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Information Technology in Organizations: Impact on Structure, People, and Tasks
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Abstract
The influence of e-mail on three basic organization components: structure, people, and tasks is explored. An organizational interaction diamond model is developed. The setting is a large, public university. The sample population consists of 390 administrators, professional and clerical support staff. Data were collected via a written questionnaire with a 54 percent return rate.

Results reveal e-mail does not alter the organization structure, but bridges hierarchical boundaries at the middle and departmental levels, but not at the senior level nor across functional boundaries. E-mail usage increases to span geographical distances and to coordinate people from dispersed organization units. E-mail enables new network paths to co-exist within the traditional hierarchical structure.

E-mail is used more for horizontal than for vertical communication. The interaction among e-mail, job categories, and tasks reveals that the media channel selection varies by job category and task types. The perceived importance of using e-mail is highly associated with the frequency of use of e-mail to provide access to various job categories at different organization levels and for different task types.

Conceptual and Research Background
E-mail purportedly increases effectiveness and efficiency, facilitates greater communication among organization members, creates new forms of organization structure, alters the roles of individuals, provides new means to accomplish tasks, is rapidly becoming a critical messaging infrastructure, and its impact is a key management issue. The abundant and diverse research on information technology and organization factors has produced conflicting results which make it difficult to paint a coherent picture of the role of an information technology in modern organizations. Various organizational factors such as structure, roles of individuals, and tasks have been studied and are believed to influence and be influenced by this information technology (Rice and Case, 1983; Steinfield, 1985; Rice and Shook, 1990; Keen, 1991; Malone and Rockart, 1991; Schmitz and Fulk, 1991; Sproull and Kiesler, 1991; Benjamin and Scott Morton, 1992; Kiechel, 1993). These studies and others follow multiple paradigms and theoretical approaches to explain the relationship between an information technology and various organization factors. There is no one best theory to guide the research in this area. A multifaceted approach, organization, information processing and economic theories, is required to gain an understanding of these relationships.

Research on information technologies and organization structure reveals divergent results that range from creating a more centralized structure (Leavitt and Whisler, 1958), to a more decentralized structure (Anshen, 1960; Burlingame, 1961), to having no impact at all on organization structure or reinforcing the existing structure (Robey, 1977, 1981; Ciborra, 1993). Other studies found greater access to individuals across hierarchical, functional, and geographical boundaries enabled by information technologies engenders the formation of new communication paths that may be reflected in new organization forms (Miles and Snow, 1988; Child, 1987; Baker, 1992; Eccles and Crane, 1987; Keen, 1991; Drucker, 1993). Changes in structural forms may occur as a result of new social interactions and new means to accomplish tasks enabled by information technologies. Whether new communication paths and new ways of working are created depends upon how the components of structure, roles of people, and tasks are designed to tap the potential offered by the technology.

Research on the impact of e-mail on roles of individuals at different levels of the organization examines the type of tasks and the media attributes to determine whether individuals at different organization levels will use e-mail differently (Daft and Lengel, 1984; Daft and Weick, 1984; Hannaway, 1985; Mintzberg, 1973; Steinfield, 1983). A review of 40 studies revealed usage of different media was significantly different for
managers from other job categories, and that media usage was correlated highly with organizational level (Rice and Shook, 1990).

The media richness, social presence, and the social influence research (Daft, Lengel, and Trevino, 1987; Short, Williams, and Christie, 1976; Schmitz and Fulk, 1991; Fulk, Schmitz, and Steinfield, 1990) move the focus of the research to the attributes of the media. This line of research indicates users at different levels of the organization assess the media to fit the task and his/her communication style within the constraints of the organization. Users know what to communicate to whom at which level of the organization, and through which media.

The research on tasks and e-mail focuses either on task characteristics, (e.g., task complexity, uncertainty, ambiguity, programmability, predictability, repetitiveness, variety, routineness, and analyzability) or it emphasizes the attributes of the technology (i.e., the degree of social presence conveyed by the medium, its asynchronous, textual, and permanent nature, as well as the speed for feedback). Types of tasks, have been used to distinguish between different types of organization structure, and can vary by organization level (March and Simon, 1958). E-mail usage is affected by tasks characteristics, personality traits, organizational status, attributes of the media, and media styles (Rice and Case, 1983; Hiltz and Turoff, 1978, Steinfeld, 1985; Markus,1988; Rice and Shook, 1990). Organizations contain a mix of information processing requirements, various tasks characteristics, and a variety of media channels, and the key to the puzzle is to find the right fit between the medium, the user, and the task.

Research Model

The model developed for this study, the Organizational Interaction Diamond Model, is based upon the works of Alfred Chandler (1962), Leavitt and Bahrami (1988), and the MIT90's project. The underlying theme of these historical paradigms is an organization redesigns itself by focusing on management processes, structure, strategies, people, and tasks, to meet the demands of such external forces as technology and changing markets. The organizational interaction diamond model depicts the relationships among four basic organization components, as well as the interaction of these components with organizational factors and external forces, and proposes that the use of an information technology, like e-mail, is a function of the task to be accomplished, the role of the individual, and the structure of the organization.

Research Hypotheses

Three sets of research hypotheses were developed. The first set of hypotheses examines the use of e-mail to access various groups of individuals located at different organization levels and in different functional areas, as well as the perceived importance of using e-mail to provide access to each group to ascertain changes in the organization structure. The frequency of use of e-mail is associated with:

a. greater access to administrators than to professional and clerical support staff within an organization level.

b. perceived importance of using e-mail to access different job categories at different organizational levels and in different functional areas is greater than the reported use of e-mail to access these same groups at the same levels and functional areas.

The second set of hypotheses examines the relationship among the frequency of use of e-mail, job categories, organization level, and the direction of the communication, horizontal or vertical.

a. Senior level administrators will report using e-mail more frequently than middle and lower level administrators.
b. Senior level administrators will report using e-mail more frequently for horizontal communication than for vertical communication.

A third set of hypotheses explores task characteristics, types of tasks, and the frequency of use of e-mail.

a. The use of e-mail increases as the ambiguity, complexity, and non-routineness of the task decreases.

b. The frequency of use of e-mail for specific tasks will be positively associated with the perceived importance of e-mail for each task.

c. When selections are made among different media for the same types of tasks, the frequency of use of e-mail will be higher for uncertain, simple, routine, broadcasting and coordination tasks than for ambiguous, complex, and non-routine tasks.

d. The length of time an individual has used e-mail within the organization is associated highly with the types of tasks for which it is used.

**Methods and Research Design**

The setting is a large metropolitan, public sector, higher education organization. An established e-mail system existed for almost ten years, with 10,000 users. Higher education institutions are information intensive, with rigid, hierarchical structures, traditional roles and tasks, and offer an excellent opportunity to study the impact of the use of an information technology.

A modified, stratified design was used to derive the sample population. The organization consisted of six functional areas. Each functional area was divided into three levels of administration, senior, middle, and departmental levels, and then each administrative level was divided into three types of positions, line administrators, managerial and professional support staff, and clerical staff. Since faculty were late adopters of e-mail and their use of e-mail was more externally oriented, they were not included.

A modified, stratified sampling approach was preferred to a completely random approach of the entire population to ensure that the sample population reflected the different functional areas, administrative levels, and primary role categories. The sample population was N=390. A mail survey was deemed cost effective and the appropriate medium for a complex questionnaire. The questionnaire was pre-tested with three groups and yielded a 54 percent return rate.

**Results**

*Respondent's profile:* The average respondent was between 40-49 years of age, worked in the organization an average of 11.4 years, worked in his/her current unit for 8.2 years, and in the current position for 4.8 years, was more likely to be a female (62.2 percent) than a male (37.8 percent), unless they were an administrator then 68.4 percent were males and 31.6 percent females. The professional and clerical support staff groups were predominantly female. Fewer people were in the administrative category (27.6 percent) than in the professional and clerical support categories (45.7 and 26.7 percent, respectively). Fewer respondents were working at the senior level (16.7 percent) than at the middle or departmental levels (40.5 and 42.9 percent, respectively). The largest functional area was Academic Affairs with 63 percent.

*E-mail usage profile:* 98.6 percent had access to e-mail and 58.5 percent reported using e-mail several times each day and sent an average 14.26 messages daily, and used e-mail for 15.93 percent of their total daily tasks. Over 89 percent reported that e-mail helped them to do their jobs better. The average number of years for using e-mail was 5.8 years, and 5.6 years within the organization. Ease of use of the e-mail system was reported by 73.4 percent.
E-mail usage to access specific job categories, located at different levels, and functional areas, and the importance of e-mail to access each job category were rated in the first set of hypotheses.

**Access variables:** Descriptive statistics and correlation analyses among the access variables show e-mail is used more frequently to access administrators at the departmental and middle level, but not at the senior level, and to access professionals and clerical staff at the senior level. E-mail is used more frequently within a functional area than across functional boundaries.

**Importance of using e-mail:** The descriptive statistics for the importance of using e-mail to access different job categories across hierarchical and functional boundaries suggest respondents valued e-mail more for access to certain groups of individuals within their same functional area than its importance for access in different functional areas. An analysis of variance procedure found significance levels at .001. A comparison of the descriptive statistics reveals the perception of the importance of e-mail was higher than the use of the medium to access these job categories. The usage of e-mail to access specific groups of individuals at different organizational and functional levels is not creating new formal communication networks or altering the existing organization structure.

While the first set of hypotheses examines whether or not new paths were being created in the organization forest, the second set of hypotheses explores the frequency of use of e-mail with job categories and the direction of the communication. Support was found for the following:

1. Senior level administrators report using e-mail more frequently than middle or departmental administrators.
2. Administrators at all levels prefer to use e-mail to communicate horizontally rather than vertically.

The third set of hypotheses examines types of tasks, tasks characteristics, and the frequency of use of electronic mail for tasks. Media selection, perceived importance of e-mail for specific types of tasks, and length of time of use of e-mail are examined.

**Tasks characteristics:** As the ambiguity, complexity and non-routineness of a task increases, the frequency of use of e-mail decreases. An analysis of variance procedure yielded significant differences between the different types of tasks.

**Importance of e-mail:** The frequency of use of e-mail is associated positively with the perceived importance of e-mail for each task (i.e., ranging from .70 to .83 for uncertain, simple, and routine tasks and at the .001 level, and ranging from .67 to .87 at the .001 level for ambiguous, complex, and non-routine tasks).

**Media selection:** E-mail is selected more frequently for uncertain, simple, and routine tasks than for ambiguous, complex or non-routine tasks, and e-mail is preferred for broadcasting tasks, but not for coordination tasks.

**Length of time:** Only a weak association exists between the length of time someone uses e-mail and the type of task for which it is used.

**CONCLUSIONS AND IMPLICATIONS**

While some new communication paths are being carved in the organization forest, e-mail appears to be reinforcing the existing hierarchical structure (Ciborra, 1993). The use of e-mail to access varying job categories at different organization levels demonstrates how e-mail is being used to span hierarchical barriers at the middle and departmental levels, but not at the senior level, and to span geographical distances and to coordinate people from dispersed organization units, but not to cross functional barriers. The lower use of e-mail to access senior level administrators reflects constraints imposed by the existing
structural design, reporting relationships, control and coordination systems that may inhibit the flow of communication.

The perceived importance of using e-mail to access different job categories indicates users understand the importance of this medium to achieve access to specific job categories when needed. While users may be aware of the impact of media attributes, social influence, and constraints on the use of e-mail, users also are aware that e-mail provides them with a potential tool to span hierarchical boundaries when necessary. This may explain why the perceived importance of e-mail is greater than the actual usage to access different job categories.

The frequency of use of e-mail varies across organization levels, but not across job categories. While electronic communication may enable the flow of vertical communication, it is not being used to increase the flow of information from lower to higher levels, but increases horizontal communication.

Senior level administrators have a higher level of overall communication than lower level administrators and use e-mail not as a substitute for face-to-face and the telephone, but as a booster to these traditional media, and may use it to overcome geographical and coordination constraints more efficiently.

The increased usage of e-mail for specific tasks suggests the type of task can be matched with the appropriate medium. The high degree of association between perceived importance of e-mail and the usage of the medium for specific tasks suggests the user is selective in the use of the medium, and can match e-mail with appropriate tasks.

Researchers are encouraged to explore information technologies, specifically e-mail systems, as (a) tools that add value to an organization, (b) media that foster the creation of teams and enables new forms of cooperative work, and (c) part of an information technology infrastructure that enables the expansion of traditional organization boundaries. These three potential research avenues, address critical issues for all organizations as they struggle to enter the twenty-first century.

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