DO KNOWLEDGE WORKERS USE E-MAIL WISELY?

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ABSTRACT

This study investigates the e-mail usage behavior of knowledge workers through an in-depth literature review and a focus group discussion. It finds that people are ruled by e-mail, but think otherwise. In daily usage, many of the weaknesses of e-mail are converted into strengths, and having an information system background does not necessarily lead to sophistication in using e-mail tools. Further, users regard e-mail as a print medium rather than an interactive medium, and it has to a great extent replaced face-to-face communication in the workplace. E-mail users use the medium's carbon copy and forwarding features habitually and not out of necessity, and they do not usually handle work-related and personal e-mail messages separately. Finally, users seek opportunities to learn about e-mail functionality out of convenience, but these are not attained with ease. A contrast between these findings and conventional wisdom is drawn.

Keywords: E-mail usage behavior, focus group, knowledge worker.

INTRODUCTION

In the past three decades, e-mail has developed from an Internet application employed only by technical users to a common communication tool that has been embraced by the general population. Over a decade ago, Frazee [19] found that the average e-mail user received approximately 15 e-mail messages per day and spent about 50 minutes reading them. A decade later, such a light e-mail load is unknown among most workers. By 2007, the global person-to-person e-mail load had reached 97 billion messages per day [22], and researchers predict that the number of electronic mailboxes worldwide will increase at a compound annual growth rate of 136 percent between 2008 and 2012 [43]. The penetration of e-mail into daily life has been unobtrusive, and yet its effect is pervasive. Many of us now depend on e-mail to accomplish tasks, and perhaps many more are emotionally attached to it as a convenient channel for personal communication.

Advances in technology have brought about more convenient communication, but have also sped up the pace of life [18]. E-mail has influenced our lives both positively, through task accomplishment and life enrichment, and negatively [7, 29, 32]. However, many of e-mail's negative effects are caused by its ineffective use. Burgess, Jackson, and Edwards [8, 9] identified five problems with e-mail communication: interruption, information deficiency, poorly targeted e-mail messages, media selection to avoid face-to-face encounters, and the burden of processing and filing. Except for media selection, all of these problems inevitably

consume time. Choosing e-mail over face-to-face communication can be a time-consuming alternative, because preparing an e-mail message often takes longer than verbal expression. The problems arising from the ineffective use of e-mail, both directly and indirectly, increase time pressure.

E-mail use is characterized by both a large volume of messages and a diversity of information formats [15, 44]. The variety of e-mail attachment types makes the use of such diversity possible, but it also increases the size of e-mail messages and intensifies the burden of processing them [4]. In the knowledge era, knowledge workers' productivity directly affects the effectiveness and efficiency of the organizations and communities to which they belong. Knowledge workers usually rely on e-mail to conduct daily tasks, and knowing how to handle it effectively is crucial to their productivity.

Mackay [30] recommended that e-mail usage research should stress the idiosyncrasy of individual behavior, rather than attempt to find a single, optimal solution for all users, as no single effective strategy is likely to exist. Idiosyncrasies do exist among e-mail users, but, as with the use of other information system (IS) tools, research has identified some common behavioral patterns [3, 14, 21]. As such behavioral patterns help to expand our understanding of how IS tools affect human life, identifying the patterns of e-mail usage is the first step toward investigating the problems with that usage.

Studies of e-mail usage behavioral patterns should not focus solely on problematic areas. As Baym [6] stressed, countless non-problematic rewarding and routine interactions also occur through e-mail communication. This study favors neither perspective: through an objective lens, it attempts to identify the most important e-mail usage patterns, especially those commonly practiced in organizations.

Ducheneaut and Watts [16] pointed out that few studies investigate how e-mail affects users' work activities and practices and how it integrates with daily work, with most instead focusing on individual's e-mail use. To understand how knowledge workers use e-mail, this study builds on previous research by using in-depth inquiry to elucidate important behavioral patterns in that usage in the work environment.

LITERATURE REVIEW

Messaging and information distribution technology are of vital importance to individuals and organizations alike. On average, knowledge workers spend three hours handling incoming information each day, and this figure is on the rise [12]. Of those three hours, approximately one and a half are spent handling e-mail, which accounts for almost twenty percent of an eight-hour working day. The volume of e-mail messages handled is also rapidly increasing, and the task of screening work-related messages has become more time consuming. This carries the potential consequences of attention slack and decreased individual productivity. About twenty percent of knowledge

workers acknowledge their inability to manage information well [12], yet few would stop using e-mail as a communication tool.

Previous research has identified many problems associated with e-mail use, including issues related to functionality, user interfaces, time pressure, and the necessity for an overall redesign of the e-mail system. The following review summarizes the general issues that arise from e-mail use. The issue of time pressure is particularly stressed because, although less obtrusive, it is often the consequence of the other problems, and because problems that do not result in time pressure are of less concern. For example, the burden of processing and filing is a problem because these tasks take time and can result in increased time pressure.

E-mail Usage

Almost all knowledge workers use e-mail several times a day, not only in the office but also at home. E-mail usage behavior differs between individuals, and many studies have closely examined how individuals use e-mail [2, 15, 27, 28, 30, 38, 49, 53]. Whittaker and Sidner [53] and Mackay [30] concluded that knowledge workers use e-mail not only as a communication tool, but also as a support for task management, scheduling, and personal archiving. Ducheneaut and Bellotti [15] stressed the omnipresence of e-mail. Ducheneaut and Watts [16] reviewed the literature on e-mail usage and presented a framework for reinventing the interface of e-mail systems. They emphasized that e-mail is no longer a simple, electronic letter-writing system and that its use is continuously evolving.

Sophisticated e-mail usage is not limited to people with extensive computer discipline or experience. In fact, more than seventy percent of users document their activities in e-mail systems [15], which indicate that those without much computer experience may be capable of creating and using rules effectively [31]. Nevertheless, Lantz [27] pointed out that many people have problems organizing e-mail messages, and that e-mail handling problems are worsened by the number of messages stored in the inbox. Lantz [28] also surveyed a group of managers to determine changes in e-mail use over time, and discovered that the average number of e-mail messages sent had not changed much in five years, but the average number received had doubled. Takkinen and Shahmehri [49] studied the usage of a few specific tools, such as signatures, aliases, and address books. Pazzani [38] investigated e-mail filtering and automation behavior, and concluded that users are intimidated by the task of setting up the rules feature provided by e-mail systems. He therefore suggested that an automated approach be designed to simplify this task. Balter and Sidner [2] addressed inbox management issues and developed several efficient predefined rules to reduce the burden of inbox maintenance. Increased e-mail volumes clearly cause problems for knowledge workers in managing their inboxes, which in turn increases the time actually spent on e-mail tasks.

E-mail Use and Time Pressure

Several studies have examined how knowledge workers use their time. Some [1, 23] have investigated how people schedule their daily activities, whereas others [24, 34] have examined individuals' time usage patterns within the workplace. The results of these studies point to the existence of a "time famine," Perlow's [39] phrase for a situation in which people feel there is a lot of work to be done, but not enough time to complete it. Research into the impact of increased time pressure is needed precisely because knowledge workers increasingly experience such "time famine."

Cottle [11] posited that people have a tendency to overestimate passive durations and underestimate active durations of time. This theory can be extended to explain the time-intensive nature of e-mail, as the time spent accessing e-mail systems and handling e-mail messages is characterized by activeness rather than passiveness, and may thus be underestimated. Lantz's [28] five-year longitudinal study reported that the average interval between receiving and replying to e-mail has increased from immediately to a day or even a week. This may be because handling incoming messages requires increasing amounts of time, thus delaying the average response time. Weber [52] stated that many people feel that their lives are ruled by e-mail, to the extent that heavy users do not even see the constant entering and exiting of e-mail systems as disruptive [27].

Some research indicates that users are conscious of the impact of e-mail on time, whereas other work points to users' denial of such effects. This may be due to differences in the degree of impact or to individual sensitivity to environmental change. Several empirical studies [40, 51] have found that more than ten interruptions a day has a clear impact on work effectiveness, because the intervals between interruptions are too short to accomplish other tasks.

Most empirical studies of e-mail usage focus on functionality and user interface problems and provide a wealth of resources to reinvent e-mail user interfaces and streamline e-mail software operation, although little such reinvention has yet occurred. E-mail has well-defined functionality, but the processes by which users handle it are continually evolving [16]. The way knowledge workers use e-mail merits greater in-depth understanding by both researchers and practitioners, because such workers are the key driving forces of organizational success.

If such use is better understood, then the unproductive activities associated with it can be avoided, and the time saved can be channeled to other meaningful tasks, thus indirectly enhancing organizational efficiency and productivity. This study investigates how knowledge workers use e-mail and elucidates their common usage patterns. The findings will inform further research into effective e-mail management strategies.

RESEARCH METHOD

The purpose of this initial inquiry into e-mail usage behavior was to qualify, rather than quantify, and therefore the study adopted a focus group approach. Hess [20] stated that focus group interviews have several advantages, including synergism, snowballing, stimulation, security, and spontaneity. The focus-group method facilitates rich data collection, because it allows participants to share their experiences and to hear others' perspectives, which often sparks interesting discussions. Although a focus group does not represent an entire sample, and the results cannot be generalized, it is a useful tool for obtaining a greater depth and breadth of information.

Previous studies have investigated e-mail usage, but they do not form a coherent body of work that can aid further theoretical development. As previously stated, of all of the types of e-mail users, knowledge workers stand out as the group that affects organizations the most, but we have insufficient knowledge

of their e-mail use to frame further research. This study is therefore exploratory in nature, and the merits of the focus group method for exploratory research are well known. The following paragraphs describe the planning and set-up of the focus group study, the development of the questions, and the recruitment of the participants, and explain how the focus group sessions were moderated and the data analyzed.

Planning the Focus Group

Many considerations are involved in planning a focus group, such as the recruitment of participants, the number of questions, and the time allocated for the session. The number of participants, question design, and session moderation also greatly affect the quality of the information collected [50]. Several such issues were considered in planning the focus group for this study.

The first consideration was whether to use homogeneous or heterogeneous groups. The former are less likely to generate divergent opinions, whereas the latter are more likely to report different opinions because the group members may differ in their cultural backgrounds or life experience. As the study focus was knowledge workers' experience with e-mail use, potential participants were likely to be homogeneous in the sense that they were all knowledge workers. However, numerous types of knowledge work exist, and it would have been impossible to form homogeneous groups of participants with similar job functions. We thus chose a heterogeneous group of knowledge workers of varying backgrounds and experience, as we expected this would create an interesting group that would engage in highly interactive dialogue.

The focus group session was conducted once with a group comprising two types of knowledge workers: those with and without an information systems (IS) background. If a group member held an IS degree or had an IS job, then he or she was classified as having an IS background. As e-mail is a type of information system, we envisioned that people with and without such a background would hold dissimilar viewpoints. We also expected the information exchange between these two types of participants to be fruitful, because it is easier to assess the degree to which concepts and opinions are rooted in participants' minds by observing the responses between two types of participants. Participant diversity proved to be very effective in collecting information.

Focus group size is related to the goal of the research. According to Morgan [36], a small group is suitable for gathering details of individual experiences, and is a good choice when the issues being studied are complicated or controversial, whereas a large group is best for participants who do not know the topic well or when the level of participation is not extensive. The issue of e-mail usage behavior is complicated but uncontroversial, and therefore a small group is most suitable. Morgan [36] indicated that the ideal number of participants in a small group is between six and ten, but other researchers have suggested a number between eight and twelve [33]. Because the focus group contained two types of participants — those with and without an IS background — we opted for a group of eleven participants, six of whom had an IS background and five of whom did not. All were experienced e-mail users. We selected an odd number to avoid ties in potential voting incidences.

The eleven participants ranged in age from twenty to forty. Five participants held an undergraduate degree, five a Master degree, and one a doctoral degree. The participants had used e-mail for between eight and fifteen years. Although they came from a wide range of industries, including accounting, consulting, recruitment, equipment sales, banking, education, telecommunications, billing, high-tech manufacturing and Internet marketing, they all relied on e-mail to conduct work tasks. The focus group session was about three hours.

Developing the Questions

Two main approaches to the development of focus group questions exist: the topic approach and the question approach [25]. The latter requires much more preparation than the former, but its results are easier to analyze. This study thus adopted the question approach for ease of analysis. Following Krueger's [25] guidelines, the questions avoided technical language and were clear. Before the meeting, we conducted a pre-test to ensure that the wording was understandable and capable of eliciting the participants' experiences. The study adopted the funnel-based interview strategy [35] and arranged the sequence of questions, number of questions, and durations according to Krueger's [25] recommendations.

We arranged the questions in the sequence of opening, introductory, and transition questions to gradually focus the participants on the issues of interest. The information for the data analysis came from discussions of key questions on whether and how usage behavior affected the knowledge workers' perceived time pressure and productivity. During the discussions, the facilitators refrained from giving examples to allow the participants to fully express their opinions [25]. The key questions concerned methods for the efficient handling of e-mail, the difficulties encountered with e-mail, and how the participants handled these difficulties. These questions were organized into three main categories: e-mail processing and filing (e.g., What are your practices in reading, replying to, reserving, archiving, sending, and forwarding e-mail and coping with junk e-mail? How do you schedule your time to handle e-mails?); e-mail overload and information overload (e.g., How many new e-mail messages do you receive a day? How many e-mail messages are in your e-mail inbox on average?); and the features of e-mail tools (e.g., What are the drawbacks or inadequate aspects of current e-mail tools? What would you suggest to improve current e-mail tools?).

Recruiting the Participants

Morgan [36] referred to focus group participants who are recruited for research purposes "purposive samples." As the topic of interest is knowledge workers' e-mail usage behavior, the target population was knowledge workers who were experienced e-mail users. Potential participants were selected by invitation from the authors' e-mail address books, by asking acquaintances to recommend candidates, and by directly contacting the personnel of information technology departments.

Data Collection and Data Analysis

Two facilitators moderated the focus group session. The discussion facilitator directed the meeting, and the process facilitator took notes and oversaw the recording [25, 36]. The former also introduced and explained the purpose of the meeting and the need for the audio recording, and informed the participants that the content was not for commercial use.

We transcribed the content of the focus group discussion and, following Krueger and Casey [26], used a long table approach to identify the main points. This approach is a systematic method of conducting qualitative research that compares and contrasts the answers, and is an effective tool for visualizing and organizing unstructured data for subsequent analysis. The long table from the focus group transcript is shown in Appendix 1. In the category of e-mail processing and filing, the behavior that the participants described clearly intensified their perceived time pressure, and we coded it as "negative." In the second category of e-mail overload and information overload, the participants said that the impact of junk mail was well contained. We thus coded this content "positive," although in other parts of the discussion that were not directly about junk mail the participants described its impact in more negative terms. A reasonable inference is that the participants were ruled by e-mail, but thought otherwise. The content in the third category of questions on the features of e-mail tools further confirms this speculation, as most of the participants stated that they responded to e-mail interruptions immediately or within a very short time.

OBSERVATIONS

The focus-group discussion analysis generated a list of interesting and important observations, which we highlight and discuss in the following sections.

People are ruled by e-mail, but think otherwise

Contrary to the popular belief that people are stressed by receiving a high volume of junk e-mail, most of the participants stated that junk e-mail had a minimal impact on their daily lives. They claimed that deleting junk e-mail immediately, organizing their folders regularly, and using automatic e-mail filters effectively minimized that impact. However, most of them acknowledged that their desire to receive e-mail messages was such that an empty inbox caused disappointment. A few stated that they could not control the impulse to incessantly check for new e-mail, and that receiving junk e-mail actually eased the feelings of loss that they felt on seeing an empty inbox. All of the participants also indicated that they responded quickly to every e-mail message, regardless of its urgency. They replied to almost all work-related messages on the day they received them, even when no explicit answer was necessary. Many of these messages were only remotely related to work, but they accorded them almost equal attention and seldom delayed in replying.

This scenario illustrates the oversupply of e-mail messages that many workers face. The information that comes through e-mail messages helps knowledge workers to fulfill their duties, and their attention on work increases with the supply of e-mail messages, but as the supply increases the demand starts to decrease. Simon's [47] attention model indicates that the intersection of the supply and demand curves is the point at which the optimal balance occurs, and that beyond this point attention to work plummets.

The focus group data suggest that much of knowledge workers' attention is taken up with receiving, replying to, and organizing e-mail messages. Their attention is taken up with attending to the large amounts of non-crucial information contained in these messages, with the probable consequence that they have less time to reflect on their work [13].

In daily usage, many of the weaknesses of e-mail become strengths

E-mails are not as immediate as newer communication tools such as instant messaging, and many people speculate that the medium will eventually be superseded. Interestingly, all of the participants considered this "drawback" of e-mail to be a strength, as it allowed them more time to compose appropriate responses. They cited e-mail as their preferred communication channel both for this reason and because of its usefulness in archiving evidence. Although e-mail messages are usually written in informal language and are often not neatly formatted, they are precisely time stamped, which is a feature that no other type of document can match.

All of the participants stated that they kept all of their work-related e-mail messages, and that these messages often proved to be very valuable. Two of the participants who worked in the banking industry stressed the importance of being able to trace business transactions through e-mail messages. Indeed, e-mail messages were so important to them that they routinely categorized their messages and made CD-ROM backup copies and paper copies for quick reference.

In summary, although limited by not being a real-time tool and by the prevalence of informal language and a lack of neat formatting, e-mail serves many purposes. Its non-immediacy is useful, and the benefit of a precise time stamp makes up for any weaknesses.

An IS background does not necessarily lead to sophistication in using e-mail tools

It was surprising to discover that those who possessed a higher level of sophistication in using e-mail tools were not necessarily IS professionals. Sophistication in e-mail usage seems to be borne of need, and the IS professionals in the focus group did not seem to have such a need. Knowing how to retrieve sent messages is a good example of such sophistication. Some of the participants needed this function to intercept messages that contained errors or were sent to the wrong recipients, which they did by configuring their e-mail client to send a request to the corporate exchange server to delete the e-mail message from the e-mail buffer.

The participants adopted two strategies to prevent sending incorrect messages accidentally. Some disabled the auto-send mechanism, which allowed them to check messages in the outbox before sending. Others sent the message to themselves first to confirm the content. Non-IS professionals consistently demonstrated a higher level of sophistication in this regard than IS professionals.

The participants' responses indicate that an IS background does not result in sophistication in using e-mail tools, nor does it help in finding new ways of using e-mail. It seems that e-mail systems are regarded as a desktop tool, rather than an information system. This is reflected in the rapid shift in the focus of research on e-mail from its adoption in the office environment [17, 42, 46] to its profound impact on modern workplaces [5, 41].

E-mail is regarded as a print medium, rather than an interactive medium

E-mail is customarily regarded as an interactive medium, but the participants disagreed with this viewpoint, concluding

that it should be regarded as a print medium. Although e-mail systems are capable of providing interactivity, this capability is seldom put to use in the workplace. E-mail is most often used for announcements or document transfers, and, as users do not expect to receive an immediate reply, the degree of interactivity is low. One participant said she was not concerned with whether replies to her messages were timely, because sending them was all that she felt obligated to do. Unless she received a negative reply, she assumed she had her supervisor's consent.

The file attachment feature of e-mail further enhances its ability to serve as a print medium due to the volume of information that can be transported in a single message. Ducheneaut and Bellotti [15] compared this mass information-carrying capability to file transfer protocol (FTP). By defining e-mail as a print medium, the participants meant that e-mail serves as a document exchange center, just like print media. This analogy prompts the speculation that many people position themselves at the center of the e-mail exchange system without knowing it. Making good use of the information embedded in an e-mail should be the purpose of using e-mail, rather than allowing it to serve merely as an information dispatcher. If people are using e-mail as a print medium, then they should try to avoid being trapped in a dispatcher position in which information arrives and leaves their inbox but does not really help them to do their jobs.

E-mail has replaced face-to-face communication in the workplace

E-mail has transformed the nature of personal communication. Its widespread adoption and ability to transmit information instantly has made it an indispensable tool. Even in an office environment, in which face-to-face communication is highly attainable, e-mail is the preferred way to communicate. Employees may not wish to appear idle by being seen to be chatting or socializing, and this can be easily avoided by chatting via e-mail or via instant messaging. In an open office setting, e-mail is also perceived to be a more private communication channel than speaking. However, this may be an erroneous perception, because, although third parties cannot *hear* the message, it is recorded on a computer system to which system administrators have rightful access. Interestingly, the participants also preferred to address sensitive issues by e-mail to avoid the embarrassment of face-to-face encounters. Finally, e-mail is obviously preferred when face-to-face communication is not feasible.

The participants' testimonies indicate that e-mail is rapidly becoming the main channel for communication in the workplace. This is so even between supervisors and subordinates, between whom face-to-face communication is deemed essential. This development is a clear deviation from the once popular concept of "management by wandering around" [13].

E-mail users use the carbon copy (cc) and forwarding features habitually and not out of necessity

Sending carbon copies to third parties is popular among e-mail users. Almost all of the focus group participants said they receive a large number of forwarded e-mail messages every day. It appears that people are fond of sharing information with acquaintances who have common experiences or interests, especially when such sharing is free of charge. The intent is friendly, but the consequence is often severe e-mail overload. Weber [52] found that these carbon copies are often sent to colleagues as a gesture of courtesy, which led him to coin the term "courtesy copies." The participants considered this gesture to be an effective means of keeping supervisors and colleagues informed and of guarding against potential disputes in the workplace. Carbon copies and forwarded messages can fill up an inbox quickly and become a burden to their recipients. However, the participants described a rather peculiar emotional state of satisfaction when receiving forwarded messages or carbon copies, as they felt that the sender or forwarder had remembered them. In other words, they were reassured of their own importance by the volume of e-mail messages they received, be those messages copied, forwarded, or original. Users clearly engage in this behavioral pattern out of habit rather than necessity.

Although being pleased to receive forwarded messages or carbon copies is understandable, this form of information transfer may be unwelcome in organizations that emphasize efficiency and productivity. The value of information transfer lies not in quantity, but in quality and relevance. If messages are not forwarded or copied out of necessity, then the result may be distraction in the workplace.

Users do not usually handle work-related and personal e-mail messages separately

The participants said they received an average of 100 e-mail messages per day, both work-related and private, and frequently spent more than an hour a day handling them. Most make use of the computing resources at work to attend to e-mail messages, regardless of whether they are work-related. These resources include e-mail accounts, storage space, and work time. Handling non-work-related e-mail messages takes up time that is supposed to be dedicated to work, and may also affect attention and productivity.

However, employees find it difficult to consciously designate and separate work-related and personal e-mail messages. Several of the participants stated that sending too many e-mail messages in the workplace resulted in e-mail usage rankings on a bulletin board and reprimands from their supervisors. Increasingly, supervisors are taking measures to monitor employee e-mail usage in an attempt to control their work time. Tightening such usage by limiting the information that can be attached to e-mail messages may be desirable, as confidential corporate information can easily slip through with a click of the send button. However, whether such measures can effectively prevent undesirable employee behavior requires further investigation. Many of the participants believed that monitoring e-mail usage is an invasion of privacy. As the information on a corporate system is supposed to be work-related, the belief that one has a right to privacy in this context is somewhat puzzling. Perhaps the best solution is for supervisors and employees to cooperate to eliminate distrust [45] or for companies to set up a formal internal policy [10, 48] regarding personal e-mail at work. According to the results of a UCLA Center for Communication Policy [50] study, about fifty-seven percent of those who use the Internet at work use it to access their personal e-mail account. This is already a very high percentage, yet our focus group results suggest that the real figure may be even higher. Accessing e-mail from work may not be seen as a problem, but there must be a boundary. Organizations should seriously consider setting up and managing such a boundary to prevent lost work time.

Most of the participants stated that they would appreciate an e-mail training course, because e-mail skills are essential to productivity. However, although their organizations frequently provided business or technical training, they did not offer courses on e-mail skills. Most organizations regard e-mail skills as basic administrative skills that employees should already have learned or should be able to acquire on their own. Corporate education expenditure is mostly reserved for courses directly related to business profit, and e-mail training is not seen as fitting this description. Interestingly, all of the participants felt that they had learned some useful e-mail tips during the focus group session that might improve their work. Seeking help at work in using e-mail is seen as embarrassing, because e-mail use is perceived to be an easy task. Therefore, learning only occurs out of convenience, for example by picking up tips here and there.

All of the participants expressed a need not only for technically oriented e-mail training, but also for training in guidelines or principles for effective use. However, they felt that neither type of training was likely to receive managerial approval, as it would be seen as peripheral to their professional discipline.

One of the participants made an innovative suggestion that was widely accepted by the group: a knowledge management platform, such as a bulletin board or a discussion forum, would be very helpful in the workplace. This platform could also house templates for document preparation and tips for handling e-mail. A more elaborate system could even offer online training material. The group also suggested that new employees be required to take an e-mail use training course and pass a comprehensive test.

To ensure that the scarce resource of attention is apportioned according to organizational objectives, organizations may need to train their employee in such skills as filtering relevant information and filing and retrieving information using information technology. E-mail use has taken center stage in many types of information flow, and thus a properly designed e-mail training course would be likely to pay off in the long run.

CONCLUSION

This study makes eight important observations about how knowledge workers use e-mail. First, such workers are ruled by e-mail, but think otherwise. Second, in daily usage, many of the weaknesses of e-mail become strengths. Third, an information system background does not necessarily lead to sophistication in using e-mail tools. Fourth, e-mail is regarded as a print medium rather than an interactive medium. Fifth, e-mail has to a great extent replaced face-to-face communication in the workplace. Sixth, e-mail users use the carbon copy (cc) and forwarding features habitually and not out of necessity. Seventh, users do not usually handle work-related and personal e-mail messages separately. Eighth, users seek opportunities to learn e-mail functionality, but such opportunities are not easily attained. These observations cover both the social and functional aspects of behavior with regard to e-mail use, with the first, third, fifth, and seventh belonging to the former and the second, fourth, sixth, and eighth belonging to the latter (Figure 1). Observation 8 seems to contain both social and functional components of behavior, as

it involves mindset. However, during the focus group discussion, it was apparent that the type of training to which the participants referred was more related to the functionality of e-mail and less to it social aspects.

Rather than proposing a conceptual framework, this paper summarizes knowledge workers' e-mail usage behavior (Figure 1). Many previous e-mail-related studies have concentrated on the functional aspect of e-mail use, whereas the findings of this study suggest that the social and functional aspects carry equal weight. Although the extent to which e-mail usage behavior is characterized as social or functional is likely to vary depending on the context, both aspects are likely to be covered. Figure 1 therefore highlights the important concept that e-mail usage problems should be approached from both the social and functional perspectives.

Knowledge workers' activities today are very much centered on e-mail, but the design of e-mail systems and the way in which they are actually used are often incompatible. Existing e-mail systems are not adequate for organizing knowledge workers' activities and thus merit a complete redesign to generate a solution that better integrates with human activities. Morgan, Cozzi, and Farrell [37] suggested that an e-mail system can better unify activities if it is embedded in the overall e-business system. Twenty-first century organizations are calling for a higher level of information integration, and e-business is becoming a key phenomenon in the increasingly dynamic business environment. Companies should therefore place emphasis on the development of an integrated system that unifies all work activities, ranging from the personal to the organizational and spanning informal and formal human communication. The speed with which e-mail systems become part of an integrated system may be vital to future business success.

The set of behavioral patterns that this study identifies can be used as a basis for action regarding e-mail usage. However, not every type of behavior necessitates action, as some are neutral in their effect. For example, using e-mail to archive evidence is neither good nor bad; it is merely a fact of usage. This finding may inspire software designers to come up with a better tool for archiving, but does not require remedial action on the part of organizations. The behavioral patterns that affect time usage are those that require immediate attention. For example, knowledge workers need help to break the habit of being ruled by e-mail, to learn new time-saving skills, and to avoid unnecessary forwarding and copying. A well-devised training course would be an effective remedy, even for organizations comprising IS specialists, because an IS background does not necessarily lead to sophistication in using e-mail tools.

Another important point is that organizations should not expect their knowledge workers to interact effectively by e-mail, as workers regard e-mail as a print medium rather than an interactive medium. Organizations should also be aware that e-mail has to a great extent replaced face-to-face communication in the workplace. Thus, if face-to-face communication is crucial to an organization's operation, then it should consider encouraging its knowledge workers to favor this mode of communication over e-mail.

Internet-based communication skills are essential for knowledge workers [54], because they are closely related to individual productivity. The patterns of e-mail usage observed in this study both reveal usage that was not intended in the design of e-mail and point to problematic areas that require intervention. Therefore, two extensions to this research are worth undertaking.

One is the redesign of e-mail systems to better suit knowledge workers' usage patterns, and the other is the design of training programs that effectively teach knowledge workers to reduce the time pressure generated by e-mail use.

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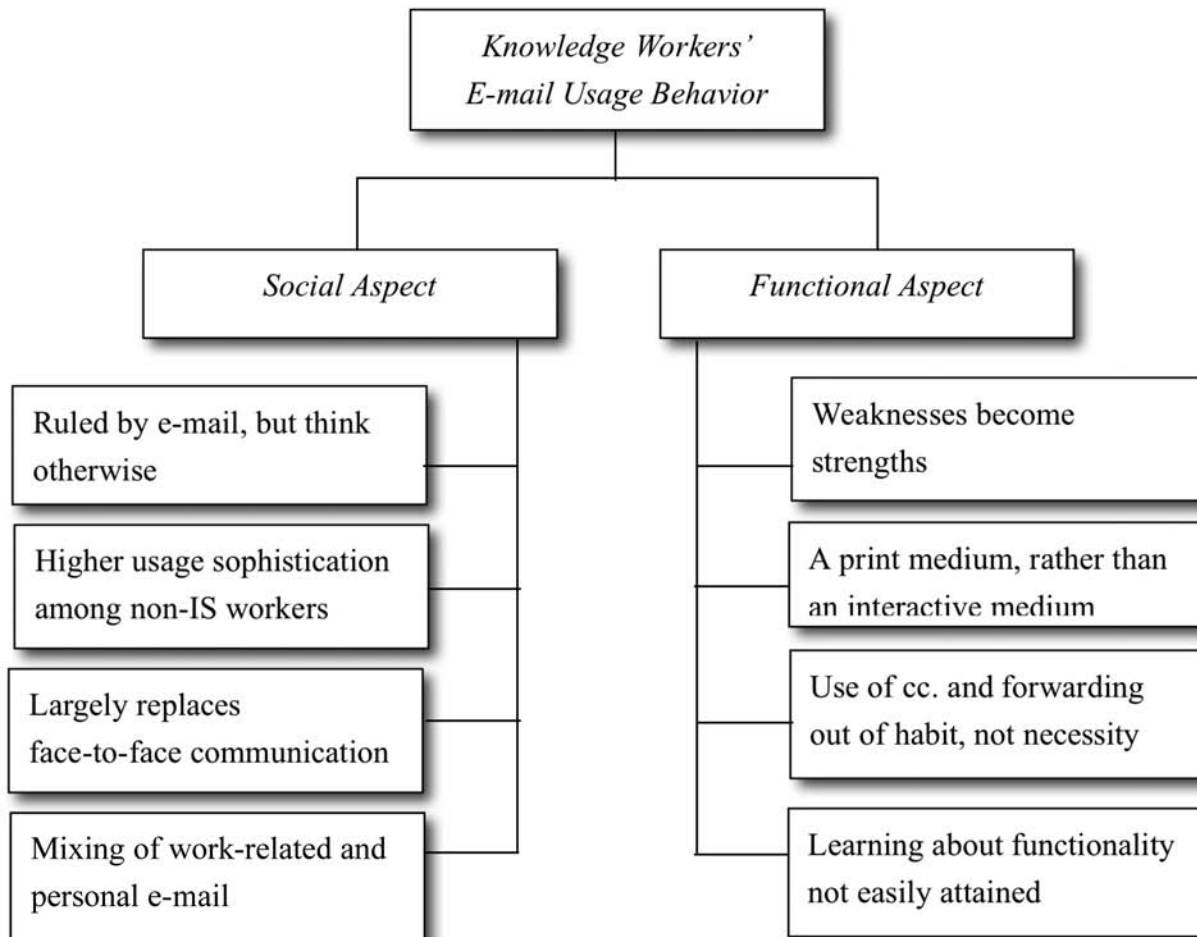
FIGURE 1. Summary of knowledge workers' e-mail usage behavior.

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APPENDIX 1. LONG TABLE EXAMPLE

Q1 : E-mail Receiving Behavior	
Coding	Participants' Speech Content
N01: (Negative)	I often open my e-mail inbox at the beginning of the day and the first thing I do is check whether any new e-mail has arrived. I do not close the e-mail program until I get off work.
N02:	I usually check e-mail many times throughout the day.
N03:	It I am expecting a work-related e-mail reply, I tend to check my e-mail constantly.
N04:	I cannot help but checking incoming e-mail messages all the time. I look forward to receiving new e-mail with eager anticipation.
N05:	The impulse to incessantly check for new e-mail sometimes interrupts my work.
N06:	Receiving junk e-mail eases the feeling of loss that I get from seeing an empty inbox.

Q2 : Junk E-mail Handling Behavior	
Coding	Participants' Speech Content
P01: (Positive)	Junk e-mails do not bother me because they are shuffled to separate mailbox by the system. Therefore, I do not spend much time on them.
P02:	I set up e-mail filtering rules in Outlook in advance and then junk e-mail is deleted automatically. Therefore, junk e-mail handling does not affect my work.
P03:	Reading junk e-mail wastes time. I set e-mail filtering rules on the system quite regularly, trying my best to limit the need to handle junk e-mails.
P04:	Some junk mails are useful, for example, clearance sales of department stores. But I delete them right away after reading.
P05:	There are only handful of people who usually send me e-mail. I set rules on the e-mail system to transfer each message to its corresponding e-mail folder according to the sender information. My inbox then contains mostly junk mails, and I need to scan the inbox to rescue some e-mails occasionally.

Q3 : E-mail Reading and Replying Behavior	
Coding	Participants' Speech Content
I01: (Immediately)	I leave my e-mail on and as soon as an e-mail arrives, I read it and act upon it immediately.
I02:	If I don't have time to take care of the matter after reading the e-mail, I would notify the sender of the possible delay.
I03:	I have a good habit of replying e-mails as soon as I receive them.
S01: (Short time)	I do not postpone e-mail reply unless I don't know how to reply yet. But I always let the sender know that I'm taking care of it.
S02:	Because senders are waiting for my response, I do not put off replying. I reply in reasonable time.
S03:	If the message is from a manager, colleague, or co-workers from other units, I reply in about an hour, but never immediately, because work-related matters need to be handled with care.