Chapter 6
From the Computerization Movement to Computerization: A Case Study of a Community of Practice

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Abstract

We find mixed results when assessing how the expectations of the computerization movement fit with our case study of a high-tech organization that is heavily computerized. In the organization, "internetworking technologies" are the main local – as well as global – means of communication. We find that hyperconnectivity fosters collaboration, community of practice, and commitment to the organization. Yet the evidence only partially supports the "death of distance" and "democratization technological action" frames of Rob Kling and associates. The organization is a local virtuality, with email and instant messaging primarily supporting local, within-department connectivity. The organization remains a hierarchy, although extensive networking occurs within organizational constraints.

Keywords: bureaucracy, computerization movements, community of practice, death of distance, frame, democratization, email, hierarchy, hyperconnectivity, instant messaging, institutionalism, local virtuality, social networks, technological action frame, technology, technology use practices, utopian visions

1. INTRODUCTION [A]

The rapidly expanding Internet and its related "internetworking technologies," as Rob Kling and associates have called it – such as email, instant messaging (IM), and discussion lists, have infiltrated North American life. About seventy percent of the North American population are online to some extent (Nielsen/NetRatings, 2006), e-commerce is growing, and both the mass and the scholarly media are fascinated with the technological and social wiring of society.

The widespread diffusion of internetworking technologies has been widely evident in organizations. However, the factors motivating organizations to adopt new computing technologies remain unclear. Traditional theories emphasize the economic gains organizations can attain from adoption because of reduced costs in internetworking technologies and improved capability. By contrast, Rob Kling and Suzanne Iacono (1996) have provided an alternative theory – "computerization movements" (CMs) – to those based on economic need. CMs emphasize macro-social and cultural dimensions, which are commonly neglected in discussions of the diffusion of internetworking technologies and their social consequences. Central to Kling and Iacono's theory of CMs is the development of *technological action frames* that legitimate in public discourses the adoption and use of internetworking technologies through the establishment of favorable links between internetworking and a new, utopian social order (Iacono & Kling, 2001; also see the overview in the introduction). Moreover, these technological action frames contain "expectations about how they [people] should use internetworking in their daily routines and how they should envision a future based on internetworking" (Iacono & Kling, 2001, p. 97).

For Kling and Iacono (1996), social change occurring in an organization due to the implementation of internetworking technologies is complex and can neither be understood in terms of technological imperatives nor by planned changes of organizational management (see also Markus & Robey, 1988; Orlikowski, 1992; Zack & McKenney, 1995). Instead, their CM theory advocates the integrated analysis of technological features, managerial visions, and "technological action frames" – the latter emerging in discourses about computerization. For Iacono and Kling (2001), "changes in worklife are shaped (but not determined) by the prevalent discourses informing new technologies and the practices that emerge around them in actual workplaces" (p. 98). The authors emphasize that meaning-making processes constantly occur as people adapt to new technologies and embed them in their daily routines and practices.

In this chapter we use Kling and Iacono's seminal work to examine the routines and practices that emerge around the use of computer mediated communication (CMC) in everyday worklife: internetworking tools that support one-to-one and one-to-many communication, synchronously and asynchronously. Our study investigates the two most prevalent forms of CMC in organizations: email and IM. We use a case study of communication in a medium-size, high-tech firm to investigate how communities of practice in this firm operate online and offline (see also Brown & Duguid, 2000; Wenger, 1998).

Instead of focusing only on the positive changes resulting from technology adoption, we examine gaps between utopian visions and actual work practices. Rather than analytically isolating CMC, we study it in the context of how it is embedded in a variety of ways in which workers actually communicate, including face-to-face (FTF) and telephone communication. We show how CMC has become routinized and integrated in this organization, using ubiquitous multiple communication to maintain *hyperconnected, glocalized, local virtualities.*

We analyze how the different characteristics of specific CMCs afford somewhat different communication possibilities. For example, the store and forward nature of email supports asynchronous exchanges where sender and receiver do not have to be online simultaneously. By contrast, IM demands simultaneous presence for successful communication.

We focus on four issues central to Kling and Iacono's analytical framework (1996, 2001):

- How do the employees of this high-tech organization use CMC? What work practices emerge around CMC?
- Does CMC function separately from more traditional forms of communication: FTF and by telephone?
- Has CMC enabled communication to overcome the constraints of physical separation as the utopian visions predict? Does CMC operate separately from "normal" in-person interactions?
- Has a networked organization developed concomitantly with computerization fostering democratization in organizations?

2. WHEN COMPUTERIZATION PERVADES WORK [A]

2.1 Technological Action Frames [B]

Iacono and Kling's analysis of computer ideologies showed how people create meanings around technology that influence adoption and use (2001). To describe this process of adaptation to technology, they introduced the term "technological action frame." The term "frame" was first used in sociology, where it describes how groups develop shared understandings that legitimate collective action (Benford & Snow, 2000; Goffman, 1986). Closely linked to the term technological action frame is the "collective action frame" term that has been used in social movements theory (see also Markus, Dutta, & Steinfield, this volume). The collective action frame describes how participants in a social movement actively and collectively create meaning for others, including constituents and observers (Benford & Snow, 2000). Technological action frames are different in that they focus explicitly on technologies and the expectations and hopes associated with technological change. Iacono and Kling defined technological action frames as multi-dimensional shared understandings of a group that support large investments by users in new technology (2001). Technological action frames not only provide explanations about why a technology should be adopted, they also encompass beliefs about how technology works and the outcomes expected from its use (Iacono & Kling, 2001).

In CMs, technological action frames play an important role because they make implicit assumptions explicit about the adoption and use of technology. Organizations constantly engage in meaning-making processes as employees integrate technologies into their work practices. Previous CM research has identified five technological action frames: productivity, democratization, death of distance, freedom/information rights, and ubiquitous computing (Iacono & Kling, 2001 and the discussion in the introductory chapter, this volume). We focus on the technological action frames that are most relevant for internetworking technologies: death of distance and democratization. We discuss the key assumptions underlying each technological action frame.

2.1 Death of Distance Technological Action Frame [B]

As a major part of computerization, CMC has come to permeate most organizations through the Internet and internal communication systems. Email use is ubiquitous in North America and many organizations have also adopted IM for real-time (almost synchronous) communication (Cho, Trier, & Kim, 2005; Rennecker & Godwin, 2003). Analysts see CMC as advantageous over traditional forms of communication because it increases efficiency and streamlines work processes (Sproull & Kiesler, 1991). They argue that CMC provides the means for leaping over work group and organizational boundaries, communicating rapidly; locally or long-distance; one-to-one, one-to-many, and many-to-many (Castells, 1996; Hinds & Kiesler, 1999, 2002). Traditional solidary work groups (and non-work communities) have featured densely interconnected relationships in physically compact spaces. By contrast, interactions in networked social systems occur with multiple others and relationships are specialized. As Manuel Castells argues:

> Cooperation and networking offer the only possibility to share costs and risks, as well as to keep up with constantly renewed information…. Inside the networks, new possibilities are relentlessly created. Outside the networks, survival is increasingly difficult (1996, p. 171).

Coupled with a low operating cost and the ability to communicate while other people are not immediately available, email enhances the ability to maintain spatially dispersed, sparsely knit, and interest based relationships. Hence, it can be a catalyst of social change, facilitating new forms of work where groups and organizations are permeable and individuals move flexibly among multiple networks (Heydebrand, 1989; Jarvenpaa & Ives, 1994; Nohria & Eccles, 1994; Sproull & Kiesler, 1991; Wellman, 1997).

The extreme vision of the "death of distance frame" sees CMC completely substituting for FTF communication. This vision is implicitly embedded in such concepts as "telework," "virtual teams," and "computer supported collaborative work (CSCW)." Telework predicted that there would no longer be a need for many workers to commute for hours through traffic jams because they could work flexibly from the convenience of their homes, accessing work resources through the Internet, and communicating with colleagues across the globe through email and IM. The virtual team would comprise experts with diverse backgrounds who would be located across the globe and team-up as needed to solve complex problems. This would reduce coordination costs, travel expenses, and allow teams to work on multiple projects.

CSCW examines collaborative work processes and the technologies that support them (Wilson, 1991). It aims to built hardware and software that is easy to use and that supports online collaboration. The underlying assumption here is that well-designed technology leads to better performance and is able to fulfill its role as an enabler and facilitator of collaboration. The large majority of CSCW research focuses exclusively on applications that support virtual teams working online and rarely meeting FTF (Shapiro, 1996).

Although there is no doubt that computerization has had a major impact on organizational communication, the extent to which space has become obsolete remains unclear. There is more assertion than evidence in the virtual organization literature about how CMC affects work relations and organizations. With advances in computing technology, the number of virtual teams has increased. Nevertheless, a large majority of organizations continue to exist in physical space.

We investigate in this chapter if the predictions of the death of distance technological action frame have been realized. Have applications such as listservs, email, and IM made physical place obsolete for collaboration? What is the role of FTF communication for collaboration in a computerized organization?

2.2 Democratization Technological Action Frame [B]

From the standpoint of Kling and Iacono's concept of the "democratization technological action frame" (1996, 2001), internetworking technologies can affect the locus of power in organizations, leading to equalizing effects and vertical forms of communication which might enable workers rather than management to be at the center of information exchanges. For example, the cue-reduced nature of text-based digital communication can lead to less salience of such attributes as race, age, and status, which in turn, might foster democratization and equalization in organizations (Short, Williams, & Christie, 1976; Sproull & Kiesler, 1991).

Internetworking technologies could also encourage democratization in organizations by speeding up the exchange of messages, enhancing employees ability to access many information sources from their desktops, and facilitating communication with a wide range of experts (Culnan & Markus, 1987; Rice & Bair, 1984; Sproull & Kiesler, 1991). Such analyses suggest that through internetworking technologies, traditional hierarchical bureaucracies would be short-circuited by employees who have direct access to all, and hierarchical divisions of labor would no longer influence communication patterns. As a consequence, decision-making would be decentralized, engaging employees at all levels and creating collaborative work settings (Castells, 1996; Leavitt & Whisler, 1958).

Despite early enthusiasm, results regarding the effects of internetworking technologies on organizational structures are mixed (Attewell & Rule, 1984; Markus & Robey, 1988; Robey, 1981). On the one hand, studies of organizational communication have repeatedly shown that CMC can increase the spread, volume, and speed of information flow (Culnan & Markus, 1987; Rice & Bair, 1984; Sproull & Kiesler, 1991). On the other hand, internetworking technologies have been found to both centralize and decentralize decision-making (Blau, 1975; Blau, Falbe, McKinley, & Tracy, 1976; Foster & Flynn, 1984), and to have little effect on organizational structure (Franz, Roby, & Koeblitz, 1986; Robey, 1981; Zack & McKenney, 1995). For example, CMC did not help to make peripheral scientists more central in an information network (Roehrs, 1998).

The democratization technological action frame points toward potential positive structural change in organizations resulting from the implementation of internetworking technologies (Kling and Iacono, 1996, 2001; see also the discussion in the introduction to this volume). Internetworking technologies affect the speed of information flow, the quantity of messages exchanged, and work efficiency. However, the perspective does not take into account the complexity of organizations: internetworking technologies alone cannot change the structure of an organization because many contextual factors affect technology adoption and use (see, for example, Markus & Robey, 1988; Orlikowski, 1992; Zack & McKenney, 1995). For example, Orlikowski's (1996) study of how an information system is implemented showed that the effect of technology depends to large extent on the culture of the organization.

Analysts have not come to grips with how people in CMC-intensive organizations actually work and network – online and offline:

> There is no coherent research program … that seeks to account for the potential or likely effects of major changes in information processing on the bureaucracy. This silence is curious given that during the past two decades, in popular writing and in political practice, many actors have been engaged in "breaking down," "abolishing," and "bashing" bureaucracy (Fountain, 2001, p. 118).

The utopian visions of the democratization technological action frame need to be examined through detailed case studies with rich contextual data of how internetworking technologies are used in actual work processes (Lee, 1999; Creswell, 1998). The combination of multiple sources of information and data collection methods often found in case studies make them a good approach to capture the complexities of the social and institutional contexts in which CMC is used and work practices emerge (Kling, Rosenbaum, & Hert, 1998). Analysts can use such case studies to identify key contextual factors influencing the adoption and use of technologies in organizations, thereby closing the gap between utopian visions of democratization and realistic work practices (e.g., Clement & Halonen, 1998; Zack & McKenney, 1995).

3. KME: THE ORGANIZATION [A]

Knowledge Media Enterprises ("KME" – a pseudonym) is an 80-employee high tech corporation located in a major North American city. KME was founded in 1997 and expanded during the technology boom. Its involvement in knowledge-intensive activity and its high reliance on internetworking technologies make it a good place to study the gap between utopian visions of computerization and the way technology is realistically used in everyday practices and routines. KME offers knowledge-based services and software to clients. A principal business is the hosting and facilitation of online communities, in which employees of other organizations can exchange information and work together. Besides hosting and facilitating business-to-business online communities, KME also supports business-to-consumer online communities, where a community is created around a specific product or service. KME operates in a highly competitive, rapidly changing environment. To remain innovative, KME relies heavily on collaboration among technologically savvy employees using internetworking tools, such as email and IM.

3.1 Description of Two KME Departments [B]

We compare work roles and social networks in two main KME departments: *software development* and *client services*. Each is located on a separate floor of the same building. Software developers work in a large open space, adopted to help them to collaborate. By contrast, community managers in the client services department are in cubicles, with middle managers having a large common area, and the two upper managers sharing a private office. The different layouts reflect – and reinforce – different communication patterns.

The software development department, with 12 employees, creates software packages that are used by customers in combination with services from the client services department. The primary task of the software development department is to write code. The department is expected to develop and implement new functionalities quickly. Often, there is no predetermined work schedule. In the lead up to a release date, employees often work at least 50 to 60 hours per week. They actively assist each other in programming, have frequent impromptu meetings, and socialize frequently by going out for lunch or coffee. A high level of communication and

exchange between members of the software development department is necessary because of the interdependence of all components of the project that affect the operability of the code.

The client services department, with 16 employees, provides KME customers with planning and support services for communities of practice and other online communities that exchange information. Some of their clients are units of large, world-famous organizations. The department creates "virtual localities": online places where participants log in, come to know their electronic neighbors, and share best practices. The tasks of a community manager include organizing relevant information for the site, keeping the site up-to-date, and monitoring exchanges between community members. While the tasks of online managers are similar across online communities, the nature of the online communities varies considerably. Some are focused on a product (e.g., car, computer, or food brand), while others revolve around common interests (e.g., soap operas or movies).

The client services department does not operate under the same time and innovation pressures as the software development department does. For the client services department, customer satisfaction is the most important measure of success, while performance measures of profit and market share are more important for the software development department. In contrast to software developers, community managers are not required to coordinate their activities with each other, because their work consists of interacting with separate clients. Hence, community managers communicate and coordinate with their outside clients and KME managers. Although most employees do similar work, their work does not contribute to a single effort: the success of one account is independent of the success of others. Thus, client service workers differ from software developers by not sharing a common goal and not feeling part of a team.

4. RESEARCH METHODS [A]

We collected data in 2002 through a web survey, interviews, and observations. Out of 28 departmental employees, 27 participated in the survey: 11 in the software development department (including 3 women) and 16 in the client services department (including 5 women). Survey participants had worked for KME an average of 28 months (range: 5-48 months). Six had a high school diploma or less, 12 had completed an undergraduate degree, and 8 had a graduate degree. Survey participants included 3 upper managers, 5 middle managers, and 19 other department members. Middle and upper managers are grouped together in this analysis.

4.1 Survey [B]

A lengthy self-administered survey gathered information about communication at each of three organizational distances with respective physical constraints: within the department, with other colleagues in the organization, and with people outside the organization. At each distance, participants were asked to report how frequently they used three types of media: face-to-face (FTF) or telephone, email, and instant messaging (IM).

Participants also reported about their social networks. They were asked to indicate how often they communicate with colleagues in both the software development and client services department by FTF/telephone, email, and IM. By focusing on the media networks of both departments simultaneously, we obtain a better picture of collaboration within and between departments and the role of internetworking technology. The 7-point scale for media use has been transformed into days per year: "never" = 0; "a few times a year" = 5; "1/month" = 12; "1/week" = 52; "several times a week" = 130; "1/day and several times a day" = 365.

To facilitate computation of social network measures and the display of graphs, UCInet was used to symmetrize the matrices by averaging (Borgatti, Everett, & Freeman, 2002). The matrices were then dichotomized, using a cut-off point of ties greater than 4="once per week": our rationale was that exchanges occurring more frequently than once per week would reflect close ties. Three social network measures were derived from the symmetrized, dichotomized sociometric data: *network density*, *network centralization*, and *cohesion distance*.

Density is one of the most commonly used measures to describe a social network. It is defined as the proportion of ties present out of the maximum number of possible ties (Scott, 1991; Wasserman & Faust, 1994). It can vary from 0 to 1, the density of a completely connected network being 1. The more ties between nodes, the higher the density.

Network centralization is based on the concept of the "star" person who is in the center of a network. Centralization measures the extent to which a network is integrated or fragmented (Freeman, 1979; Scott, 1991). Networks can be centralized around specific nodes or sets of nodes. We use Freeman's network centralization measure to indicate network integration (Freeman, 1979). A network centralization of 0 indicates an egalitarian distribution of ties, whereas a network centralization closer to 1 suggests that a few actors are most central. To obtain a percentage, we multiply the proportion by 100.

Cohesion distance measures the sociometric length of the distance between two actors in a network (Wasserman & Faust, 1994). The more interconnected the network, the shorter the path separating one person from another. The lower the cohesion distance, the easier and faster information can flow through a network and reach all actors to keep them informed.

4.2 Interviews and Observations [B]

To obtain more information about participants' work practices, we complemented our survey with interviews and observations. Five employees from each department participated in the interviews and observations conducted by Quan-Haase, coming from a range of positions and roles. Two-hour, semi-structured interviews provided flexibility to follow important leads while covering the same set of questions in all interviews. To guarantee the confidentiality of interviewees, pseudonyms are used throughout our research reports. Through the interviews, we obtained insight into the meaning-making processes occurring in the two KME departments (for more details, see Quan-Haase, 2004).

People often cannot report accurately on their own behavior, even in interviews. Hence, Quan-Haase also observed everyday work practices in each department to learn about how employees used CMC to exchange information and collaborate. She observed each of the ten interview participants for one work day, observing all FTF (including formal and informal meetings), telephone, and online interactions. Through the use of these complementary data sources, a complex picture emerged of work and communication in KME.

5. KME: A LOCAL VIRTUALITY [A]

The Internetworking CM, as discussed by Kling and Iacono, with its "death of distance" technological action frame, predicted that CMC would enhance organizational communication by spanning spatial, temporal, and social distances (Kiesler, Siegel, & McGuire, 1984; Sproull & Kiesler, 1991). From this viewpoint, CMC is a technological driver that creates and maintains global electronic networks that constantly exchange information. While there is no doubt that CMC has drastically changed the nature of communication with its speed, instantaneity, and

flexibility, analysts do not know much about how employees use CMC for boundary-spanning communication and how contextual factors affect CMC use in everyday work life (Quan-Haase & Wellman, 2004). Moreover, it remains unclear how employees use CMC in relation to traditional media, such as FTF and the telephone. To what extent have utopian visions of the death of distance become reality in organizations? Are there contextual factors in the everyday work practices that these utopian views have overlooked?

Our research shows that computerization has not made KME a spaceless place and that group membership continues to structure communication. Several contextual factors influence the use of CMC in everyday work practice. For example, locality as a physical place to meet and interact is a key dimension for the formation of collaborative community. However, locality is given new meaning in the digital era where employees integrate CMC and traditional forms of communication, creating a hyperconnected work environment that simultaneously operates in real and digital space. At the same time, distance no longer impedes communication with employees using the Internet as a means for boundary spanning beyond the department and the organization.

5.1 Distance and Communication at KME [B]

Despite the availability of CMC, a large proportion of KME communication is local with other departmental colleagues. This is because the departments heavily structure communication, and they are each physically contiguous on single floors. The local focus of communication is more pronounced in the software development department than in the client services department. Employees in the software development department report a mean of 313 days per year of within-department communication, which means that they communicate more than once per day, based on a 250-day work year (5 days x 50 weeks). By comparison, the within-department communication among client services colleagues is lower with a mean of (a still-high) 263 days per year (see Table 6.01).

[TABLE. 6.01 Here]

Boundary-spanning communication is less frequent than within-department communication for both departments. Employees in the software development department report a mean of 179 days per year of communication elsewhere in the organization and 14 days per year of communication outside the organization. Employees in the client services department report a mean of 174 days per year of communication elsewhere in the organization and 100 of communication outside the organization (see Table 6.01).

Even though both departments show about the same frequency of communication elsewhere in the organization, a large discrepancy arises in terms of communication outside the organization with the client services department, communicating considerably more frequently outside than the software development department. A closer examination of the tasks performed by the two departments sheds some light as to why the client services department is outwardly oriented while the software development department is inwardly oriented. The two departments perform different types of tasks, and these tasks have different levels of interdependency. The primary task of the software development department is to write code. Even though all departmental members know how to program, each person is responsible for specific components of the software that require specialized expertise. By dividing the responsibilities for software development among departmental members, a strong dependency is created between programmers to consult one another and to coordinate the various components. Charlie, one of

the managers, explains how tasks are interdependent, creating a need for frequent communication among department members:

> The engineers need to talk to their partner about the module that they are working on and documentation needs to know about every single module. Testing needs to know about every single module. Design needs to know about every single module.

Departmental members seek information outside the department when they do not have the necessary expertise to solve a problem. Respondents reported interacting with programmers located across the globe through online communities of practice (Brown & Duguid, 2000). While they recognize the importance of these external ties, they rarely use them. For one thing, they commonly find answers to their problems within the department or organization. Second, they are producing proprietary code which KME wants to keep confidential for competitive advantage. This is not a milieu that supports open source, interorganizational creation of software (Raymond, 2001).

By contrast, the client services department consists of experts in community management who have an outward orientation. Employees in the client services department work on separate accounts doing tasks that require little information sharing and coordination. Andy, a community manager, describes this more independent work practice:

> We don't meet and we don't talk about stuff. So, it may not occur to the other community managers that anything that occurs with their clients may have any relevance to my client and vice versa. I think we need to be more aware of what each other's clients are like.

The independence of tasks in the client services leads to an individual-based work culture. Still, Andy's statement suggests that community managers could benefit from sharing best practices, but their vertical division of labor neither fosters nor necessitates collaborative community.

Employees of the client services department do need to be in contact with clients outside of KME. The tasks of an online manager include organizing relevant information for the site, keeping the site up-to-date, and monitoring exchanges between community members. These exchanges can occur asynchronously (i.e., on bulletin boards) or synchronously (i.e., in real-time chat rooms). If inappropriate material is posted to the site, the community manager is responsible for removing it. When people behave inappropriately (flaming, swearing, etc.), the offending individuals are banned from the community. Employees engage in frequent discussions with a client about content development, tracking and monitoring, and the evaluation of a web site. Lori, a community manager, describes the close relationship she has with the client she works for:

> But we communicate so often through email and IM that once the conference call comes around, there is really not much else to talk about.

By contrast, the software development department has no contact with outside customers. They rely on intermediaries – the client services department, the marketing, and sales units – to obtain information about users and their requirements.

The physical layout of the two departments also contributes to the disparities in communication patterns. The software development department is located in a large open space,

with a washroom and a small kitchen next to the meeting room. The open concept was adopted to help programmers to engage in joint problem solving. Studies of the role of physical configurations for collaboration show that geographical proximity combined with open space concepts increases communication (Allen & Cohen, 1969; Hillier, 1996). The department manager is the only person who has a closed office separate from the common working space. However, the manager keeps his office doors open most of the time, so that people can walk in.

The client services department has more people and occupies a much larger space that is adjacent to the organization's marketing, sales, and head office departments. Community facilitators are in separate cubicles, with supervisors having a large common area, and the two senior departmental managers sharing a private office. Low visibility and the spread of employees over a large space reduce possibilities for sharing information. In addition, because of a fear of interrupting colleagues, the dense workspace discourages impromptu exchanges as the following quote by a community manager shows:

> Every time I say: "Hey, bla bla bla." They don't need to know about it and it is just an interruption to them. Lori and I don't talk as much as we used to during the day because we are too close to other people who are not doing the same stuff and we just get distracted.

The only exception is at meals: there is a kitchen, with a large table where employees gather for breakfast or lunch, and free breakfasts are provided to encourage some mingling.

5.2 Distance and the Role of CMC at KME [B]

Contrary to the Internetworking CM's "death of distance" frame (Kling and Iacono, 2001), CMC – and not phone or FTF – predominates among departmental colleagues at KME. CMC bridges both people and groups, and it supports local collaborative community. Employees in the software development department report communicating FTF and by telephone with departmental colleagues on average 280 days per year in comparison with 315 days per year by email and 344 days per year by IM (see Table 6.01). Even though employees are physically contiguous on a single floor and could easily exchange information in-person, they chose to communicate by CMC.

The client services department shows the same pattern of communication as the software development department with an average of 210 days per year of FTF/telephone exchanges with departmental colleagues in contrast to 299 days per year by email and 279 days per year by IM. For both departments, CMC is used more frequently for local communication than FTF/telephone. Our analysis of within-department communication shows that the availability of internetworking technologies alone does not lead to specific communication patterns. Even in this high-tech organization, where employees have diverse CMC tools available to them for boundary-spanning communication, they continue to exchange information primarily with other department members. Moreover, most local communication is CMC-based because employees prefer its speed, flexibility, and convenience.

CMC is also the primary means for boundary spanning at KME. Members of the software development department communicate more frequently with other KME employees by email (an average of 251 days per year) and IM (191 days per year) than by FTF/telephone (96 days per year). Similarly, members of the client services department communicate more frequently with other KME employees by email (186 days per year) and IM (232 days per year) than by

FTF/telephone (105 days per year). Colleagues in other departments are spread across the organization and hence CMC provides flexibility and ease of communication. Instead of having to get up and locate a colleague, who may be busy or unavailable, CMC allows for asynchronous communication and convenient information exchange.

In these ways, CMC fulfills the utopian vision of overcoming distance by facilitating contact from one's desktop. Yet, while CMC provides a means for flexible communication, in-person meetings, and phone conversations have not been displaced: they serve a different function because they allow for the transfer of complex knowledge and collaborative problem solving. This is not possible by CMC as it has limited ability to transfer information and especially tacit knowledge (Daft & Lengel, 1984, 1986; Daft, Lengel, & Trevino, 1987; Lengel & Daft, 1988; Markus, 1994; Rice, 1992).

In our analysis of boundary-spanning communication outside of the organization, we see the influence of contextual factors on communication the most. In the client services department, CMC greatly dominates communication patterns for contact outside of KME with email (159 days per year) and IM (113 days per year) used more frequently than FTF/telephone (28 days per year). By contrast, employees in the software development department make little use of any media to communicate outside the department, with an average communication of 22 days per year by email, 11 days per year by IM, and 10 days per year by FTF/telephone.

Software developers rarely communicate outside of KME, even though they rely heavily on CMC for communication with departmental colleagues and colleagues elsewhere in KME. When expertise is required that is not available within KME, programmers send information requests to other programmers via electronic group discussion lists. CMC thus provides a means to access a community of practice of programmers when information is needed (Brown & Duguid, 2000; Lesser & Prusak, 2000; Wenger, 1998). While this occurs infrequently, programmers at KME consider their community of practice an important source of information.

As discussed above, much of the work of the client services department consists of interacting with users and customers. CMC is the primary communication mode to keep in contact with customers, supplemented with annual or bi-annual in-person meetings. In-person meetings are rare because many customers are located either elsewhere in the U.S. or on other continents. Community managers interact with users only online through the community web site. Thus, CMC is used frequently by the client services department to communicate with customers located outside KME. The differences in work practices between the software development and client services department necessitate distinct communication patterns and uses of internetworking technologies.

5.3 The Reviving of Distance with the Rise of Local Virtuality [B]

The communication patterns at KME reveal a more complex picture than the early utopian visions of the computerization movement that expected organizations to embrace boundary spanning internetworking technologies that would enhance competitiveness and innovation (e.g., Heydebrand, 1989; Jarvenpaa & Ives, 1994; Miles & Snow, 1992; Nohria & Eccles, 1994; Sproull & Kiesler, 1991; Ward, Wamsley, Schroeder, & Robins, 2000; Wellman, 1997). Considering the large pressures in the software industry, innovation is a fundamental goal of KME. Nonetheless, contrary to the death of distance frame, KME does not function as a boundary-less, networked organization. Most communications at KME are with colleagues in the same department. This is especially the case for the software development department, which is

more focused on innovation and creativity. Much information circulates within the department due to specialized knowledge and a perceived need for proprietary, confidential software. Outside ties are important, but only in situations where necessary information is not available inside the organization.

At KME, the technology is available to facilitate communication outside of the organization. Both email and IM allow communication with spatially or temporally distant others, with email providing the additional ability to converse while not simultaneously connected to the communication system. KME employees use both internetworking tools extensively. But, KME employees use CMC more for communication within their departments than for communication outside of their department or the organization because physical and organizational propinquity tells them when they can interrupt departmental colleagues.

Local virtuality, the use of CMC for local communication, is endemic in this high-tech organization, where each employee has a computer terminal. Employees rely on CMC for the majority of their communications, even though they work in physical proximity. After all, they are already at their computers and staring at their screens. The time spent writing an email or an IM generally is shorter than the time it takes to lead a FTF or telephone conversation. Therefore, CMC allows communicating with a larger number of people as well as communicating with each of them more frequently. The utopian visions of the internetworking CM did not foresee the local virtualities that the routine and habitual use of CMC has created at KME. People are communicating by email and IM with those sitting next to them. Email and IM have properties that make local communication flexible and convenient.

6. THE INTERMINGLING OF COMPUTERIZATION AND DEMOCRATIZATION [A]

KME employees are *hyperconnected*, switching between CMC, FTF, and the telephone to communicate in their rapidly-changing, technology-intensive work. Despite the limitations of text-only CMC, technological savviness, coordination, and task interdependency (in software development) fosters high rates of CMC use at KME.

How does the heavy reliance on CMC affect organizational structures? A second key technological action frame in the internetworking CM is the utopian vision of "democratization" which holds that CMC can transform the social structure of organizations and societies into more egalitarian and collaborative institutions by facilitating bottom up, interactive, two way, peer-to-peer communication (Kling et al., 1998; Iacono & Kling, 1996, 2001; also see the introductory chapter, this volume). For organizations, this means the weakening of bureaucracy and the emergence of networked organizations where status, roles, and departmental divisions no longer restrict information flows (Fulk & DeSanctis, 1999; Hinds & Kiesler, 1999).

At KME, bureaucracy is not a relic of the past and continues to influence communication. However, KME is a hybrid organization, what Adler and Borys (1996) call an "enabling bureaucracy," where rules about work and vertical divisions of labor exist along with high levels of trust and community cohesion.

6.1 FTF/Telephone Networks [B]

To what extent is horizontal communication occurring at KME? Are employees at the same hierarchical level talking to each other, or are communications centralized and hierarchical in nature? Patterns of connectivity in the two departments differ.

In the software development department, the FTF/telephone networks show high levels of connectivity, with a density of .55 (Table 6.02). There is much horizontal communication (see Figure 6.01). No software developer is isolated, and the level of connectivity does not vary greatly between software developers. Programmers meet frequently FTF one-on-one in the kitchen or at each other's desks. The small workspace encourages frequent informal FTF interactions, in which both work-related and social exchanges occur. FTF interactions are more frequent than telephone conversations because colleagues are located in the same workspace, minimizing the need to call. FTF exchanges are important for discussing changes in the software and seeking help with complex problems requiring others' expertise. James, a programmer, explains:

> If there is any complexity to it, I use the phone sometimes too … the phone and face-to-face: it is kind of similar in that if it is at all complex, I want it that way just to have it back and forth.

[TABLE. 6.02 Here]

[FIG. 6.01 Here]

The software development department also meets frequently in formal FTF meetings to discuss developments and problems with the code. Impromptu meetings also take place if a pressing issue arises that requires input from all members of the department. With a cohesion distance of .75, departmental members easily reach each other. With a network centralization of 31 percent, the departmental members have similar patterns of connectivity.

The .24 density of FTF ties in the client services department is less than half that of the software development department. As discussed above, the tasks in the client services department are more independent in comparison with tasks in the software development department. Best practices are rarely shared. In addition, the cubicle work space arrangement impedes FTF exchanges, despite the availability of a kitchen. Not only are the informal in-person meetings less frequent, but formal meetings are rare.

Many meetings occur one-on-one between managers and departmental members because of the division of labor along different accounts. Bridget, one of the managers in the client services department, prefers FTF to IM:

> I would actually say face-to-face because I will actually stop what I am doing to talk to you, then email, and the phone. I don't like IM. IM is great across buildings. But when I am 50 feet away from someone, I think they can get up and see me, or I can get up and see them. So face-to-face is the best.

These one-on-one meetings with managers allow departmental members to go over problems and progress related to their specific accounts.

The FTF network centralization score of client services department is 49 percent, appreciably higher than the 31 percent of the software developers. Thus the FTF client services network is more centralized than the software developers: some employees are more connected than others, with managers being the most central (Figure 6.01). The FTF cohesion distance of .57 is also lower in the client services department than in the software development department (.75), reflecting the lack of contact between many department members.

[FIG. 6.02 Here]

6.2 Email Networks [B]

In the software development department, the .53 density of the email network is comparable to the FTF/telephone network. This is a densely-knit network with extensive horizontal email exchanges between programmers (see Figure 6.02). Email is valued as a communication tool because it gives programmers more time to think about a message and edit it if necessary. In addition, email is convenient because of its asynchronous nature: often people can respond at times that is suitable for them. Employees feel more comfortable emailing someone about less urgent matters because email is less interrupting than IM, FTF or phone. As Linda says:

> Email, if it is something that I do not need immediate response to. Using email because I can develop a well-thought through thought, and the other person can respond to it at a different time.

In addition, email is convenient because people can return to the parts they want to peruse more, they can reply or forward with annotations to what has been sent to them, and they can keep a record they can consult later. Programmers often use the cc: feature available in email systems because it facilitates many-to-many exchanges between departmental members as James, one of the programmers, explains:

> On email I want to communicate with more than one person at once, because it is not too often that I will actually call a meeting or grab people to come to the same place. So when it is important to communicate to more than one person at once I do email.

However, the archiving of email is a two-edged sword, as managers have a right to read email messages. Moreover, the U.S. Sarbanes-Oxley act of 2002 is now requiring organizations to archive all email messages, in response to allegedly missing records and messages during investigations of earlier scandals at corporations such as Enron and WorldCom.

The .75 cohesion distance for the email network is the same as for the FTF network, showing that most software developers are linked by email. The email network centralization of 33 percent is similar to the FTF network's 35 percent: this percentage suggests that most departmental members have rather egalitarian connectivity. Most departmental members are well integrated with four or more email connections to colleagues (see Figure 6.02 above). The exceptions are Richard and Paul, who have one and two ties, respectively.

The email network in the client services department is sparse: its density of .15 is two-thirds less than the software developers' density of .53 (see Table 6.02). Moreover, the density of the client services email network is lower than the .24 density of the department's FTF/telephone network. This is surprising as it usually takes less time and effort to send an email than to hold a FTF/telephone conversation. There are few connections among departmental members, with those ties that do exist often between managers and departmental members (Figure 6.02). Mark, Sophie, Anna, and Bridget – all managers – are well connected with about four ties each, while most departmental members have only one tie, which is often to one of the managers. The only exceptions are Ian and Andy with four and five ties, respectively: they are also well connected with ties to both managers and other departmental members.

The sparse email network in the client services department reflects the independence of tasks. Email communication is infrequent because client managers can complete their work without requiring coordination with other departmental members. Therefore, even though email is available for quick and convenient information sharing among departmental members, it is rarely used because it does not fit with their work tasks.

The .59 cohesion distance in the email network of the client services department is similar to the .57 cohesion distance of the department's FTF/telephone network. Network centralization is low at 21 percent, reflecting the low level of email contact. Although the email network is sparse, client managers nevertheless say that email is a valuable communication tool:

> I like to write it and then go back and read it. Make sure I am being cohesive and the things are making sense, whereas with IM I have a tendency to just type and send it, why you spell that word completely wrong and it just does not make sense. So, I like email.

6. 3 IM Networks [B]

With IM being always on and departmental members communicating often with each other, we expected the IM network to be denser than the FTF/telephone and email networks. To some extent this is true in software development, where programmers report an average IM use of 344 days per year within the department – much more than the frequency for FTF/telephone or email contact. Yet the social network data show that IM exchanges occur with fewer people. The .29 density of the IM network in the software development department is nearly half that of the density of the FTF/telephone (.55) and email (.53) networks (see Table 6.02). Where FTF/telephone and email are widely used with a large number of other programmers, IM is used more often, but with only a select number of people.

People do not feel comfortable sending other colleagues an IM because it is perceived as being intrusive. When an IM is sent to a colleague, the recipient's computer flashes, alerting them of an incoming message. Through this flashing, IM draws people's attention to the message and interrupts their workflow. Therefore, in the software development department, IM messages are only sent to those colleagues with whom one has a close relationship and feels comfortable interrupting. Moreover, IM messages are mainly sent when the request is urgent and a prompt reply is required. Linda, a software developer, explains:

> Instant messaging exists for immediate things, for quick exchanges, where you don't care about archiving.

In this way, IM promotes horizontal communication more than email because it is used primarily with close colleagues rather than managers. Employees feel less comfortable interrupting their managers than they do interrupting their colleagues. They use IM when they want a quick response to a brief question. For complex interactions, programmers use email or FTF/telephone. Linda reports:

> I use IM a lot. IM is great if you have one question that you just need an answer to. When you need to explain something in detail, an outline, kind of a business case for doing something, or for getting somebody to take action, email is the best.

IM cohesion (.59) is somewhat lower than in the FTF/telephone and email networks, while centralization (38 percent) is slightly higher. Software managers are less central in the IM

network than in the FTF and phone networks, with about two to three ties each (Figure 6.03). Yet there are variations: Linda, a departmental member, has five departmental ties and one inter-departmental tie to client services. Brian, Jerry, and Roger, all departmental members, are also central with four ties each within the department, and Brian also has two inter-departmental ties to client services.

[FIG. 6.03 Here]

For IM as with other communication media, the client services department has a less densely-knit network than the software development department. Moreover, the .19 density for the IM network in the client services department is a bit higher than the .15 density of the email network but less dense than the FTF/telephone network (.24). On the one hand, FTF meetings bring people and relationships together; on the other hand, it takes less time and effort to write an IM than to hold a FTF/telephone conversation. Moreover, FTF/telephone conversations often require coordination, while an IM can be sent flexibly at any time.

By comparison to the FTF/telephone networks, the client services IM network shows more horizontal communication, with departmental members often exchanging messages. Unlike the software developers who often need a textual email record of their code and problems, the client services employees are apt to use the less formal IM medium.

The IM cohesion of client services, .59, is similar to that of the department's FTF/telephone and email networks. Centralization is 24 percent, half as high as the FTF/telephone networks (49 percent), because of similar levels of connectivity among departmental members. The managers of the client service department have greater connectivity than departmental members. Sophia and Bridget – both managers – are well connected with six and five ties, respectively (Figure 6.03). By contrast, Jeanette – a departmental member – is not a part of the IM network at all, and Tanya has only one tie.

8. CONCLUSIONS: THE NORMALIZATION AND ROUTINIZATION OF THE COMPUTERIZATION MOVEMENT [A]

CMs provide a useful framework to examine the utopian visions inherent in technological adoption and use. We have conducted a case study of two departments in a high-tech firm to examine the extent to which utopian visions inherent in the death of distance and democratization technological action frames are played out. We have found that the utopian visions that have driven the implementation of CMC are not in accord with the reality of how CMC is embedded in work practices and daily routines. Rather, the study shows a complex picture of CMC use and social structure that depends on contextual factors.

We have identified three key characteristics associated with CMC use at KME:

1. Hyperconnectivity: The availability of people for communication anywhere and anytime.

2. Local Virtuality: The pervasive use of CMC for interaction with physical proximate people.

3. Networked Hierarchical Organization: CMC has not realized the utopian visions of flattened bureaucracies. On the one hand, KME employees are communicating widely in flexible networks; on the other hand, traditional hierarchical bureaucratic structures organize their work and communication.

CMC itself does not create hyperconnectivity, local virtuality, and a networked hierarchical organization. Technologies themselves do not determine work practices and organizational structures, but rather provide possibilities, opportunities, and constraints for social change – what Bradner, Kellogg, and Erickson (1999) have called "social affordances" (see also Bradner, 2001). Moreover, many changes that occur within organizations are complex and depend on contextual factors that can greatly vary from one organization to another (Markus & Robey, 1988; Orlikowski, 1992; Orlikowski, 1996; Orlikowski, Yates, Okamura, & Fujimoto, 1995; Zack & McKenney, 1995; Kling, 1996, 1999; Kling & Saachi, 1982).

8.1 Hyperconnectivity [B]

KME is hyperconnected. The adding on of CMC to FTF and telephone contact has created hyperconnectivity where community members – at work or elsewhere – are always connected to CMC and available for communication. Employees can easily send an email or IM to any other member of the organization, regardless of status or role (Sproull & Kiesler, 1991). Hyperconnectivity affords new forms of collaboration, such as instant availability of contact and constant monitoring of IMs (Quan-Haase, Cothrel, & Wellman, 2005). Hyperconnectivity combines the traditional availability (and surveillance) of all-to-all contact that was characteristic of pre-industrial villages and work places with the flexible connectivity to socially and physically dispersed others that is characteristic of the Internet age. It fosters employee independence and interdependence.

In this hyperconnected organization, and perhaps in many others, pervasive CMC has become the routine means for communicating and sharing information with people within and outside workgroups, departments, and organizations. We may be observing a change in the use of CMC and traditional media unique to firms where work consists of sitting at desks. Organizations that have multiple and the latest technology available for communication may prefer to rely on CMC for communication. CMC is simply the *modus operandi* of the organization, with organizational norms outweighing social presence and message-media fit limitations.

Colleagues do not need to be in FTF contact to trust each another. In the software development department, there are frequent shorthand IM conversations, so much so that we marveled at how employees withstood their apparent intrusiveness. More structured emails are equally frequent in the department, with email leaving more time for thought, allowing the attachment of documents, and providing archives and paper trails. Emails are supplemented by FTF encounters, both formal meetings and casual conversations in the software development department. It is clear that FTF contact is not the only trustworthy form of communication. In a milieu with much individual networking and little direct supervision, it is hyperactive CMC that fosters collaborative community within and between departments (Heckscher & Adler, 2006). Yet, all is not bliss: the high velocity of CMC means overload and distraction.

8.2 Local Virtuality [B]

CMC-fostered hyperconnectivity means that KME is a *local virtuality*. Most local communication is by CMC, both email and IM, despite the physical proximity of fellow employees. People go online to exchange email and IM with colleagues who are sitting next to them. They not only communicate by CMC with fellow department members on the same floor, they mainly use email to communciate with them. Moreover, email is their predominant means of communication with people outside of their department and outside of KME. Rather than the

utopian dream of the death of distance making community independent of geography, CMC has become a routine way to communicate, locally as well as globally.

Technology does not determine communication behavior at KME. Rather, technology creates possibilities for behavior. Norms and social structures of interdependence affect media use. For example, software developers use IM more than email, while client service employees rely more on email. The needs of the two departments differ: there is close collaboration among the software developers and a culture that favors rapid IM exchanges. By contrast, client service people, more oriented to external relations use email to reach users and customers.

8.3 A Networked Hierarchical Organization [B]

The computerization movement has asserted that internetworking technologies can promote greater use of functional networks with flexible membership – and less use of stable groups – in organizations, thereby diminishing the role of hierarchy in decision-making and information flows (Iacono & Kling, 2001; Sproull & Kiesler, 1991; Wellman, 2001). Hence, when we began studying KME, we expected to find a networked, post-bureaucratic organization where people worked in shifting teams with multiple others, with little structured departmentalization and hierarchy. Instead, we found a hybrid organization, what Adler and Borys (1996) call an "enabling bureaucracy," where rules about work and vertical and horizontal divisions of labor exist along with high levels of trust and community cohesion. How does a high-tech, hyperconnected organization such as KME reconcile the tension between collaborative, networked community and hierarchy?

KME has an explicit hierarchy that relates people and functions. The hierarchy provides a way of organizing individuals around work tasks as well as coordination and communication. The roles and statuses of people at KME are clearly formalized, with titles such as "Manager." People know what their role is, to whom they report, and what the adequate type of engagement is. Decision-making takes place at the top and is then communicated to employees.

Yet, KME is also an enabling bureaucracy. Rules about work and vertical and horizontal divisions of labor co-exist along with high levels of trust and community cohesion. Employees enjoy sufficient freedom to perform their jobs without reporting constantly to their managers and asking for permission. Their meta-awareness of the reporting structure – combined with hyperconnectivity, trust, expertise, and experience – allows employees to work largely independently while connected to a larger departmental and organizational enterprise.

Moreover, the type of work done by these high-tech employees has reached such complexity that the boss often cannot give much input for dealing with a technical problem. Such circumstances preclude direct hierarchical-bureaucratic supervision. To function, KME management must trust and rely on their employees to make decisions because they depend on their expertise.

CMC supports hierarchy as well as collaborative community. While CMC allows managers and employees to communicate, it is especially useful for communication among employees within and between departments. This is especially the case in the software development department where programmers need to be in close contact and frequently share expertise. Although the hierarchy is explicit in this department, employees communicate by email and IM with those who have the expertise they need, regardless of their status in the hierarchy. Yet, employees remain aware of status differences. Although their interactions within

the department do not reflect this – people socialize and trust each other – the awareness of hierarchy affects their interactions with the organization's management. Thus, CMC supports communication with all employees within the department but does not remove hierarchical barriers outside the department.

Hierarchical position has more influence in the client services department on who talks with whom (see Figure 6.01). A person's status within the hierarchy of the organization plays a key role in how messages are replied to. Lower status employees feel compelled to reply to messages of higher status employees because the receivers of messages know that senders are aware that they have received the message. Thus, awareness of others' availability leads to expectations in senders about how long it should take recipients to reply (Erickson & Kellogg, 2000).

For example, Brian, an upper manager in the client services department, received two IMs during our interview. Each time, when the message popped up on the screen, Brian glanced at his screen and quickly scanned it. Both times he excused himself and spent two or three minutes replying. When asked what had happened, Brian replied,

> I usually do not answer messages while I am engaged in a face-to-face meeting unless they are short questions or are urgent.

Yet he answered these messages, because they were from his superior. With IM, the status of the communicator and the urgency of the message can be more compelling than the physical presence of someone FTF.

8.4 Implications for the Internetworking Computerization Movement [B]

It would be fatuous to state that KME represents the epitome of computerization, now and definitely not in the future. Yet, KME is a company that lives by, for and on computer networks. Employees spent most of their times in front of desktops interacting with colleagues within their departments, in the organization, and outside the organization. For these high-tech workers, the computer screen is much of their work environment as the physical space in which they work. Even employees who sit next to one another often chose to interact by CMC.

All in all, the internetworking CM has much to celebrate at highly-computerized KME. There is collaboration and communities of practice (Brown & Duguid, 2000; Lesser & Prusak, 2000; Wenger, 1998). Although we do not have a control case of a non-computerized organization, our survey, interviews, and observations all show the impact of hyperconnectivity, with email and IM always-on and always attended to.

The KME evidence only partially supports the internetworking CM's technological action frame: that there is connectivity without spatial constraints. Although the great majority of long distance communication is by computer, local within-department communication still comprise the bulk of communication – online as well as offline. CM's advocates, mesmerized by the McLuhanesque dream of the global village (McLuhan, 1974; McLuhan & Powers, 1989), need to remember the many reasons that KME employees have for communicating locally online. We caution, though, that because all the members of each department studied worked cheek-by-desktop on one floor, we cannot distinguish between locality and work organization in fostering this local virtuality.

Finally, in terms of the gap between the internetworking CM vision of democratization and the reality in an organization, KME does not reflect a full-fledged networked organization

(Heckscher, 1994; Heydebrand, 1989; Jarvenpaa & Ives, 1994). Computerization does not have magically transformative powers. A hierarchy – with employees, and middle and higher managers – remains in place with clear reporting relationships. Yet, within this hierarchy, computerization enables the professionals at KME to seek help easily from peers, managers and subordinates.

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Table 6.01: Communication at KME by Department *(Days per Year)*

	Overall		FTF & Phone		Email		IM	
	SD	**CS**	**SD**	**CS**	**SD**	**CS**	**SD**	**CS**
Within Department	313	263	280	210	315	299	344	279
Elsewhere in Organization	179	174	96	105	251	186	191	232
Outside Organization	14	100	10	28	22	159	11	113

SD = Software Development *CS = Client Services*

Table 6.02: Network Characteristics of KME Departments by Media

	FTF & Phone		Email		IM	
	SD	**CS**	**SD**	**CS**	**SD**	**CS**
Density	.55	.24	.53	.15	.29	.19
Network Centralization (%)	31	49	33	21	38	24
Cohesion – Distance	.75 (1.6)*	.57 (2.06)	.75 (1.56)	.59 (3.69)	.59 (2.07)	.59 (2.07)

*Path Length.

SD = Software Development *CS = Client Services*

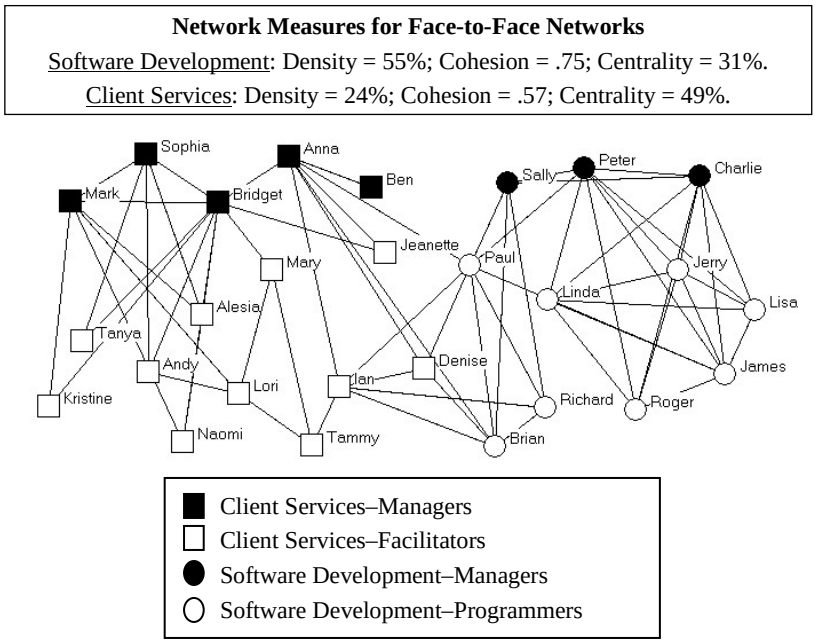

Figure 6.01. Face-to-Face Networks at KME.

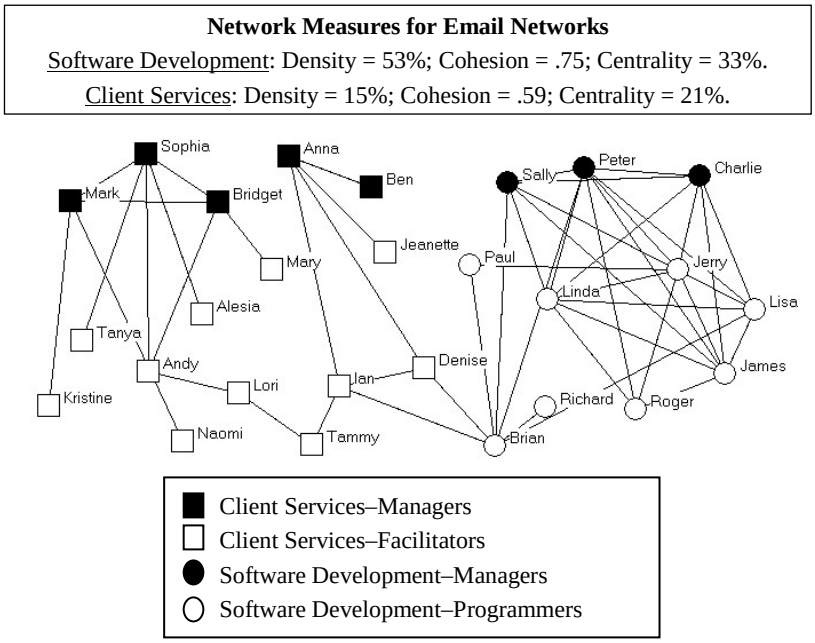

Figure 6.02. Email Networks at KME.

Network Measures for IM Network

Software Development: Density = 29%; Cohesion = .59; Centrality = 38%.

Client Services: Density = 19%; Cohesion = .59; Centrality = 24%.

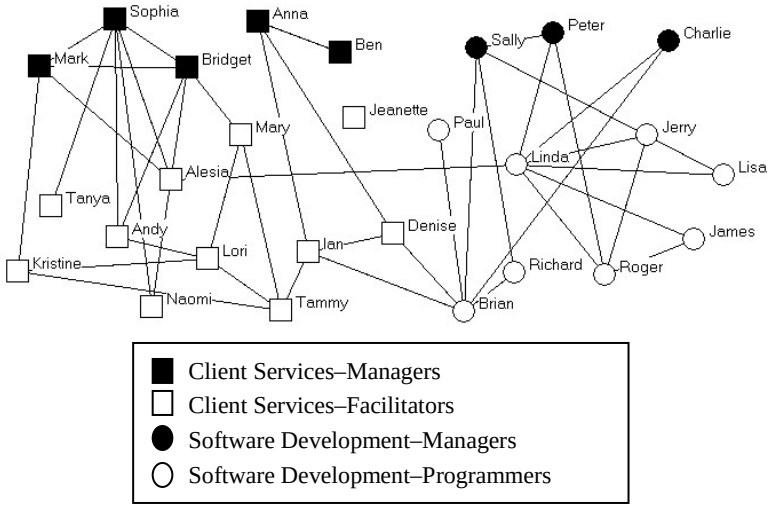

Figure 6.03. IM Networks at KME.