The assumptions for this study were that:

- Questions within the survey were valid.
- Agents responded honestly to survey questions.

- Self-reporting of computer skill levels adequately reflected skill levels.
- Job satisfaction scores as measured by the Job Descriptive Index work scale are a valid reflection of agents' satisfaction with the work itself.
- Job performance evaluation scores by MSU Extension administrative staff are a valid reflection of variations in agents' job performance.

### Definition of Terms

Email: Electronic mail service operating under any system whether mainframe or electronic bulletin board system.

Extension county faculty: A term used interchangeably with Extension county agents.

Internet: An international computing network, made up of smaller regional computer networks, that links millions of personal computers around the world through 1 million mainframe computers (Library of Congress Management Team, 1993). It can be used for long distance collaborations, obtaining programs and documents, accessing library catalogs, supercomputers, etc. (Kochmer, 1991)

Job Performance: Job performance as assessed and recorded on a five-point scale by MSU Extension administrative staff.

Job Satisfaction: Feelings that a worker has about his or her job as measured by the Work Itself measure of the Job Descriptive Index (JDI) developed by P. C. Smith, L. M. Kendall and C. Hulin. (1969)

Online or on-line: A person using a computer to connect to a distant computer, usually for the purpose of communicating with people or retrieving information.

## Methods

### Population

This study was limited to the 66 full-time MSU Extension county faculty who had been with MSU for a year or more as of October 1, 1993 and who were not on extended leave when data was collected in November 1993. Only full-time agents were used, because it was judged that the job pressures and economic pressures on part-time staff might be different than those forces on full-time staff. A list of the study population was obtained from MSU Extension administrators.

### Instrument Development

Type of Questionnaire. A structured telephone interview was used to collect information. This method was chosen in preference to an anonymous mail questionnaire, because it was expected that those with the least interest in computers would be least likely to return a mailed questionnaire about computer use, which would bias the results. This potential bias was judged more important to avoid than any bias that might be introduced if some county faculty attempted to frame "acceptable" answers.

Draft Questionnaire. A draft of the questionnaire was developed and tested on two out-of-state Extension agents in November 1991 (see Appendix B). It was extensively modified in October 1993. Extension administrative staff and faculty in two MSU departments reviewed the 1993 instrument. It was then

retested with three Extension agents from neighboring states. The names and phone numbers of the agents were obtained from MSU Extension administrators.

Telephone-administered questions included the work satisfaction subset of the Job Descriptive Index (Smith et al., 1969). The complete JDI includes subscales that measure satisfaction with pay, coworkers, promotion, and supervision as well as the work itself. Normative data is available for each subscale. However, for several reasons only the "work itself" measure was used in this study. For instance, since MSU Extension faculty have had no pay increases for two years and no incentive-pay for special effort, the JDI's satisfaction with pay measure was inappropriate. Coworkers are different for each extension agent, so the usefulness of information from that scale seemed limited. Supervision of agents is conducted from a distance and could be clouded by the supervision that occurs, at least informally, at the county level, so the JDI's measure for supervision was inappropriate. Since computer skills are tools for work, satisfaction with the work itself was the most appropriate JDI scale to use.

In the pilot instrument, some questions were asked to measure the respondent's tendency to be generally satisfied or dissatisfied. This measure of "affective disposition" was developed by Joseph Weitz (1952) and modified by Timothy Judge (1993) to refine measures of job satisfaction. During pretesting, subjects repeatedly halted to comment on some of the unusual phrases developed by Weitz and Judge. Because of this, the Weitz/Judge series of questions was eliminated from the final questionnaire.

In addition, the instrument included questions to determine the agent's access to computer equipment and degree of use of computers and telecomputing. First, an agent was asked whether he or she, personally, used a

computer for word processing, spread sheets, database programs, acquiring information from distant computers, and electronic mail. If the answer was yes, the agent was then asked to assess his or her proficiency in that computer skill area on a one-to-three scale, where three indicated higher proficiency. If an agent did not use a computer for one of these purposes, a zero was circled on the paper questionnaire. All questions were worded to avoid suggesting a "right" answer.

Content Validity. Questions relating to computer use, computer access, and satisfaction with information resources were developed. These factual questions were reviewed by graduate committee members, a statistician, and a sociologist with extensive experience devising and conducting surveys. Since they related to concrete activities rather than concepts, were carefully worded, and reviewed by several faculty, the graduate committee decided that content validity was not likely to be a problem.

The Job Descriptive Index (JDI) by Smith, Kendall and Hulin (1969) was licensed and its Work Itself Index used to measure this portion of job satisfaction. The JDI is balanced in its use of positive and negative phrases, and whether a "yes" or "no" response is scored as a satisfied attitude. (See Appendix C). The JDI had high validity in its testing by Smith during development (1969), and has been used extensively and revalidated since its introduction (Hanish, 1992; Judge, 1993; Parsons & Hulin, 1982; Smith et al., 1969; Taber, 1991). Taber (1991), comparing several measures of job satisfaction, found that an average job satisfaction rating by 11 judges assessing the responses of 249 telephone operators correlated substantially ( $r = .54$ ) with a sum of the five facets of the JDI and similarly ( $r = .46$ ) with the JDI's Work Itself score. Balzer and Smith (1990) updated the tone and revalidated the measure in 1987, reporting that it correlated

well with behavioral measures of job satisfaction such as absenteeism, rated performance, and termination decisions (Balzer & Smith, 1990), though they did not give details of validity in that publication.

In addition, one question was used from a study by Gerhart (1990), which was intended to determine the agent's perception of ease of movement to another job. Gerhart found that it correlated with job satisfaction in such a way as to suggest that job dissatisfaction was more likely to result in intentions to leave when employees perceived ease of movement to be high.

Reliability. Balzer and Smith (1990) reported an average internal consistency (alpha) of the five scales of job satisfaction of .88, which was similar to those reported by Judge (1993), which were between .85 and .91.

The JDI usually is administered by an employee responding on a paper form. However, the JDI has been verbally administered when reading or language problems were anticipated (JDI co-author Patricia Smith, personal communication, October 19, 1993). It lends itself to telephone administration, because it uses either simple words or phrases. It conforms to the suggestion of Davis (1971) to "use multiple measures for key variables whose operational definitions are problematic" (p. 18).

### Obtaining and Protecting Information

About one week before questionnaire administration began, the Vice Provost and Director of the MSU Extension Service sent a letter to county faculty encouraging them to cooperate with the study. The interview phone calls were made during normal business hours, and each interview took less than 10

minutes. At the end of the interview, each agent was offered a summary of the findings after the survey results were completed.

All agents were asked a series of questions relating to computer use and job satisfaction, and this information was added to a statistical database. These responses were used in conjunction with information from public employee records, which included the agent's gender, highest degree earned, length of employment at MSU, tenure status, and salary. To get a total number of the professional staff in each county, one point was given for each agent and half a point for either a program assistant or aide. A unique situation existed in Yellowstone County where the agent in charge of the Extended Food and Nutrition Education Program was in charge of a separate office and had the title of "county chairman," separate from the main Extension Service office. In this case, the two offices were handled as separate units. After the interview, responses and information available from public records were entered into the database, the names of agents were removed from both the database and the physical form, leaving only a code number to differentiate among them.

The coded public and interview information was combined with information from a matching coded form filled in by Extension administrators (See Appendix A). Initially, county faculty names appeared on a cover sheet attached to the coded forms Extension administrators were to use. Once they had completed the form, they tore off the cover sheet with the agents name, leaving only the code number for identification by the researcher.

The coded administrators' forms had a place in which to designate the agent's main area of program responsibility (agriculture, 4-H, etc.) and the employee's most recent performance appraisal. From the administrators' coded

forms, their data was added to the appropriately coded entry for each agent in the statistical database. MSU's affirmative action officer and director of personnel services both gave verbal approval of this method of maintaining faculty anonymity while using data from staff performance appraisals.

### Data Collection

Questionnaire Administration. At the beginning of each phone call, the subject was asked:

“Do you have time now to answer about 10 minutes of questions? The questions that follow relate to your use of computers and satisfaction with various aspects of your job. All of the information will be confidential and no one except me will see your answers until after all record of your name has been removed from the data.

If the agent did not have time, a later appointment was made. To introduce the Job Descriptive Index section of the questionnaire, the following introduction was read:

Next, I will read a series of adjectives. If the adjective applies to your work, tell me “yes.” If it doesn't apply, tell me “no.” If you're unsure whether the adjective applies to your work, tell me you're “unsure.”

No clarification of questions was offered. If an agent asked what a question meant, the response was that they were to make their own best judgment of the meaning of the question. Agents also were asked not to discuss the questionnaire with other county faculty.

Recording Responses. Responses were recorded on paper questionnaires, then entered into the statistical analysis program. The paper copy acted as a check of computer entry and was proofread against the computer database

entries three times. When administered on paper, the Job Descriptive Index requires participants to circle a "y" for yes, an "n" for no, or "?" for unsure. From the outset of this study, a few respondents would answer "sometimes" instead of one of the three preferred responses. All answers of "sometimes" were scored as a question mark.

### Data Analysis

Biographical and organizational information was entered into JMP® version 3, a statistical analysis database by the SAS® Institute Inc. of Cary, North Carolina. This computer program is the Macintosh version of the SAS program licensed by Montana State University-Bozeman.

As an exploratory study, a liberal definition of whether results were significant was chosen. If, in the various analyses, there was less than a one-in-ten chance of the result occurring by chance alone, the result was considered significant ( $\alpha = .1$ ). The reason for this choice was that the consequences of falsely rejecting the null hypothesis of no relationship between computing skills, on the one hand, and job performance or job satisfaction, on the other, were minimal, while the potential benefits of finding tools to increase job performance or job satisfaction were judged to be more important.

Job satisfaction and job performance appraisal scores were analyzed separately to see if they formed normal distributions, which is a prerequisite for some statistical analyses. Then the contributions of individual and cumulative computer skill measures and other variables hypothesized to influence job satisfaction and job performance were investigated using multiple regression analysis and then stepwise regression analysis.

Scoring Job Satisfaction. The Job Descriptive Index work scale was scored following the procedures described by William Balzer and Patricia Smith (1990) (See Appendix C). Basically, faculty were read a series of adjectives and asked whether the adjective applied to their job, did not apply to their job, or whether they were unsure whether it applied to their job. The response to each adjective was then quantified. Each response that Balzer and Smith judged to indicate satisfaction was given a score of 3. Each negative response was given a score of 0. In keeping with Balzer and Smith's (1990) and Hanish's (1992) findings that an unsure response was slightly more negative than neutral, it was scored 1.

Scoring Job Performance. Extension administrators annually do a performance appraisal using a scale that ranges from "unacceptable" on the low end, through "below expectation," "meets expectation," "exceeds expectation," to "extraordinary." The same scale is used throughout Montana State University and lends itself to assignment of numbers between one (unacceptable) and five (extraordinary) for analysis. Two administrators performed the 1993 reviews between October 1993 and February 1994. By frequently working together, the process contributed to consistency in the evaluations of different agents.

Scoring Computer Skills. Scores for computer use and expertise were based on the county faculty member's self-reported personal use of word processing, spreadsheet applications, database management, and telecommunications tools. A zero was recorded if an agent reported not

personally using that tool. If the agent used the computer technique, he or she was then asked, "On a scale of 1-to-3, where the higher the number the better you are at the task, how proficient are you?" In addition, an agent could receive a score of one point for using telecommunications with people outside of Montana. The rationale for this was that in-state telecommunications had been facilitated by Extension's computer applications specialist, who has made electronic mail distribution lists of Montana Extension staff available, while telecomputing with people outside the state indicated that the agent acted independently to extend telecommunication contacts.

Other Intervening Variables. Previous job satisfaction studies have suggested a host of variables that sometimes are associated with satisfaction, including gender, length of time in job, the perceived availability of other jobs, general tendency to be satisfied or not satisfied, pay, education level, and job performance (see the Literature Review for citations). The number of Extension agents in the county and whether or not an agent was tenured or tenure track also were considered plausibly associated with job satisfaction. Information on most of these factors was available from public records or the interview, except for the general affective tendency to be satisfied or not, which was dropped from the study (See the section "Draft Questionnaire" above.). All others were considered in the analysis.

### Hypotheses

⊙ H<sub>01</sub>: Examined separately, the independent variables do not provide a significant and unique contribution to the prediction of job performance after the other independent variables have been taken into account.

H<sub>02</sub>: There is no relationship between Extension administrator's rating of job performance and the set of independent variables including county faculty's level and type of computing skills, computing facilities, gender, education level, length of time in job, pay, tenured/nontenured status, job satisfaction, perceived availability of other jobs, worry about job changes, and number of agents in a county.

H<sub>03</sub>: Examined separately, the independent variables do not provide a significant and unique contribution to the prediction of job satisfaction after the other independent variables have been taken into account.

H<sub>04</sub>: There is no relationship between the JDI measure of job satisfaction and the set of independent variables including county faculty's level and type of computing skills, computing facilities, gender, education level, length of time in job, pay, tenured/nontenured status, job performance, perceived availability of other jobs, worry about job changes and number of agents in a county.

⊙ Timeline

The telephone interviews were completed between November 3 and November 15, 1993.

## CHAPTER 2

### LITERATURE REVIEW

The fascination with the potential of computer technology to improve communication and job performance has been reflected in the organizational planning of the USDA Cooperative Extension Service. In 1985, an Extension Service report's first recommendation was that Extension "must embrace the philosophy that the adoption of emerging electronic technology will enhance its program delivery capability" (Electronic Technology Task Force, 1985, p.vii). In 1990, a report from the USDA's High Technology Commercial Agriculture Task Force called for development of computerized databases which would be "available in every county office and also to producers with the technology and ability to access the data" (Weber & Poley, 1990, p. 9). Its FACT report (1991) said:

Communication technologies will be an essential part of the future-oriented organization: to facilitate communications in the network environment, to enable our human resources to stretch to reach more people, to lessen the negative impacts of geography or cultural differences, and to support timely, flexible approaches to solving problems "just in time." (p. 10)

The FACT report also set a goal of every Extension professional receiving electronic mail "directly to his/her desktop plus remote computer access and file transfer capability" (p. 13) by 1993. The logic was that Extension staff, as information professionals who are separated from coworkers by great distances, would be able to do a better job if they had access to more, and more timely,

information. This view of extension-like organizations' need to improve information resources is held outside of the United States, too. Before computers were widely used, Bernardo (1981) commented on the need to improve Philippine Extension workers access to information. In 1986, Dillman asserted that USDA Extension's challenge was how to systematically change "so that staff skills, the nature of the Extension Organization, and the technology at its disposal make possible a systematic and appropriate transition to the information age" (p. 107). Use of computer technology and particularly email by Extension staff also has been described as an integral part of Extension's role in technology transfer (Risdon, 1994).

Developing the physical telecommunications connections between MSU county Extension offices and training Extension staff in the use of the new systems was a high priority, as evidenced by the one-time MSU Extension funding that brought all county offices "on line" in 1992. Training in uses of other computer applications, such as computer spreadsheets for assessing business profitability and reducing business risk, has been the subject of statewide seminars by agricultural economists who are also Extension specialists.

However, little is known about which computer skills are most useful. For the Extension Service, formal definition of which computer skills enhance job performance began only after the FACT report. In December 1991, a message on an Internet Extension Technology electronic mail group asked for volunteers to help define which computer skills are necessary for Extension personnel (Gamble, 1991). Such a definition would seem to be particularly important since some studies have indicated that there is a point beyond which additional information decreases job performance (O'Reilly, 1980); whereas others have shown that

workers who were separated from other workers benefit from active use of electronic mail (Huff, Sproull, & Kiesler, 1989).

Just where the needs of MSU Extension Service staff fit between these dichotomous possibilities is not known. Does MSU county faculty job performance relate to their computer skills? In fact, which of the plethora of variables sometimes associated with computer skills, job performance, and job satisfaction are associated with MSU Extension county faculty's computer skills, job performance, and job satisfaction? This literature review will examine briefly the:

- skills and circumstances associated with computer use
- characteristics of on-line information resource users
- needs of telecommunications users
- constraints on computer use, both organizational and personal
- motivation and its role in job performance and job satisfaction

#### Skills and Circumstances Associated with Computer Use

The degree of computer use or nonuse can be logically linked to keyboard skills. Degree of computer use also has been linked to such factors as proximity to a computer (Brien & Potter, 1972; Dahlgran, 1987; Marshall, 1989; Shaffer, 1991), training (Marshall, 1989; Rubinyi, 1989; Shaffer, 1991; Wilson, 1990), expense (Charles Egan, personal communication, 1991; Harold Johns, personal communication, 1991; Rubinyi, 1989), gender (Schmidt, Rockwell, Bitney, & Sarno, 1994), and age (Schmidt et al., 1994; Shaffer, 1991).

Age has been associated with differences in computer use. Older library patrons have been found to do less electronic database searching than younger patrons (Noble & O'Connor, 1986). Older farmers also were found to do less computer data input than younger farmers (Schmidt et al., 1994). However older college students were found to use computers more than younger college students (Pope-Davis & Twing, 1991). Increasing age was not found to be a barrier to the adoption of computer-facilitated end-user searching of information databases (Marshall, 1989). In Shaffer's 1991 study, younger Extension agents tended to use PENpages, an information computer bulletin board at Pennsylvania State University, whereas older agents tended to assign someone else this responsibility.

The need for training in proper database search techniques (Bradigan & Mularski, 1989) and proper use of a distant computer information system (Shaffer, 1991) also have been shown to be important to later use of the systems. For instance, in Bradigan and Mularski's study of second year medical students' use and learning of database searching, one student commented on a posttest that it was a disadvantage of computerized searching that the user "must know the tricks, such as Boolean logic" p. 351. Shaffer reported that a "substantial relationship . . . exists between respondents' use of PENpages and whether or not they received training" p. 47.

Differences in computer use by gender have been reported, but not consistently. Schmidt, Rockwell, Bitney, and Sarno (1994) found that among farmers, women recorded accounting information on computers less than men, even though when computers were not involved they were about equal in

accounting responsibilities. Pope-Davis and Twing (1991) found that gender did not significantly influence attitudes toward computers among college students.

Wielhorski (1994) suggested categories of telecommunications users that highlighted the skills possessed and needed by different groups in a university setting. Her three categories were:

- the technologically challenged remote user who is “interested in results rather than in the operation of the computer or the mechanics of searching” (p. 9)
- the “techie remote user . . . (who is) interested in the technological aspects of telecommunications and techniques of remote access, but may not be familiar with the subject area they are researching or with effective search techniques” (p. 9)
- the “research-naive remote user . . . (who) may not be able to construct a search strategy that includes all the possible ways of expressing the concept that they are searching for” (p. 9).

Marshall (1989) characterized on-line database searchers as generally cosmopolitan. This he defined by the number of out-of-town meetings attended and number of professional associations reported by respondents. Casey and Krueger (1991) showed that agents who were identified as continually producing successful programs "got ideas for programs from extended networks not limited to their county or Extension" (p. 11).

Characteristics of  
On-line Information Database Users

There have been many descriptions of on-line information users (Ashe, 1991; Dahlgran, 1987; Marshall, 1989; Noble & O'Connor, 1986; Shaffer, 1991; Wallingford, Humphreys, Selinger, & Siegel, 1990; Wilson, 1990) and the preferred information sources of Extension personnel (Brien & Potter, 1972; Burns, 1974; Hazell & Potter, 1968; Sattar, 1984). However, there were differences among the populations in these studies. In addition, the studies of preferred information sources of Extension personnel were considerably older than the other studies, which introduces the question of whether or not there were differences shown by the studies or simply changes over time. Noting these limits to comparing the findings, these studies suggested that researchers (Hazell & Potter, 1968) and specific groups of Extension specialists (Dahlgran, 1987) used computerized databases more than other Extension personnel, but that the differential use by specialty area seemed to disappear at the agent level (Shaffer, 1991). This might have been because similarities between different subgroups of Extension agents may have been greater than the similarities between different subgroups of specialists.

For instance, Shaffer's 1991 study of Pennsylvania State University Extension personnel's use of PENpages showed no relationship between an agent's area of special expertise and use of PENpages. However, Dahlgran's 1987 study showed that agricultural economists were disproportionately represented among users of electronic bibliographic databases. In addition, the

economists who used computerized databases in Dahlgran's study tended to have research rather than Extension appointments (56.6% to 42.1%). Wilson and Teske's 1990 study also found that researchers use information databases more than Extension specialists or agents.

Evolution of both the information and telecommunications systems has been dramatic and rapid. The MSU Extension Service, and others such as Pennsylvania State Extension (Shaffer, 1991), came on-line in definable "pushes" when funds were committed to the goal of telecommunications and remote information access. Because of this, the timing of studies was very important in relation to the unit's stage of acceptance of the new technology. For instance, a Pennsylvania Extension Service study in 1991 reported agents accessing their state information system daily (Shaffer, 1991) while an Illinois Extension Service study in 1991 reported that "the impact of electronic technologies wasn't yet apparent" (Shih & Evans, 1991, p. 19). Other evolutionary changes were partly due to the fact that early on-line information tended to be highly technical. Most early on-line information systems--such as DIALOG® and that of the Advanced Research Project Agency Network (ARPANET)--were intended for researchers, not the home or even general business audiences (Ashe, 1991).

Needs of Telecommunicators:  
Data, Answers, or Communication?

As both computer systems and computer skills improved, more people who needed information could consider using computer information services. For instance, Wallingford, Humphreys, Selinger, and Siegel (1990) reported on the

change in use of one of the oldest computer information systems: the National Library of Medicine's MEDLINE database.

In the past, the principal users of the NLM's online system were medical librarians, . . . Since 1985, however, the composition of the NLM's online user group has changed. Nearly half of the passwords that allow access to the NLM system are now assigned to individuals as opposed to libraries or other institutions, . . . Over the past 12 months, individual users accounted for more than one third of the 4.5 million MEDLINE searches conducted on the NLM system. (p. 166)

This study also linked use of on-line databases to the type of information needed and how soon the information was needed.

Early adopters of on-line information database searching have been found to highly value formal sources of information such as books, journals, and libraries (Marshall, 1989). However, as mentioned previously, some studies have reported that Extension faculty have not found traditional library and journal information very useful (Brien & Potter, 1972; Burns, 1974; Sattar, 1984; Shih & Evans, 1991) Brien and Potter's 1972 study of Australian Extension workers concluded that low interest in library sources was not due to lack of enthusiasm about all agricultural science literature but simply that Extension workers wanted the information in a very brief form. Sattar (1984) found that Extension agents did not consider indexes, abstracts, or bibliographic databases easy to use, accessible, or better in quality. All library related information sources were ranked low in priority for use, so low that he concluded that "the respondents perceive these sources as useless" (p. 306).

Burns (1974) surveyed Montana, Colorado, New Mexico, and Wyoming Extension agents and specialists and concluded that the information sources and the characteristics of the information for both the Extension agent and the

Extension specialist were varied. Drawing attention to the context of the Extension worker, Burns said:

Like the people they serve, Extension personnel consume great amounts of unorganized, highly volatile, non-print information . . . Extension staff do not rely heavily upon the traditional library sources of information for help. They are often required to be ingenious and creative in developing their own sources of information. (p. 14)

Hazzell and Potter (1968), after finding that Extension workers made heavy use of periodicals, though less than research workers, wrote that the differences did not seem related to whether the worker was an agricultural college diplomat or had a university degree but only to whether they worked in research or extension.

These earlier looks at information preferences are supported by the 1991 work of Shih and Evans, which showed that agents said when answering client's questions, they used journal articles substantially less than Extension publications, non-Extension publications and personal notes. They indicated they would use journal articles about 6% of the time they were looking for information

#### What Telecommunicators Say They Want and What They *Really* Want

Some studies have indicated that what people say about seeking information may not shed light on their actions (Ashe, 1991; Eveland & Bikson, 1989; Sattar, 1984; Sproull & Kiesler, 1993). Sattar found in a 1984 study of Illinois Extension specialists that reports of preferred information sources differed from actual information seeking behavior. Specifically, agents and specialists reported that they preferred personal contact with colleagues as a means of

getting information, but that in practice they used this source least. In a report about people telecomputing from home, Ashe (1991) noted a similar discrepancy. Ashe was chairman of an information and telecommunications system in the 1980s called Viewtron. He concluded that:

From the beginning, Viewtron customers reported high satisfaction but showed rapid attrition. . . What a minority of them did want, and were willing to keep using, was something else. It wasn't information. It was communication—interaction not with a machine, but with each other. (p. 13)

Scientists were little different than these first home users in what they wanted from distant computers. ARPANET, which was the first extensive computer network, was begun in 1969 to let researchers share scarce resources by logging in to remote computers. As put by Sproull and Kiesler (1993), “to everyone’s surprise the most popular and extensively used feature of the ARPANET was electronic mail” (p. 10). Eventually, ARPANET became the foundation of the Internet.

Whereas these reporters of early telecommunications and information seeking showed surprise at the popularity of email, this has since become widely accepted. By the 1989 publication of a study by two Rand Corporation researchers of how computer support molded work group structures, the authors stated their pre-research assumption that “communication is intrinsically motivating, so that when provided with that capability (email) task force members would be likely to use it” (Eveland & Bikson, 1989, p. 357). In light of reports that older employees sometimes have tended to avoid computer use (Noble & O’Connor, 1986; Shaffer, 1991), the assumption in the Rand study of a motivation to use email even though no participants in the study had never used computer-based communications and they averaged 62 years of age, was interesting. Only a

quarter of the Rand study's participants had used a home computer, and the primary home use was for games. That communication was, for some people, intrinsically rewarding was also supported by the experience of the Prodigy information service. As reported by Branscomb (1991), when Prodigy had no charges for electronic mail, "A few users . . . discovered that electronic mail service (EMS) was a great new toy, with some transmitting as many as 13,000 messages monthly."

### Constraints on Computer Use

Wilson (1990) identified six factors that constrained computerization in developing countries. The constraints were funding, resistance to change, organizational policy, training, hardware/software availability, and individual confidence. These categories are useful for summarizing constraints on computer use in the United States, too and can be grouped broadly into organizational/system constraints and personal constraints, which are examined below.

#### Organizational and System Constraints

Researchers have linked organizational policies and leadership to adoption of new technologies. Morehouse and Stockdill (1991), in describing a model of technology adoption, suggested that full organizational implementation of technologies may be more directly affected by interrelated political and communication forces than by rational information about the technology. Steinfield (1990) concluded that implementing a new telecommunications system

requires an internal advocate. These studies seemed to assume, however, that technologies had equal ease of use and were supported by adequate training resources.

Though a decision to implement a new technology was one impetus for its adoption and an internal advocate may have been useful, this “top down” view of organizational change did not incorporate the idea that the ease of use (or lack thereof) of the software was associated with its degree of acceptance. Computer magazines have dealt with this issue of “user friendliness” regularly and the concept of “user friendliness” was pervasive enough to have been featured in the popular general-interest magazine *Time* (McCarroll, 1991). At the crux of the user-friendliness problem has been the fact that the more a computer program could do, the more commands there were to tell it what to do. McCarroll (1991) reported in *Time Magazine* that electronic mail, while “readily embraced by techie types . . . was shunned by secretaries and others because it proved too difficult to use” (p.45). One of McCarroll’s sources said, “There are too many options, and every option has suboptions. It’s easier to just pick up the telephone” (p.45). Brown (1993), coordinator of the North Central Region Education Materials Project at Iowa State University, reported that the majority of respondents in a survey of users of the system “rated themselves with low understanding of how to search an online database” (p. 4).

Funding and Training Constraints. Funding constraints have limited the use of new technologies in several ways: by limiting the purchase of new technologies, by limiting training in the new technologies, and by limiting the rewards that were given to employees who adopted new technologies. In 1974,

agents in Montana, Colorado, Wyoming, and Utah, reported "little interest in the electronic equipment offered to speed the flow of information. Indeed, several raised objections to its installation on the basis of high costs" (Burns, 1974, p.20). As mentioned previously, Montana county faculty recently have cited lack of funding as a limit to telecomputing. The Extension FACT report also acknowledged the constraint of funding by suggesting a progression of investments in telecommunications equipment as the equipment could be afforded (FACT Task Force, 1991).

Federal funding for employee training may have been inadequate (Rubin & Huber, 1986). Rubin and Huber (1986) documented that, though expenditures for training federal employees increased between 1967 and 1980, the number of employees trained fell by half. The FACT report (1991) also cited Sang Lee, Director of the Center for Research in Decision Science at the University of Nebraska-Lincoln as saying that training in appropriate technologies deserved much greater attention and greater resource commitment. Shaffer (1991) found a correlation between training and subsequent use of a computerized database.

Funding could have provided rewards for personnel who adopted new technologies, but tangible rewards for performance sometimes have been either absent or perceived as absent in the Extension Service. In Montana, all Extension Service faculty received a 1.5% raise in January 1993, but salaries were frozen in July 1993 for a period proposed to last until January 1995 (W. Ekegren, personal communication, February 1994). Rewards for performance under these circumstances have been intangible. In Ohio, Van Tilburg (1986) studied 244 Cooperative Extension Service county agents. She found that they did not feel that Extension rewarded good performance by agents.

### Personal Constraints

Why is one person consistently first to learn a new way of doing something while another person is last? The answer lies somewhere in the rich amalgam that makes up an individual. It includes a mix of a person's confidence, personality, and motivation, as well as getting beyond the organizational and funding constraints mentioned above.

Confidence. Noble and O'Connor (1986) found that distrust of computers could be a self-fulfilling prophecy. In their study of users of a computerized library database system, they found that those who distrusted or were suspicious of computers said they would have less use for the system in the future, found difficulty in remembering search commands, and used other computer terminals infrequently. Smith and Kotrlik (1990) studied the computer anxiety in a number of contexts among Extension agents in 11 southern states. They found that 55% of the agents were classified as anxious overall about computing as measured by a Likert-type scale. On a subset of information related directly to computer science, 77% were ranked as mildly to very anxious. Kivlin and Fliegel (1967) and Driver and Onwona (1986) found a correlation between adoption of innovations and positive attitudes toward risk taking.

The same group of people have been shown to hold contradictory attitudes toward computers. For instance, the two strongest explanatory variables in Nobel and O'Conner's 1986 study of library patrons use of online public access catalogs conflicted with each other. The factor explaining the largest percentage of variance (17.9 percent) showed characteristics of distrust of

computer technology. This factor was composed of responses to statements such as “computers make serious mistakes because they fail to take the human factor into account” (p. 607). However, their second most explanatory factor, which explained 13.9 percent of the variance in the study, included characteristics of positive acceptance of technology. This factor was composed of the responses to statements such as “computers will bring about a better life for the average person” (p. 607).

Personality. Moreland (1993) suggested that managers could reduce the complex of fears surrounding requirements for librarians to learn many new high-technology tools by assessing personalities. She termed employees’ fears “technostress” and described librarians as facing “an endless proliferation of high-technology tools and sources. They cope with multiple software interfaces, varying equipment configurations, escalating user demands, and perpetual change. Both literature and folklore attest to the serious stress that can result” (p. 59). Her description of the challenge facing librarians as they adapt to new information technologies was very similar to the description in the USDA FACT report of the challenge facing Extension staff.

Interaction with other students has contributed to successful learning. Papa (1990) found that interaction between individuals who were trying to learn to use a new technology was associated with their adoption of the technology. Similarly, after studying a group of 18 farmers in Wisconsin and Kansas, Iddings and Apps (1990, p. 20) suggested that “a wide network of other computer users” was important to farmers learning to use computers.

## Job Performance and Job Satisfaction

### Motivation and its Role in Job Performance and Job Satisfaction

Researchers have described motivation as a key that arouses, directs, and sustains behavior (Keefe, 1988); as an attribute that has categorized groups (Driver & Onwona, 1986), and as the force that propels an individual to satisfy basic needs or wants (Pardee, 1990). Pardee added that “needs will determine what rewards will satisfy an employee” (p. 3) and, in doing so, would be an important influence on job performance. Although motivation has been difficult to define, several theories of motivation have been developed, including Maslow’s Hierarchy of Needs, McGregor’s XY Theory, Herzberg’s Motivation/Hygiene Theory, and McClelland’s Need for Achievement Theory.

Maslow (1943) proposed a hierarchy of needs that must be satisfied from the most basic, at the bottom of the hierarchy, upward. The hierarchy begins with basic physiological needs, then rises to safety needs, social needs, ego needs (such as the need for achievement), and self-actualization or the need to realize one’s potential. Only unsatisfied needs provide motivation, so when a lower-order need is satisfied, the next higher need becomes the motivator of behavior.

McGregor built on Maslow’s work; Maslow’s need for ego satisfaction was the beginning point for McGregor’s XY Theory of motivation. According to Pardee (1990) the “Y Theory” portion of McGregor’s work added factors of self-direction, self-control, motivation, and maturity.

Herzberg proposed a dichotomous system of separate “hygiene factors” and motivators (Pardee, 1990). Hygiene factors are items which could cause dissatisfaction, but not satisfaction. Motivators, on the other hand, could cause satisfaction. Among the hygiene factors are company policies, supervision, working conditions, salary, and job security. Among the satisfiers are achievement, recognition, the work itself, responsibility, advancement, and growth. Though Herzberg’s scales overlapped Maslow’s Hierarchy of Needs, in Herzberg’s system, the opposite of satisfaction is not dissatisfaction, but no satisfaction at all. It is only the goals associated with Maslow’s ego-status and self-actualization that supply motivation or satisfaction in Herzberg’s system (Pardee, 1990). In Herzberg’s system, an employer would identify hygiene factors and provide them for employees but still need to provide specific motivators.

McClelland’s Need for Achievement Theory emphasizes socially acquired needs. While these socially acquired needs are not identical with Herzberg’s motivators or Maslow’s higher order needs, there are similarities. McClelland’s Need for Achievement is similar to Maslow’s concept of self-actualization (Pardee, 1990). One of McClelland’s main theoretical elements was that needs are learned by coping with one’s environment. When an action is rewarded, the behavior will occur more frequently. The need for achievement and self-actualization becomes more important as people mature, implying that older workers need higher level needs satisfied. In addition, the employee must perceive that variations in performance lead to variations in the amount of reward received.

On a more applied level of investigating motivation, Brophy (1987) linked motivation to adopt new methods to an understanding of the benefits that would

flow from their adoption. He also linked their motivation to expectations a person has about the difficulty of achieving the desired outcome; if it were more difficult to achieve, the person would be less motivated to make the attempt. Similarly, Kivlin and Fliegel (1967) found that the clarity of communication of benefits received from the innovation influenced adoption, and Morehouse and Stockdill (1991) suggested that once an organization has formally adopted a technology, "It may be necessary for the organization to provide a level of recognition or reward for those who adopt the new technology" (p. 7).

#### Cause or Effect? Job Satisfaction's Relation to Job Performance

Pardee (1990) argued that motivation is the strongest influence on job satisfaction. Balzer and Smith (1990), though not referring by name to the above theories of motivation, succinctly summarized the relationship of the theories to job satisfaction in their user's manual for the Job Descriptive Index.

Job satisfaction is a principal concept in most theories of work motivation and work behavior. For many theorists, satisfaction is seen as a direct *cause* of such behavior as attending work, maintaining quality standards, seeking improved work methods, and cooperating with employees. For other theorists it is a *consequence* of such behavior, because the behavior leads to rewards from the supervisor or the work itself and, hence, to satisfaction. For others, it is merely a symptom or a by-product (e.g., inadequate job design leads to both job dissatisfaction and to uncooperative behavior). In any case, job satisfaction, if carefully measured, is a useful and readily available index. (p. 7)

The perception of feeling like a part of the organization has been linked to job satisfaction and quality of work life, and communication of an organization's goals and challenges related to that perception (Castrogiovanni & Macy, 1990; Miller, Ellis, Zook, & Lyles, 1990). As Castrogiovanni and Macey put it, "The

direct implication is that use of participative strategies and processes can improve organizational information processing that may, in turn, improve organizational effectiveness and enhance employees' quality of work life" (p. 332).

However, reported job satisfaction has been shown to have other intervening variables. Van Tilburg (1986) suggested that only when employees are rewarded for good performance would their performance be positively related to satisfaction. In addition, Judge (1993) showed a relationship between a person's general tendency to be either satisfied or not satisfied and their reports of job satisfaction, and Bluedorn (1982) cited the support from seven studies that confirmed the relationship between "met expectations" and employees remaining on the job. Manton and van Es (1985) also found that a discrepancy with expectations was one reason given by former Illinois Extension agents who had quit their jobs.

The relationship between work performance and work satisfaction has been studied in great detail, at least partially with the hope of motivating workers to superior work performance (Balzer & Smith, 1990). Even with the great amount of study of job performance and job satisfaction, only a small amount of the variability in these measures has been explained. Van Tilburg (1986) provided a concise summary of research on the relationship between job performance and job satisfaction:

Most of the research which has investigated the job performance-job satisfaction relationship has shown only a slight positive relationship between the two. . . The original hypothesis explored suggested a positive relationship between satisfaction and performance with satisfaction affecting performance. . . Later research reversed the hypothesized causality and suggested that performance led to satisfaction, but still major literature reviews reported that the relationships found were very slight or non-existent. (p.2)

Iaffaldano and Muchinsky's 1988 meta-analysis of 70 studies of job satisfaction and job performance concluded that "the best estimate of the true population correlation between satisfaction and performance is relatively low (.17)" (p. 251). Schermerhorn, Hunt, and Osborn (1988) concluded from a review of research on job satisfaction and job performance that "there is no simple and direct relation between individual job satisfaction at one point in time and work performance at a later point in time" (p. 53). They also studied the converse theory: that better job performance leads to greater job satisfaction. They concluded that this relationship is "typically stronger than the one between initial job satisfaction and later work performance" (p. 53). Schermerhorn, Hunt and Osborn said that the perceived equity of the reward is a moderating variable between performance and satisfaction. In other words, they suggested that the reward had to be perceived as a fair return for the effort of the employee. Consistent with this, Van Tilburg (1986), who found that Ohio Extension agents did not think Extension rewarded them for higher work performance, found that rewards were not a significant moderating variable for job satisfaction.

#### Relationship of Electronic Mail to Job Satisfaction

In an attempt at fully conceptualizing a model that predicted employee turnover, Bluedorn (1982) placed communications as one variable among the organizational factors an individual experiences at work. He suggested that all of the organizational factors would interact with a person's expectations as they developed either job satisfaction or dissatisfaction (turnover). Bluedorn also suggested that age, education, length of service, sex and race were the most likely

demographic characteristics to influence an employee's expectations. He tied met expectations to lower turnover, or, in the phrasing of this paper, job satisfaction.

Based on a survey of Fortune 500 company public affairs directors, of which 56% responded, Susan A. Hellweg (1984) reported that the majority "perceived a slight increase in employee job satisfaction as a result of the emergence and growth of the technologies" (p. 10). This study, however, did not explain why public affairs directors were the appropriate source for this information, and it appeared that it was a subjective assessment on their part.

In a study of city government employees, Huff, Sproull, and Kiesler (1989) reported that neither the amount of electronic mail received nor a person's reporting that he or she felt in the know about what is going on in the city predicted commitment. Rather, the amount of electronic mail a person sent predicted commitment. They found evidence that the benefits of electronic communications accrue more to workers who are at a distance from each other than to those at a central site. However, their report of increased benefits to shift workers inappropriately compared the multiple regression coefficients of two groups that were very unequal in size. Shift workers numbered 68, while nonshift workers numbered 259. Since they had the same seven independent variables in their multiple regression equation but very different sized groups, they had very different sample-to-variable ratios. Because a population to variable ratio for shift workers was not near the recommended 20 or 30 to 1, the  $R^2$  for the shift workers was inflated compared to nonshift workers.

A Rand Corporation study by Eveland and Bikson (1989), however, found related benefits with equal representation in the groups of workers "at a distance" from their organization (retirees) and those still at work. They reported

that an electronically networked group of employees and recent retirees of the Rand Corporation thought they had formed significantly more lasting social ties than those in a similar group that was not networked together electronically. In this Rand study, people were randomly assigned to either the electronically supported or standard group, had the same assignment, substantially the same prior work experience and prior experience (almost none) with computers, no preexisting group structures, and the people in the electronic group were provided with identical computer systems and software. Both groups were of equal size and had equal representation of retirees, received standard office support for functions such as mailings, etc. Among the authors conclusions were that the networked group:

became increasingly more positive about task involvement as well as subgroup and task force effectiveness, even though the standard group initially scored higher on most measures . . . When asked about their general satisfaction with the overall accomplishments of their task force, participants showed the same pattern. That is, the electronic group showed increases, while the standard group showed stagnation or even declines. (p. 367-368)

Researchers have suggested that electronic mail can be used by individuals to intentionally foster specific impressions of themselves with coworkers and bosses and by corporations to deal with organizational problems. Kersten and Phillips (1992) suggested that employees who used electronic mail “to generate impressions of being likable, competent, intelligent, and trustworthy are likely to experience greater job satisfaction” (p. 11). Keen (1990) suggested that telecommunications offers the chance to deal with a number of common organizational problems as well as to maintain organizational health. Potential problems included depersonalization of senior management, field/head office tensions, subservience to documents, and fragmented organizational knowledge.























































































