

15 COLLABORATION AND COLLABORATIVE INFORMATION TECHNOLOGY: WHAT IS THE NATURE OF THEIR RELATIONSHIP?

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Abstract

Collaborative information technologies have been claimed to enhance collaboration in organisations, under certain conditions. This claim was found to be problematic in several respects, particularly in the light of the results of 17 case studies taken from the literature. A number of issues emerged in the review that could help in understanding the relationship of collaborative information technologies and changes in work and organisation. The issues included the role of the specific capabilities of the technology, the difference between technology as a product and technology-in-use, the kind of care needed in bringing about desired changes, the emergent, drifting nature of the change process, the role of the technology as a constructive tool in improvising and enacting the changes, and the gradual translations of influences from work practices to organizational practices.

Keywords: Collaboration, collaborative information technology, Lotus Notes.

Introduction

A recurring theme in commercial IT literature during the past 10 years or so has been that collaborative information technology (CIT)¹ should enhance (foster, engender, etc.) collaboration in organizations (e.g., Kiely 1993; Papows 1998) and between them (e.g., Adhikari 1998), because the products have been designed specifically for this purpose (*the collaboration claim*)—they have even been called “collaborative work management products” (Anonymous 1998). Collaboration can be taken here simply to denote communicating and working together across organizational boundaries (Baker 1992). The collaboration-inducing facilities of CIT are identified as related to their capabilities to support a high-level of interaction, many-to-many communication and information sharing, in a group of known users, across the hierarchical, divisional or time-geographic boundaries (Coleman 1996; Dyson 1990). With these facilities, CIT is seen to have such potential that, for example, Jirotko, Gilbert, and Luff (1992) claim that “an appropriately designed CSCW system...should increase horizontal lines of communications within an organization and potentially undermine hierarchical levels of authority.”

The strongest form of the collaboration claim says that—in one way or another—CIT “causes” collaboration. This view has been observed in practice by, for example, Vandenbosch and Ginzberg (1997, p. 68): “many organizations believe that introducing Notes and similar technologies will impact collaboration and problem-solving behavior no matter what, and they act accordingly.” These beliefs have become so pervasive that the opposite views have also been forcefully presented:

Take Notes, for example. In talking informally with tens of organizations, I have yet to find one that believes that Notes transformed how groups worked. It’s a pretty good information distribution system and not too shabby, albeit slow, for e-mail. But show me a company where Notes has transformed how work is done and decisions are made, and I’ll water-ski to Nantucket in January. [Davenport 1993]

The CIT that is chosen as the focus in this paper is Lotus Notes®, which was the first common organization-wide commercial CIT software package. In response to reports of confusion about the nature of Notes from both researchers (e.g., Bannon 1993) and practitioners (e.g., Schwartz 1996), Lotus Corporation sought to explain the inherent model of their product (Lotus Corporation 1996). They first discussed three facets of cooperation—communication, collaboration, and coordination—and then pointed out the ways Notes is designed to enhance these: by providing electronic messaging, shared databases, and integrated messaging and databases. These capabilities are linked to the expected consequences:

It has been suggested that groupware will lead to increased collaboration among individuals in organizations, in part through the creation of networks of shared spaces that facilitate common understanding and are fundamental to enabling people to collectively grasp key concepts and issues....[Notes is] a technology that supports the

¹The term CIT is in itself a problematic one, implying that this particular subspecies of IT is indeed collaboration-inducing. Its use here is deliberate to keep the issue in focus throughout the paper.

building of a collaborative organization by enabling the creation of community knowledge bases that may pull organizations toward a more open sharing of ideas. [Lotus Corporation 1996]

In general, CIT is seen as a collaboration-enabling technology with an inherent model of collaboration, a particular collection of certain facilities or features, by which the technology then enables or constrains collaboration in its own particular way. If this inherent model then has not produced the wanted results, if collaboration has not increased or improved, it has typically been attributed to a failure of the particular technology with, for example, poor interface and low functionality (Alsop 1997), slow transmission speeds (Bowers 1994), or the particular circumstances (Applegate, DeSanctis, and Jackson 1995; Bowers 1994; Gallivan et al. 1993; Orlikowski 1993). Thus the conditions for successful implementation with resulting increase in collaboration (and thereby efficiency and productivity) have become a focus of interest. Based on a review of research, Vandenbosch and Ginzberg (1997, p. 68) have identified four conditions, under which the implementation of CIT “will enhance” collaboration in an organization. Each of these conditions alone is necessary but not sufficient. The conditions are: (1) organization members need to collaborate; (2) users understand the technology and how it can support collaboration; (3) the organization provides appropriate support for the adoption, implementation, and continued use of the technology; and (4) the organizational culture supports collaboration. We will now examine each of these conditions in more detail.

When Is CIT Claimed to Enhance Collaboration?

Need to Collaborate

The first of the conditions identified by Vandenbosch and Ginzberg is that for CIT to enhance collaboration, the organization members need to collaborate. However, there may be no direct relationship between the need to collaborate and the actual collaboration, due to organizational or external circumstances. An urgent need for collaboration may be created, say, by changes in the market circumstances, but the actual collaboration in work may emerge, due to internal circumstances, only slowly. Also, there can be “bad collaboration” (Easterbrook 1993), i.e., existing problems in interpersonal communications or poorly thought out collaborative tasks, which CIT may only make worse.

Also, it might be that while organizational members need to, and do, collaborate, CIT would not necessarily enhance this collaboration. It could also hamper it by, for example, allowing much wider or freer exchange of information, beyond the established structure of collaboration. Harper and Sellen (1995) have reported on a highly integrated and structured system of collaboration at the IMF for producing country reports. Even though IMF staff clearly collaborated in the production of the reports, the IMF abstained from using a particular CIT to support this work, because they feared that the technology could weaken this structure of collaboration.

Understanding Technology and How it Supports Collaboration

The statement “CIT will enhance collaboration when users understand the technology and how it can support collaboration” is problematic in several ways. First, it might well be that the users do not understand the technology (beyond the very basics) or—initially—how it supports collaboration, but that the particular technology is designed in such a way that it facilitates collaboration, for example by embedded rules, routings, or instructions, before the users understand that this is so.

Second, collaboration in work is often changing and can take many forms. How CIT could support any particular collaboration situation may not be clear. What is productive use of a shared document archive in one case might not be that in another. A certain way of communicating with a technology could suit one situation and be totally inappropriate in another.

Third, as the users learn more about the technology and its possibilities, they can change the way it is used and understood. An appreciation of collaborative (and other) possibilities maybe comes only after a considerable time of use. Admittedly, this awareness could then open up new collaborative uses for the technology, and in this way the above statement could be seen to be valid at a certain point in time. However, rather than looking at the situation—the people, the tasks, and the technology—at any one point, a more fruitful way is to look at CIT use as an evolving process.

Appropriate Support

The one claim that the current research studies seem to support unanimously is the third one concerning appropriate support for the adoption, implementation, and continued use of the technology. The importance of training, hands-on support, and a proactive stance toward adjusting the technology to the work have been identified as important, both by practitioners (Keselica 1994; Lloyd and Whitehead 1996; Smith 1996) and researchers (Bullen and Bennett 1990; Karsten et al. 1997; Orlikowski et al. 1995; Rogers 1994).

Collaborative Culture

The collaborative culture condition is the most repeated one, many citing the early study by Orlikowski (1992, 1993) of a consulting organization with a very competitive culture that had difficulties finding applications for CIT. For example, Applegate, DeSanctis, and Jackson reported that the successful implementation of groupware at Texaco required a culture of information sharing; Bowers told that individual division of labor militated against use of CIT; and Gallivan et al. emphasized the need for compatibility with the organizational culture.

In these studies, however, it appears that the term “culture” is merely a description of acceptance of collaborative work practices. But if we take organizational culture to be shared values and beliefs (e.g., Dawson 1996, p. 141), then collaborative culture could mean something like the profound values of the “collaborative workplace” (Marshall 1995, p. 15) where “true consensus, ownership and alignment in all aspects of the organization” would produce “trust, integrity and break-through results.”

This kind of collaborative organizational culture is not necessary for acceptance of collaborative work practices. While there might not be apparent collaborative values or beliefs, practices of collaboration may nevertheless be an integral part of how the organization works. It can be assumed that CIT can be used to support these practices, regardless of the organizational culture. For example, there can be external reasons to share information, contrary to the company culture. Kiely reports on two consulting companies, one with a team-oriented culture and another with an individualistic environment, which both used Notes because of the “market-driven necessity” to share information. The latter consultancy, the same firm as in the study by Orlikowski (1992, 1993), was reported by Kiely to be the largest user of CIT in its field, and has constantly updated its ways of use (Garcia 1997; Ouellette 1996), with no reports of change in the company culture.

Second, organizational culture or work practices are seldom uniform throughout the organization. Thus if there are areas where collaboration is supported and others where it is not, will the impact on collaboration then be different in different parts of the organization, even when they interact in doing similar work with similar CIT support?

A third comment could again point out the assumption of stability inherent in this claim, that organizational culture is something that persists, when the opposite, that it undergoes constant change, could be an equally defensible position (Dawson 1996). What will happen to the CIT-enhanced collaboration if the organizational culture suddenly changes to oppose all joint endeavors? Is the collaboration, supported by CIT, so strong that, for example, managerial direction or organizational development are not able to break the work patterns and values, or is the collaboration undone and CIT deemed to support some other work pattern? Or could CIT even be used as a tool to challenge the prevailing organizational culture?

To summarize, three out of the four conditions appeared problematic. Even if conditions were modified, the view that under certain conditions CIT is likely to enhance or encourage collaboration by virtue of its inherent model of collaboration raises further questions. Can the necessary conditions be defined, when organizations and their circumstances are so different and constantly changing? Is there an inherent model of CIT that can be discerned in all installations, regardless of the specific software and applications, or regardless of the multitude of design decisions that influence different use situations? Does CIT have the ability to influence collaboration in any way, or is there something else that would be needed in the equation? To address these questions, we will take a closer look at a number of case studies, to see what kind of evidence can be found in them on the relationship between CIT and collaboration and whether other approaches could be found to understand the nature of this relationship.

Studies of Lotus Notes Use

Seventeen major research case studies discussing implementation and use of Lotus Notes in its organizational and work context have been collected from scholarly journals, conferences, and directly from the researchers. They were written between 1992 and 1998 and represent the majority of reported empirical work. While in some cases there are repeated reports or reports that cover several years, in most cases the study covers a relatively short period. However, each case is presented according to the study, even though additional sources such as commercial press or company participants might have been available to give additional information on later developments.

Table 1. Cases of Exploratory or Conservative Use of Notes

The organization	What was implemented?	To support what work, to be used by whom?	How was it implemented, adapted and modified?	With what results, over what time period
Alpha. Large consulting company with highly competitive culture	Electronic mail, some discussion databases, some databases for browsing. No specific applications.	CIO: "to manage our expertise and transform our practice." To be used by consultants.	No explicit tying to work practices. No applications. No training to build applications.	During the first 6 months of use in one office: Used to support communication, if at all. Seen as a personal productivity tool.
Midwest Insurance. Large U.S. insurance company	Document databases, discussion databases and electronic mail. No specific applications.	LN had been used successfully as a communications tool in a BPR effort. Thus the management initiated wider use of LN to alter the nature of communication in the company, in the hope of a much more collaborative organization.	No specific, centrally developed applications. No information available on the locally developed 2,000 document databases. Training only in mechanics of use.	2,200 users at the end of the study. Most saw Notes as email. Perceived efficiency gains in communication. The more interdependent people were, the more satisfied they were with Notes. No change in the measured collaboration during the 9 months of the study.
TRC. Materials testing unit within the Technical Research Centre	Test tracking: a workflow application	Keep track of the tests' progress and help creating customer reports. Everybody in the testing unit used, all had low computing skills.	The application followed the management ideal of testing progression. Tied to actual work practices only in report creation.	After 4 months, used after the materials testing to enter data for the reports and to create the reports. Workflow aspects were worked around.
Petro. Information services unit of a petrochemical company	News feed: news gathering and distribution applications.	Distribution of external news (intelligence) from the information services unit to management.	By the departmental IS specialist, modified according to the user's needs.	In limited use after a year. (Later reports about extensive use of Notes for communication and EIS)
Unilever. R&D in product development	IPM, Innovation Process Management, to collect and distribute information about a new product initiative and its progress through evaluation "funnel."	To enable global management of the innovation evaluation. To be used by product managers worldwide, 1000 users.	Initially free access to all project info to everybody. This proved too extensive, threatening the independence of the project, the database was divided into public and project areas.	The public area was official, formal and lagging behind the events. The private area was not used as other tools suffice. During the first 18 months of use, no influence on collaboration.
EDF. The international distribution organization (ID) of a French energy provider	E-mail. Directory of 2100 people. Resource allocation system in marginal use. Some discussion forums and an interactive newsletter.	Executive director expressed the ambitious goals of supporting ID by creating a common knowledge pool, to enable global mobilization of personnel, to ease search of information, and to improve quality. To be used by 70 people.	Directory and email were implemented first, to familiarize people to IT and to start the process of continuing changes. More ambitious applications were developed by the end of the study period.	During the first 18 months of use only email and directory integrated into work. Considerable resistance due to limited prior IT exposure or a failed centralized IS project. The business processes of the company were being planned in parallel.

To expand the focus to the specifics of each case, as a first step of comparison, the cases were summarized in a table, with the following information:

- What was the implementing organization?
- What was implemented?
- To support what work and to be used by whom?
- How was it designed, implemented, adapted, and modified?
- With what results, over what time period?

The next step was to find whether the studies had similarities, whether they could be grouped according to some of these dimensions. Instead of looking solely at the expectations—such as increase in collaboration, efficiency or control—that the organizations have set on the technology, the approach the organizations have taken in implementing the technology and their strength of commitment emerged as a possibly fruitful overall focus. Looked at in this way, there appeared to be three major groups. In the first group, the cases discuss exploratory, conservative, or cautious use of Notes. The next group reports cases with well-planned core applications. The third group consists of cases where the use of Notes was extensive and where the users had taken an active role in incorporating Notes applications into their work. The consequences of Notes use also appear to be quite different in the three groups: while minor in the first group, and restricted but positive in the second, major organizational changes are reported only in the third group. Short overviews of the cases are presented next, arranged into these three groups.

Exploratory, Conservative, or Cautious Use of Notes

These six cases discuss tentative, exploratory use of Notes. There were either no major applications built at the time of the study (Alpha, Midwest Insurance), the applications were used to automate existing routines (TRC, Petro), or they were very limited in scale (Unilever, EDF).

The first two cases, **Alpha** (Orlikowski 1993) and **Midwest Insurance** (Vandenbosch and Ginzberg 1997), describe a quick implementation of the basic infrastructure, use of electronic mail capabilities, and discussion databases; in the case of Midwest, there also were document databases. However, no specific applications were developed and there was no explicit link to established work practices. The infrastructure was implemented in one step to a large number of people with a goal of broad coverage. The support was limited to the technical aspects; use of Notes was limited mainly to communication. In Alpha, the CIO set the goals as “to manage our expertise and transform our practice,” but then expected this to happen just by installing a basic communications infrastructure, without ensuring appropriate resources to adjust it to company needs. The company work practices left no room for experimentation and free development; thus Notes was marginalized even as a communications tool. If it was used, it was used to support personal productivity. In Midwest Insurance, Notes had been used successfully as a communications tool in a reengineering effort. Then the management initiated wider use of Notes to alter the nature of communication in the company, in the hope of a much more collaborative organization. Notes was indeed used widely to discuss the current issues in the company, but there was no increase in collaboration, measured as degree of interdependence, between the two surveys

conducted three and nine months after the rollout. In summary, Notes was used as a communications tool (“glorified e-mail”), but this had no consequences on how the company worked, at least not during the relatively short periods of use reported (Alpha, five months; Midwest, nine months).

In the two Finnish cases, TRC and Petro (Karsten 1995b), the applications were built to automate existing processes. The materials testing unit of a technical research center (**TRC**) used a *workflow application* for managing testing activities, assuming a highly structured way of cooperating in running the tests. While use of the application made some parts of the work easier (such as writing reports, collating them from various bits and pieces), it also disrupted the work practices and ways around it were developed by the users. It was built in an attempt to reinforce existing structure, as seen by the management, but the workflow in the application was not aligned with the actual interdependencies in the testing process. If the unit had started working as the application required, the result would have been delayed tests and more time spent on testing.

The information services unit at **Petro**, a major petrochemical company, built experimental *news feed applications* for collecting external intelligence and news information and feeding it to internal executives. Within the first year, no changes in management work evolved and the changes in the work in the unit were those of automating existing processes, thereby making them more effective. While these applications were used by very few people, they provided experience and chances to explore the possibilities of Notes for the information services staff. With these applications, they realized, for example, the differences between push and pull type information services, the first happening when information is sent according to a certain distribution list and the second when information is entered into a store to be used when needed. Based on these and some other experiences, the company later built an extensive Executive Information System with Notes and the management considered Notes as the major communication tool for the company.

The third pair of cases, Unilever and EDF, discuss specific applications built for a particular task. In product development at **Unilever** (Ciborra and Patriotta 1996), the evaluation process of innovation was reorganized and an application, *IPM* (innovation process management), built to track each innovation and its evaluation process. Several issues in the company work practices and structures became visible with the introduction of IPM and recognition of this restricted its use. For example, initially, there was free access to all, but this had resulted in unexpected interventions from company management, disrupting the free flow of information. The application was then divided into two, with a formal part with summary information for company-wide use and an informal part for internal use in the project team. The information in the formal part was usually out of date and therefore not used much. The more informal part was not used because a combination of previous practices was deemed sufficient.

The newly launched international distribution department (ID) of the French energy provider **EDF** (Ciborra and Suetens 1996) worked in over 80 countries. Their core tasks were finding business opportunities globally, setting up projects with resources from EDF, supervising the projects, and then distributing the know-how gained within EDF. In this, they used electronic mail, an interactive company newsletter, and a resource directory of potential people for projects, on a regular basis. However, the more ambitious plans for applications such as workflow systems took off only slowly as the

department was working on its procedures and quality systems in parallel. In addition to considerable resistance to the move from face-to-face communication and use of secretarial help to mobile computing, the collaborative capabilities of Notes were still largely unexplored by the end of the study period.

While the goals for both Unilever and EDF were ambitious—to enable global management of innovation evaluation, to create a common knowledge pool for the global organization, or to harmonize methods and tools of operating—the realities of the applications were far below expectations. This was reported as being due to their misalignment to the (possibly constantly changing) work practices, low quality of the applications, and insufficient support in their use. However, even these experiences provided opportunities for change, when the applications already in the planning stages worked as “constructive tools” and places for reflection on the current work practices, helping to highlight gaps and problems in the organization (Ciborra and Suetens 1996).

In all these cases, while to some degree the use of Notes was planned to be in alignment with existing work practices, this alignment was limited and static. Sometimes the expressed goals for use contradicted actual management direction or were clearly seen as detrimental to work practices. In three cases (Unilever, EDF and Petro), however, the applications, while modest, provided tools to enable exploration of the possibilities of the technology and acted as means for reflecting on the company. The periods covered in these studies were also relatively short (5 to 18 months) if we compare them with the other cases presented later.

Planned and Expanding Use of Notes

These cases report on planned, initially restricted applications or collections of applications, with at least some plan to expand Notes in this or some other area in the company.

In **Insurance** (Wynn 1996), the approach was exploratory and started with experimenting with Notes application building. One of these applications, a workflow application for *insurance policy enrollment*, then took momentum with the help of a dedicated developer in the user organization and a championing manager. The application included some expert system capabilities as well. By virtue of the embedded rules, it acted to clarify and enforce workflow. It also acted as a boundary-spanner between three departments, allowing back and forth movement of the policy. However, it also removed iterations from the work by checking for consistency before transfer to the next department and in this way made the policy preparation even more sequential than it had been before.

The Quality Handbook (QH) for the **Plywood Plants** (Karsten 1995b) and the *Tasman* application for the paper machinery manufacturer **Valmet** (Karsten et al. 1997) were both essentially shared document archives, with some support for constructing the documents. They were intended to be used in a particular, limited task, in helping to keep the documents stored in order. A similar approach was used in *Cosis*, the electronic notebook application for the service organization of a large multinational pharmaceutical company **Roche** (Ciborra 1996b) and the *Shaman Diary* in the **Process Industries** (Kovalainen, Robinson, and Auramäki 1998). Both QH and Tasman were supported by e-mail but no discussion databases were directly linked to the task. Discussion databases

Table 2. Planned and Expanding Use of Notes

The organization	What was implemented?	To support what work, to be used by whom?	How was it implemented, adapted and modified?	With what results, over what time period
Insurance Regional health insurer	Enrollment application, a workflow application which had editing and expert system capabilities.	To support insurance policy enrollment between three departments. Editing and correcting applications for health insurance.	A prototype was developed further by an in-department developer, who actively sought the users to give the specifications of what the application should do. A manager as the champion critical.	The study covers 18 months of the development and concurrent production use but no actual use. Awareness of Notes and its position in the company increased. Some changes noticeable in work, such as fewer iterations between departments.
Wood products industry, eight Plywood Plants	Quality Handbook application. Also Notes e-mail and several company-wide discussion databases available for these users.	Creating the Quality Handbook: managing versions and composing the whole from the parts, used by engineers and technicians.	By the Notes application developer in the central administration. Practically no modifications during the Quality project. Some problems with distant access to support.	The users saw it as an efficient support for constructing the Handbook. Views of it as a tool for collaboration also emerged during the 3-6 months of use.
Roche Diagnostics division, service organization	Cosis, multidisciplinary knowledge base, captured as stories and service conversations. LN was chosen as the platform because it could gather all scattered practices and extend them to all in an uniform manner.	Sharing knowledge about maintaining analytical machines and instruments in the service organization of 300 engineers scattered around the globe. All communications, reporting and updating of handbooks went through the electronic notebook to be shared through the network.	The idea was a combination and expansion of existing solutions. The system was developed by the IT/service engineers of the division. Introduced gradually, supported by thorough basic training. Services and functionalities added incrementally, slowly enlarging the number of users, country by country.	Become a much used tool during the 1-2 years of use. Style of communication changed. It was used widely, entries read by all. Success was claimed to be due to the focused nature of the application and the homogeneity of the user community. Use of Cosis in other areas considered.
Valmet Large paper machinery manufacturer; delivery project department	Tasman application to support project documentation archiving and project communication. E-mail. Several discussion databases and company-level applications.	To make project documentation more uniform and accessible to all concerned and to collect various bits and pieces all into one place. To be used initially by teams of project managers and their assistants, later expanded to the whole project team of up to 50 people.	The application was tailored for the department. Its use became department policy after the first year. It was modified constantly by the support person in the department.	Used in all projects after one year. Different ways of use emerged after two years. Users came up with suggestions for expansion and enhancement.

Table 2. Planned and Expanding Use of Notes (continued)

The organization	What was implemented?	To support what work, to be used by whom?	How was it implemented, adapted and modified?	With what results, over what time period
<p>Process Industries Large paper mill; paper production group</p>	<p>The Shaman Diary application to record problem situations and their solutions in running a paper machine.</p>	<p>To support factory floor management of the paper production process. Used by factory floor workers and workers of adjoining units, their foremen and some engineers. Several workstations around the machine.</p>	<p>The application was tailored for the production workers, based on an earlier paper diary and observations of the work (Auramäki et al. 1996) to support local organization and 6 communication of relevant material.</p>	<p>Use enforced by the workers themselves. Expansion to adjoining units and to management has not prompted modifications to the application.</p>
<p>SH A small consulting company with a hierarchical structure. Two owners, others employed.</p>	<p>17 Business management applications, including e-mail.</p>	<p>All aspects of business and project management, with the emphasis on reporting and monitoring, used by management and the employees, total of 20 people.</p>	<p>The internal LN developers worked on the internal applications when they did not have customer projects. Users wanted for clearer rules for application use.</p>	<p>Applications well accepted after 2 years of use. Increased efficiency and productivity and better information sharing mentioned as results.</p>
<p>HDB Housing and Development Board of Singapore</p>	<p>The Integrated Office System (IOS): email, several databases on corporate and departmental level, often with tracking capabilities, sometimes agents or workflow capabilities</p>	<p>To support the core functions of the HDB: provide housing in Singapore. To be used by the staff of the agency. 3000 users.</p>	<p>Positive feedback from users, management support strong, wide use. End-user development met with technical difficulties. More and more sophistication in use (image enabled applications, IOS, intranets)</p>	<p>End-user application development, core applications modified continuously during 3 years of use. High return on investment, clear efficiency gains.</p>

were used in Cosis and in the Shaman Diary, also for the purpose of discussing their use practices.

Even though all four were relatively simple as applications, the shared access to them prompted the users to come up with new visions of their collaborative function. One user of the QH perceived its use as if they were around the same table while in practice residing in eight different locations around the country. Tasman users saw the other parties in the project joining in at a later stage and contributing in the form of messages, documents, and reports, reducing phone and paper mail traffic. The entries in the Shaman Diary and the stories and service conversations in Cosis expanded the informal exchange of know-how to a wider audience, acting as an aid to building organizational memory (Bannon and Kuutti 1996; Stein 1995).

HDB in Singapore and SF were Finland were similar in their comprehensive approach to support the core business. The Housing and Development Board of Singapore (**HDB**) used a large integrated office system, *IOS*, facilitating communication and shared access to documents and other information (Tung and Turban 1997b), for “increasing productivity, quality and customer satisfaction” (Tung and Turban 1997a). The main applications were implemented by mid-1996 and they were used by 3,000 HDB staff. In addition to electronic mail with standard mail forms, several hundred corporate and departmental applications were implemented. The main purposes of the applications were informing, tracking, and automating processes to reduce the time the staff spent on clerical tasks so that they could devote more time to planning and analytical activities. Several of the described applications appear to concern regulations, proper procedure, and standardization of documents. Users’ suggestions and feedback have been incorporated into the applications on a continuous basis. There was some resistance to the system, but training was seen as a measure to overcome this. The IOS system was reported to have a high return on investment and its use had resulted in changes in the nature of work tasks (Tung and Turban 1997a), but no major changes in the way HDB works were reported.

In **SF**, a small software house with two owners and 18 analysts, Lotus Notes was used to build almost all internal business and project management applications (Heikkinen 1995; Heikkinen and Ovaska 1998). In alignment with the hierarchical form of the firm, the main areas of use for Notes were in monitoring and in reporting, with some internal communication. Interaction with Notes was structured in the same way as it was prior to Notes and the applications were assumed to support the existing way of cooperating. The 17 applications were closely tied to existing work practices and no new ways of working arose during the three years of use.

In both HDB and SH, a full variety of Notes applications was used to support the current way of working, with the aims of efficiency, quality, and access. Both of these studies showed that Notes could also be used to support a hierarchical organization, both in its coordination and control tasks. No new collaboration was reported as having been induced in conjunction with Notes during several years of use.

In all of these cases, Notes use was mainly for company and task specific applications, especially for coordination, and not just communication (e-mail and discussions). In the cases of Cosis and the Shaman Diary, their success was attributed to the focused nature of the applications and the homogeneity of the user community and this may hold true for the other cases, too. The applications had been built explicitly tied to certain tasks and adjusted to the company’s way of working. The use of the appli-

cations had prompted some ideas for increased collaboration, but no major changes were reported. The expansion of Notes use outside of these applications appeared slow, and the benefits acquired were mainly on the group level.

Extensive and Engaged Use of Notes

The third group consists of four cases where the use of Notes was extensive and where the users took an active role in integrating Notes applications into their work. In all of these cases, there were changes in collaboration, either in its nature or its amount. The length of use period was variable in this group.

At **Eiger** (Ngwenyama 1996, 1997), in a software development team working on three continents, several applications and e-mail were used to coordinate and manage the annual update of its major software product. The applications made the work more visible, both to the people themselves and to their counterparts in other countries. The countries also became “closer” in the sense that the colleagues learned about each other as individuals and started to converse in a much more informal fashion than before. During the study period of nine months, there was increase in lateral communications. This was then influential in replacing hierarchical organizational structure with a distributed hierarchy.

THC was a small holding company that was formed when a large insurance company outsourced most of its departments and local offices throughout the U.S. (Ruhleder and Jordan 1997; Ruhleder, Jordan, and Elmes 1996). Its main task was to coach the now small independent units to carry out their business responsibilities. This was done by having the management available 24 hours a day, seven days a week, and by carrying out constant development projects. The traditional functional and hierarchical barriers were dismantled and teamwork and open access to people and information was promoted through a series of physical and organizational arrangements. These arrangements were supported by laptops, Notes applications (e.g., *Work Manager* to track project activities), calendaring/scheduling tools, e-mail, and remote meeting technologies, actively championed by the CEO and a small core of key players. The collaborative work arrangements were planned and implemented first. CIT was then used consciously to support the new work arrangements. While the setups suffered from technical problems, CIT was integrated quickly into the projects.

A small Finnish computer consulting company, **CCC** (Karsten 1995a; Karsten forthcoming; Karsten and Jones 1998), had a group of applications to support managing the company, its projects, and sharing expertise. The applications played key roles in parallel organizational transformations, supporting a variety of organizational forms and cultures. At the end of the three-year study period, the form of the organization had become more integrated, more consensual, and there was more collaboration in projects. The consultants had modified their roles as their skills expanded, as their discourse about the firm became more visible (for example, during a discussion of the company ground rules), as their participation increased in volume and involvement, and as their work became more visible. All these were much influenced by the use of Notes, some as planned, but others opportunely and as unexpected consequences of Notes use. The implementation and use of Notes was more strongly influenced by aspects of the organizational context (economic recession) and internal social structure (changing foci of control and role changes of consultants) than by any intrinsic logic of the technology.

Table 3. Extensive and Engaged Use of Notes

The organization	What was implemented?	To support what work, to be used by whom?	How was it implemented, adapted and modified?	With what results, over what time period
Eiger Software division located in the U.S., Asia and Europe	APMS to support the annual revision of a manufacturing management software package. A workflow application for the development work, a tracking application for changes and e-mail.	Support coordinating and managing flow of work activities, track changes in the software being developed, and communication. Company ISD methodology implemented in the Notes rules and forms. Used by designers in the US, programmers in Asia and translators in Europe, total about 80 people.	The applications were implemented by the software specialists themselves. The inscribed policies on access and workflows imposed a level of control beyond what had been the practice. New innovations to the applications were implemented through the study period. The work practice and the Notes application kept being modified to support collaboration.	Wide and continuous changes in work practices, also some unintended ones. Increased knowledge of the company work situation, work practices and regulations plus increased closeness between continents. Increased lateral communications gradually led to distribution of the hierarchy.
THC A small holding company with a relatively flat hierarchy and team-based project-centered environment	Several applications (Work Manager, information distribution apps, meeting coordination etc) and e-mail. Quarterly reports, balance sheet, income statement. Also as a conduit to business units, for their reports and for coordinating meetings.	To support managing a network of outsourced units and local offices, throughout the US. Virtual workspace. Used by the 6 in management and the 32 associates. To communicate, share documents, keep people "in the loop" and to document activities or decisions.	The pan-THC applications developed centrally. The work practices and the Notes applications keep being modified to support collaboration. Local experts develop team-level applications.	Several modifiable applications. Local application development. Use of Notes was linked with other CIT in meetings. Used consciously to support the continuing processes of change in the organization.
CCC small computer consulting company	Several applications: Business Base, Customers, Meetings, several discussion and news databases, project databases	Managing the company collaboratively, managing projects, used by the 10-14 consultants (one of whom was the managing director) and the administrators.	Key applications by two developers, according to users' wishes. Everybody could develop own applications. Applications revised often and new ones devised.	Increased collaboration in management, increased number of joint projects. Use stabilised for the first time after 3 years of major changes in the company and in LN use.
Zeta Major software house in USA, Customer Support Department with cooperative culture	Incident Tracking Support System (experiments 1992, full use 1993) to facilitate tracking of incidents and more effective management of workloads.	Customer support by phone; tracking customer calls. Bugs tracking database. Used by 50 specialists for solving and tracking customer problems on phone.	Based on a previous system and two prototypes were developed first. Design was done within the group.	Significant changes in work, norms, structure, coordination mechanisms, evaluation criteria, and technology use. Changes ongoing. Emphasis on changes in work, not in the applications.

The phone support group of a major software house, **Zeta** (Orlikowski 1995, 1996), developed a call tracking support system. The development work was carried out carefully with the lessons learned from the previous system and two cycles of prototyping. While some of the changes in the work were planned, others were opportunistically taken up during the course of events, during the two years of study. Significant changes in work, norms, structure, coordination mechanisms, evaluation criteria, and technology use were reported, with increased integration throughout the organization.

In summary, this third group of cases describes extensive and engaged use of Lotus Notes. In all of these cases, there were several applications that were tied directly into established work practices. Application development was conducted as a careful process, with prototypes and user involvement. Usually the developers were themselves part of the work organization and had experience not only in groupware development, but also in business application development in general. Despite these measures, there were also major problems with the applications not being in alignment with the work practices. For example, some microlevel structures, such as a certain rule in an application, could be seen to constrain work (Monteiro and Hanseth 1995; Ngwenyama 1997).

With these applications, aspects of work were moved from meetings, hallways, paper, and phone to several venues in Notes (and possibly other CITs as well). These venues were usually structured and gave the historical progression of events. The events can be seen to have taken place in an “organizational information space” (Karsten forthcoming), leaving a record there. Thus, the work became more visible and this visibility brought about unexpected consequences, such as recognition of unfair practices (Ngwenyama 1997).

What was common for all was that the expected and unexpected experiences had been used as fuel for innovation. Both the applications and the work practices were consciously being modified in a mutually influencing fashion, or, as Ngwenyama (1997, p. 20) puts it “groupware applications and organizational processes influence the emergence of each other.” Characteristic of this third group were the proactive and creative activities of the knowledgeable and experienced users. As Orlikowski (1996, p. 69) puts it:

The transformation [of the organizing practices at Zeta], while enabled by the technology, was not caused by it. Rather, it occurred through the ongoing, gradual, and reciprocal adjustments, accommodations, and improvisations enacted by the CSD members.

These change processes were also seen as learning and development opportunities by the users: “Every time we had a serious problem with (our system) we learned more about Notes and about the way we did our work” (Ngwenyama 1996). Ruhleder, Jordan, and Elmes (1996, pp. 12-13) emphasized that learning and sense making around the technology was a social and cultural phenomenon, where experiences in one group influenced those of another group:

The adaptation of Work Manager (to local situations), for instance, propagates not only a specific application of the Notes technology, but further stimulates ideas about organizing work and coordinating activities.

They concluded that

The case of THC suggests that managing the cultural and learning aspects of new organizational forms requires a deep understanding of the fundamental inseparability of technology, practice and community.

The cases described not only the planned and serendipitous changes in technology and work, but also how these changes gradually translated into organizational level changes. An example of this was the major changes in the relationship between the U.S. and Asian software development teams in Eiger, where collegial, informal relations emerged during the ongoing discussions (Ngwenyama 1997). The increased lateral communications then led to organizational restructuring. In CCC, when everybody in the organization was demonstrably having a regular usage pattern, the MD started printing out certain reports directly from Notes databases, instead of querying each person by e-mail of the status of their report (Karsten and Jones 1998). While it cannot be said that Notes had transformed how work was done and decisions were made, we can say that the possibilities of Notes had been exploited in these companies in such a way that these kinds of changes had indeed taken place.

Support for the Collaboration Claim?

With these case studies at our disposal, we now go back to the collaboration claim and its conditions and take a look at whether support for it could be found in the cases.

Need to Collaborate

In the cases, there seemed to be no clear relationship between the need to collaborate and the use of CIT. In the first group, the need was mixed and often there were no clearly defined tasks for which the technology would be used. In the second group, the need to support a particular way of working—be it collaborating, coordinating, or controlling—in a particular group or in particular tasks was clearly defined and the applications were built to meet this need. In the third group, the applications and adaptations were again geared to support a variety of work practices, but there were also examples of emergent collaboration.

We can also try to distinguish different kinds of collaboration and their relationship to CIT. Collaboration can be looked at as planned, occasional, or emergent. Planned collaboration is a *structured* phenomenon, something that can be supported in an orderly fashion, for example with specific applications. Examples of planned collaboration were common in the second group, but the software development at Eiger and call tracking at Zeta also fall under this category. However, as we saw, the nature of collaboration can also change in these situations. A further problem with structured collaboration is how structured the collaboration needs to be and across which organizational boundaries it can span. For example, in Unilever, the initial solution was free and wide, and led to unexpected use, when the actual need to collaborate was much more bounded.

There are also *occasional* collaboration situations, anticipated or unanticipated, where the shared information space (in cyber or real life) provides a forum for collaborative activities. The proponents of CIT in the first group appeared to believe that

unanticipated occasional collaboration is much more prevalent in their organizations than it appeared to be in practice. The collaboration in the projects of THC is an example of anticipated occasional collaboration. In CCC, when Notes use was quite established after several years, it was used in occasional collaboration situations, such as the effort to update the company ground rules.

Finally, there is *emergent* collaboration, when in a particular situation the organizational actors move toward realizing that with collaboration a particular task could be carried out in a better way, and as a consequence start realizing this insight in their actions, for example with the help of a particular tool or application. There were several examples of this, especially in the third group of the cases. In other groups, the possibilities of this happening in the future were hinted at. In the case of structured collaboration, there is a planned area of use for CIT whereas in emergent collaboration the technology may be the instigator for collaboration by relaxing previously definite limitations imposed by, for example, geographic location or different times at work.

Understanding Technology and How it Supports Collaboration

The need to understand the technology and how it is used did not find much support in the cases. There is naturally a minimum threshold of understanding in order to use the technology at all, but not understanding the collaborative possibilities seemed not to be an issue even in the first group of cases—but rather the adjustment of the technology to the company. In the second group, at least two cases (Plywood Plants and Zeta) show CIT supporting collaboration even though the users did not understand—initially—how it could support collaboration. In these cases, the key seems to be a specific application built for a particular task.

A repeated message seems to be that the applications can act as “constructive tools” when users and developers labor to formulate work practices. If we take the statement that users need to understand technology and how it supports collaboration to depict a process rather than a status, then we can see significant changes in work, as shown in the third group of cases. Looked at this way, the users and the developers work toward increased understanding of what the “constraints and enablements” (Orlikowski 1995) or “affordances and constraints” (Schmidt and Simone 1996) of their particular CIT are in their particular situation, how it can be fitted to support their work, and how the work can be changed to utilize these. However, these processes do not necessarily lead to changes in the amount of collaboration. For example, in THC, the various CIT were deliberately used to support planned and enacted collaboration, which might have been accomplished without the technologies.

Appropriate Support

In the first group of cases, the support was usually minimal and restricted to setting up the technology. In the second group, the focus of the support was the technology and the applications, not so much the proactive changing of work practices. In the third group, support was extensive and engaged, and while the technology-side was also taken care of, the emphasis was on work practices. In all cases, there were influential individuals,

such as managers, developers, champions, support personnel, whose role was in some way crucial, in one direction or the other, in bringing about the outcome.

If we take appropriate support to cover all of the activities of taking “care” of the CIT implementation and use, the cases support the conclusion of Ciborra that “collective and individual care seems to be a necessary, but not fully sufficient condition for an effective groupware implementation” (1996a, p. 6). For example, in EDF, the care was exercised, but the organizational context undermined its positive effects.

The cases also support the view that CIT demands more effort and commitment in the implementation and requires much more focused support or “care” than traditional information systems because, first, the technologies were previously relatively unknown by those concerned and, second, because the applications can give opportunities for major—if only slowly unfolding—changes in work. Moreover, the take-off of a groupware application seems to depend on how it is embedded in the “local content,” i.e., the local work practices, thus a key role for support could be to adjust the technology so that it will be well embedded (Ciborra 1996a).

Collaborative Culture

The claim that “CIT will enhance collaboration when the organizational culture supports collaboration” found no consistent support in the cases. In several of the cases, CIT was used to support the existing culture (collaborative or not) but it was also used as means to challenge and change it. In the cases of Insurance, HDB, and SF, the organizations were hierarchical, with clear division of tasks and high degree of control. Notes was adaptable to be used in those companies, but there were no reported changes toward increasing collaboration.

In those cases where Notes contributed to collaboration, the organizational culture was formalized (Eiger), competitive (THC), first independent, then formalized and finally collaborative (CCC, Zeta). Thus a claim could be made that CIT can be used to enhance collaboration not only when the organizational culture supports collaboration, but also in other kinds of organizational cultures.

Did CIT Influence Collaboration?

Was there increase in collaboration in these cases? Could that increase be attributed to use of Notes? In the first group of cases, there clearly was no increase. In the second group, there were no major changes reported on the organizational level, but the collaboration that had probably already existed on a group level was reported to have become more visible in Plywood Plants, Roche, and Process Industries. In the third group, there was increased integration either on the group or organizational level, but in no case could this be attributed solely to the technology. The changes were reported to be more due to the particular implementation and appropriation processes (Eiger, Zeta), the parallel introduction of team structure (THC), or to changes in the context and the internal social structure (CCC).

While the conditional collaboration claim summarizes lessons that can be helpful in planning implementation projects in some situations, the evidence provided by the

case studies did not support the conditions nor the belief in the inherent collaborative model. Lotus Notes seemed to yield to a whole variety of uses in practice. Use of CIT is a rich and varied phenomenon, where the possible causal relationships seem to be very content and process specific. The whole process of CIT implementation and use, and the changes in the work and the organization, are emergent and mutually interacting, with a complex set of issues at play. The task thus seems to be to understand the relationship between CIT and a range of aspects of changing work practices in particular situations rather than to define the conditions under which CIT will make work collaborative.

Conclusions

So, what do the cases tell us about the relationship of CIT and patterns of work? What have we learned from the detailed look into these 17 cases?

First, if there is no “collaboration-inducing” inherent model in Lotus Notes, then what is special about it? How is it that in some cases it had indeed been used in such a way that collaborative work practices had emerged? Lotus Notes as a software package is very modifiable in practice—just compare the applications in HDB and SH with those at Eiger or Zeta—and even the same application can be used in a variety of ways (“technology-in-use,” Orlikowski 1995). Notes does contain capabilities that can ‘enable and constrain’ collaborative work practices, because it was designed to do that. If a technology is designed to support certain kinds of activities—for example, the door closer was designed to close a door (Latour 1992)—then of course it usually can do that, be it well or badly. Thus we can expect that Lotus Notes can support certain kinds of cooperative activities and, at least in some circumstances, that it will do just that. What needs to be kept in mind, however, is that only some patterns of use realize the “collaborative intent” of the designers (Orlikowski 1995). Collaboration is possible only when the collaborators know, to a degree, in some way, what the others are doing. Notes has the capabilities to help in this. The visibility of what others do is increased via the textualized work practices and explicit articulation of interaction (Schmidt 1997; Simone and Schmidt 1993; Zuboff 1988). That is, documents and messages and rules in the applications and such, written into Notes, “textualize” the work that is carried out with or by them. The whole interaction process is explicitly “articulated” in, for example, the threads of discussions, in the sequences and chains of messages.

Why is it, then, that these capabilities of Notes have not necessarily lead to collaboration, or for that matter, to any changes in work, even when change was sought? Ciborra (1996a, pp. 11-12) discusses this in terms of the kind of “care” that is taken in appropriation and adaptation processes. Use can be detached, that of a “thing,” specifically planned to fit in a particular work process, but not fully integrated to it. There were examples of this in the first and second groups of cases. This kind of care does not necessarily lead to any changes. The second type of care is practical problem solving and incremental learning, actual implementation and use in the local context, getting “feet wet and hands dirty” with the technology in making it work in the particular situation. Much of this was done, especially in the second and third group of cases. With this kind of care, changes in work or substantial support for existing work practices can be expected, and were reported in the cases. However, Ciborra discusses yet a further kind of care, that of understanding the technology, where the technology

becomes so intimately familiar, so intermingled with work activities, that it loses its separate status. This kind of full appropriation was discernible in CCC and in Zeta, where the focus was on the work practices, in changing (or keeping) them, and Notes appeared to be used in these as smoothly and effectively as, for example, the telephone.

How do these changes then take place? We can look at this mutual interacting of technology and users from a longitudinal perspective. While there were intentional uses and modifications of CIT, there also appeared to be unanticipated developments. These could have detrimental effects on use, as in Unilever, but they could also be consciously exploited, as Orlikowski (1996) has illustrated in discussing the planned and improvised changes in Zeta, or Wynn in describing the bricolage at Insurance. Ciborra (1996a) refers to this as “drifting.” Drifting brings attention to the unexpected, the unplanned, the surprises, and the unnoticed influences. Ngwenyama (1997) points out that the emergent nature of these change processes is exactly due to these improvisations, bricolage, and driftings.

Does this technology then influence the change process differently from some other technology? A major reason why drifting takes place and “understanding care” is possible is the “radical tailorability” (Malone, Lai, and Fry 1992) of the particular technology used. When compared with traditional information systems, the rate of modifications appears to be, at least in some cases, faster and the interaction between users and developers more immediate. What is seen is not so much periodic developments (Tyre and Orlikowski 1994), but constant adaptations and innovations, as described in detail by, for example, Orlikowski (1996) and Ngwenyama (1997). Also, the time perspective during which the usage patterns congealed seemed to be radically longer than the three to four months of use that Tyre and Orlikowski suggested.

What, then, is the role of CIT then in this emergent change? The repeated observation in the cases was that the technology, unless it was implemented in a very restricted and clear-cut way—i.e., HDB and SH excluded—was used as a “constructive tool” (Ciborra and Patriotta 1996) in reflecting upon the work practices. This can be attributed to the above-mentioned increased visibility, to the newness of the technology, to the possible poor alignment to the actual work practices, or to the considerable possibilities it had to impact work. The issue in all cases was that the technology was close to the users, even so close that the applications were developed in the department according to the users’ own specifications, and in many ways accessible as this constructive tool.

Are the change processes restricted to the work processes or do they have a wider influence? In some cases, it was reported how a stable pattern of use, the use volume, or the number of users influenced the methods of use, phenomena that have been recognized previously, for example, by Grudin (1989). Changes in work and technology were translated gradually to organizational level changes, as we saw, for example, with Eiger and CCC. An interesting area for further studies would be to revisit some of these case organizations and to find out more about the wider influence of these implementations. Also, the changes in the context were very influential, like recession in CCC, on local changes. All is intertwined, be it the context, the process, the technology, the design, use and modification processes, their length of time, or the work and organizational practices.

In summary, the issues that can be seen to influence the relationship between collaborative information technology and changes in organization and work include the

role of the specific capabilities of the technology, the difference between technology as a product and “technology-in-use,” the kind of “care” needed in bringing about desired changes, the emergent, “drifting” nature of the change process, the role of the technology as a “constructive tool” in the improvising and enacting the changes, the gradual translations of influences from work practices to organizational practices, and the intertwined nature of all aspects involved in the changes.

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