A Groupware's Life

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The paper describes a long-term study of a groupware application which covers the complete lifecycle from the groupware's introduction to its removal. During that time our field of application offered the opportunity to gain deep insights into personal, organizational and technical aspects of the groupware's usage. We focus on the late phases of a groupware's life, i.e. on the new aspect of groupware removal and the resulting requirements for groupware platforms. Additionally we contribute to the current discussion on organizational change processes which are initiated by the introduction of groupware.

Introduction

Groupware is more and more applied in different types of organizations. As a consequence of practical experience, the CSCW community has become increasingly aware of the intertwined relationship between groupware usage and the structure and culture of organizations (cf. Button and Sharrock 1997). The introduction of groupware is often related to processes of organizational change. From an economist's point of view the introduction and the change process can be measured by evaluating whether they improve the given work processes, increase the quality of the output or offer new options of future development. But looking at the case studies presented in the literature, we find success stories as well as major failures even when introducing the same kind of applications (cf. Lloyd and Whitehead 1996). The different experiences indicate that the way groupware is introduced and maintained in organizations is a crucial success factor. Describing

our experiences in the POLITeam project, we discuss how those organizational change processes can be stimulated. These processes lead to a beneficial assimilation of groupware technology in organizations. We also report on possible problems and obstacles for those processes.

Since groupware technology is rather new there are only few studies which have followed the organizational adaptation of these technologies over several years (cf. Orlikowski 1996, Karsten and Jones 1998). Such studies are important to judge on the role groupware can play in organizations Our study offered the opportunity to cover a complete lifecycle of a groupware application, from its introduction to its removal. Especially the removal phase with its problems has not yet been observed in field studies elsewhere and induced new requirements for groupware platforms.

We will first describe the research setting and methods. Then we take a closer look at the core work processes in our application field. Using the groupware lifecycle phases as a structure, we then describe the major experiences in the application field and finally analyze and discuss the results.

Research Setting and Method

The case study took place in the government of a Northern German state in the context of the POLITeam project (cf. Figure 1). In this contribution we focus on work processes connecting the State Chancellery (SC) (located in the state's capital)of that state and the State Representative Body (SRB) in the federal capital Bonn with the Bundesrat (The second chamber of the German parliament representing the different states).

In the SRB about 30 people were occupied representing the interest of their state within the process of federal legislation. The SRB belongs to the State Chancellery. Within the State Chancellery one organizational unit (a head and three employees) is responsible for the coordination of the different state ministries within the process of political decision finding. The SRB is responsible for transferring documents and distributing information between the state government and the
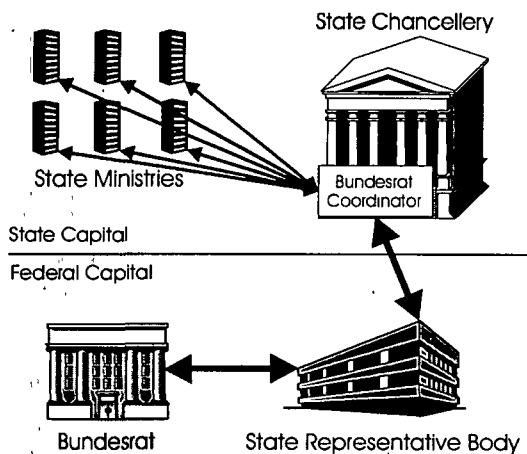

Figure 1. Organizations and Information Flow

Bundesrat. A detailed description of the related work processes will be given later.

Before the beginning of the POLITeam-project, employees of the state government were only partly equipped with computers. Network-PCs were mainly used by typists and secretaries. Thus, the SRB had no IT-department on its own, the IT-department associated with the SRB belonged to the State Chancellery in the state's capital, 700 kilometers away. When problems occurred they asked the IT-support of another state's Representative Body in the same building.

A groupware application based on LINKWORKS™ by Digital was introduced in the government administration of the state and its SRB in the federal capital Bonn. The functionality of the system offered support for shared workspaces, electronic circulation folders, e-mail including electronic document transport and related basic awareness services. The groupware based on a client/server architecture. An application programming interface allowed extensions of the groupware system.

The POLITeam project was a cooperative software development project in which the applying organizations required technical support for distributed cooperation. We developed the groupware application evolutionary according to the users' requirements. After the project was established in summer 1994, it started with a series of semi-structured interviews with nearly all potential users to learn about their work practice. The interviews resulted in textual scenarios describing typical work processes. Following this we tailored the LINKWORKS application according to the requirements found, and presented it to the users of the different organizational units in training workshops. By the end of 1994 the system was introduced. During the introduction phase users have been supported with daily site visits. Over the following four years of usage project members visited the different sites twice a month for a full day to provide individual support by visiting every user briefly. A telephone hotline was offered to the users. When necessary, we facilitated discussion groups in workshops where mainly organizational problems were discussed. Once a year we conducted interviews with selected users to ask about training and support, individual and collaborative work with the system, cooperation and usage of information, search facilities, awareness of others and conventions. The results presented in this paper are based on a collection of transcripts from user interviews, site visits, telephone hotline calls, and group discussions. Concerning POLITeam in the state government the authors were engaged in different roles: interviewer, facilitator of discussion groups and provider of system support.

Most of the published POLITeam papers, which are related to organizational aspects (eg. Mambrey et al 1996, Mark et al. 1997, Wulf 1997, Prinz et al. 1998), draw their cases from another application field: a federal ministry. As the industrial partner of the POLITeam consortium guided the project in the state government, originally less scientific attention was paid there.

Preparing a session of the Bundesrat

We will now describe the main work processes of the SRB in the federal capital as they were given in the beginning of the project. These processes represent the core activity of the organization. Other activities, as for example the organization of representational events or the writing of press releases, later also involved groupware usage (e.g. collaborative text writing), but will not be discussed here.

The main task of a SRB is the management of the information flow between the federal and the state capital concerning the legislation procedure in the Bundesrat. The Bundesrat meets every three weeks to discuss and vote on an agenda of about 80 different issues. The SRB and specific sections of the State Chancellery and the state ministries cooperate in determining the state's vote on each of those issues. As the state was governed by a coalition of two parties which were opposing each other on the federal level, the decision concerning the state's vote on an issue in the Bundesrat occasionally required complex negotiations. In that work context, we distinguish four different, but closely connected work processes.

The first work process we have named *Issue Distribution* is the distribution of information materials from the Bundesrat to the appropriate sections of the state government. The treatment of an issue began with printing the federal government's proposal in the print shop of the Bundesrat. It was sent via a courier service to the SRB. After the registrar had taken out some copies for internal use, the remaining ones had been sent by another courier to the State Chancellery. There, some more copies were taken out and sent via courier to the state's ministry of internal affairs. From there, couriers brought the documents to all other ministries involved in that issue. The document transport took three days. Any other transport of documents between the Bundesrat and the state government was going a similar way.

The second work process prepares the negotiation processes which leads to the state's vote. This one we call *Vote Preparation* (cf. Figure 2). Two weeks before the meeting of the Bundesrat its different commissions (e.g. commission for internal affairs) meet to discuss and vote on the different issues of the next agenda. An issue is typically worked on in several commissions. The state is represented in each commission by one employee of the SRB who typically is the head of the corresponding section in the SRB. After the meetings of the commissions a personal protocol including main discussion points and results of test voting was hand-written by each section head. They gave it to a secretary for typing, followed by further correcting and re-typing until the result was satisfactory. Then it was sent by fax to the corresponding state ministry. Besides, a secretary of the Bundesrat wrote an official protocol about each of the commissions' meetings and sent the paper document via the SRB to the corresponding state ministries. Within the commissions each state ministry acts independently by means of the corresponding section of the SRB. To coordinate

the different ministries' activites, which concern one issue of the agenda, the SRB had invented a coordination mechanism (cf. Schmidt and Simone 1996) based on a form sheet. It worked as follows:

For each issue one section of the SRB took the main responsibility (Issue leadership). The issue leader created a hand-written form sheet for each issue he was responsible for. He marked the issue and gave a rough political judgement. He added the result of the test voting in the commission of the Bundesrat, for which he was responsible. He wrote down the names of other sections of the SRB, whose commissions were also dealing with that issue leaving space for those sections to add comments and their commission's test vote. That "form sheet" was

Figure 2. Vote Preparation Process

typed and printed by a secretary, and re-checked by the issue leader. Then he carried it to the heads of the other sections involved to get their test vote results and further comments were integrated into the paper. With the section heads being absent quite often, this could take several attempts in each section. Finally, all the form sheets were given to one section head who was responsible for collecting them and transferred by fax to the section of the State Chancellery which was responsible for the coordination of the state's activities in the Bundesrat. The deadline for the arrival of the papers alway was the Tuesday of the week before the meeting of the Bundesrat, which frequently led to high time pressure in completing the papers. The Chancellery used the form sheets to get a survey on the political process so far and to recognize inconsistent activities of the different ministries.

The third work process (*Vote Negotiation*) mainly took place in the State Chancellery. The state's vote now was negotiated at government level. Having identified possible conflicts between different ministries, the employees of the State Chancellery contacted the conflicting ministries, identified the political dissent and tried to find a compromise. Inside each ministry, there was a section responsible for the coordination of the Bundesrat activities. To coordinate the negotiation process, those sections again had to contact sections responsible for certain special issues. The negotiations continued for the following days. In the State Chancellery the negotiation results were summarized for the state cabinet, which decided how to act on each agenda issue in a meeting three days before the session of the Bundesrat. The options have been to agree, to disagree, to abstain or to suggest a modification of the given issue proposal. The results were
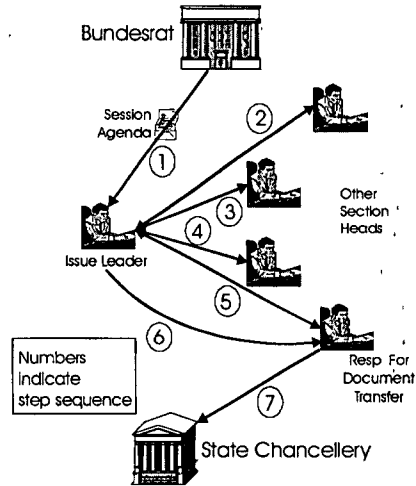
transmitted via fax to the SRB where they were used to prepare the Bundesrat session (negotiation with other states, additional test votes, etc.). If the cabinet decided to propose a modification concerning one of the issues on the agenda, it had to reach the Bundesrat two days before the meeting. These modification proposals have been formulated in one of the ministries, sent to the SRB to check formal correctness, approved by the State Chancellery and finally sent to the Bundesrat through the SRB by courier. This process had to be carried out within one day. During that phase the documents usually have been sent by fax, which led to frequent text retyping.

The forth process we call *Session Preparation*. The day before the meeting of the Bundesrat the modification proposals of the other states have been sent via the SRB to the State Chancellery and the ministries. The state government had to make up its mind on how to react upon the proposed modifications until the next morning . This means, that coordination task suffered from extreme time pressure as well.

The lifecycle of the POLITeam groupware

The term lifecycle is often related to an acknowledged model distinguishing more or less distinct phases, e.g. product lifecycle models in marketing (Kotler 1980) or the software lifecycle in software engineering (Sommerville 1989). We do not rely on such a model, because neither is there a model representing a groupware lifecycle, nor is there enough empirical basis to build one.

We only roughly distinguish the phases introduction, use and removal. The introduction phase covers the installation of the new technical tools, related qualification processes, analyses of the work processes, identification of processes which should be improved with the help of the new tools, etc. During the use phase the adaptation of the new technical infrastructure by the organization takes place. Technical fine-tuning, adjustment to new external developments, discovering and implementing organizational innovations, and minor qualification measures for new users are typical activities here. The removal phase begins with the decision to remove the groupware infrastructure or to change to another groupware product.

Our project started in late 1994. The introduction began in December 1994 and can - for the SRB - be considered as completed in March 1995. The subsequent use phase ended in September 1998, where the decision for the removal had been fixed. The groupware application had been de-installed by December 1998. We will now describe important organizational changes within these phases.

Introduction Phase

The SRB in Bonn got equipped with the hard- and software by the end of

1994. Due to problems with the hardware infrastructure the corresponding unit of the State Chancellery got equipped more than a year later.

As a result of the initial interviews and analyses two major problems became apparent:

- The transport of paper documents from the Bundesrat via the SRB to the state government was very time consuming.
- The typing of protocols and other documents by the secretaries was a bottleneck for the SRB's activities. As all the sections worked in the same rhythm, it created peaks in the work load of the secretaries causing a significant prolongation of processing time. Additionally, the quality of typing was judged to be rather bad.

The groupware application has been deployed among the secretaries, the registrar and those sections which wanted to be equipped with computer support. There was no organizational pressure on the staff members to participate in the introduction of IT. As the Bundesrat already provided most of its documents electronically via a X.400 message transfer system, we equipped the groupware with a X.400 interface at the registrar's workplace, which accelerated the reception of documents considerably.

We started to deploy the LINKWORKS and MICROSOFT OFFICE applications by means of a one day workshop where participants could explore system functionality guided by a trainer. The trainer focused on presenting the functionality he judged as being most important for supporting the work processes identified before. After the training, the systems were directly installed on the desks of the users. During the first week, members of the project team were permanently present in the SRB to answer questions and support system usage. Additionally, a hotline has been established during working hours and task-oriented handbooks have been provided for the users.

Use Phase

After the introduction project members visited the users about every second week. Users got additional training, got the possibility to ask about new functions and got support in solving technical problems. Moreover, it turned out that these visits were major occasions to coordinate cooperative work and to develop process innovations.

Task Shifts

The first effect of the groupware assimilation was a dramatic decrease of the workload for the typists. The users equipped with a computer started writing their texts on their own or gave them to the typists only for typing drafts and entered corrections on their own PC. Although most staff members were not able to type very fast, the elimination of correction-retyping-cycles and the faster document transport shortened the time for text production significantly. We started with

three full positions in the typing pool. After one and a half year of groupware usage, only one part-time position remained. Since typists left the SRB rather often due to bad payment, the decline of the typists' workload did not lead to active discharges. Positions which became vacant were not filled in again but were moved to other sections of the SRB. Similar effects have been observed in other application fields of POLITeam (cf. Wulf 1997).

Even the intense support offered by the project members was not enough. During everyday work many questions - mainly concerning the OFFICE products – occurred where immediate help was needed. Slowly one staff member, who showed more knowledge and interest for computer usage than others, took over the role of a local computer expert. Soon after the introduction his increasing workload concerning computer support impaired his regular work too much. It took a longer discussion with the organization's head until he finally got compensated by adding half a position of a secretary to his section.

Process Innovations

The work processes Issue Distribution, Vote Negotiation and Session Preparation within the SRB improved in two ways. First, since the process of document production was conducted by the users themselves, process speed as well as the quality of outputs improved (the latter due to less misunderstandings). Second, the use of electronic documents offered faster document transport and easier handling (e.g. copying) of document distribution. Especially the Issue Distribution process underwent slow but constant change over the four years since more and more external sources and documents were made electronically available by the cooperating organizations.

The work process Vote Preparation underwent more significant changes (cf. Figure 3). It also improved with the benefits described above, but the main improvement came with the parallelization of a sequential process part. Neither the project members, who have conducted the interviews with the users before introducing the system, nor the users themselves,
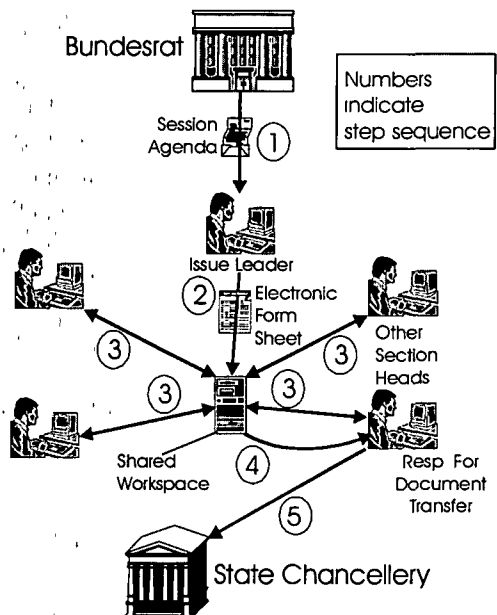

Figure 3: Vote Preperation revised

having been taught about the functionality of the application, directly recognized that potential for process innovation. During a site visit several months after the introduction, a project member and a section head discussed rather accidentally the stack of "form sheets" (see description of the Vote Preparation process) on the head's desk. They noticed that the process of filling out the "form sheets" could be supported by the object sharing feature of the groupware application. They involved other section managers to form an electronically supported procedure.

In that procedure the document template of the form sheet is stored in a public folder. The issue leader can copy it from there and fill it out for this issue of the agenda stating the commission's test voting results and further comments. Then a link to the document is sent via e-mail to all the other section managers being involved in that issue. The recipients can enter the vote of their section whenever they like. Because of the document-sharing, it is not necessary to maintain a temporal order, except that it is not possible for two users to have access to the same document at exactly the same time. After all sections, which had to contribute to an issue, had entered their votes and comments, the issue leader sent a link to the completed form sheet via e-mail to the section head responsible for transferring the documents to the State Chancellery. So, the shared workspace of the LinkWorks system allowed to overcome the sequential order to fill in votes immanent in the paper based version.

Groupware Distribution within the Organisation

At first, only those users who voluntarily agreed on groupware usage have been involved into the introduction process. The improvement of the Vote Preparation process described above boosted groupware usage among the section heads significantly. When the reorganized process had been implemented, the available workstations had to be redistributed among staff members according to the needs of that process innovation. The other staff members then got equipped by and by, according to the tight IT budget of the SRB.

Not all users who had the groupware installed actually used it. One of the section heads let the (remaining) secretary still type the forms for the Vote Preparation process for him and made her handling the data exchange. Since she only had a part-time position that slowed the process down. It took more than two years until he finally used the computer by himself. The head of the SRB was another example for a very reluctant attitude towards groupware usage. The major motivation for her to finally participate had not been to improve the work processes, but because she felt that a new field of activity had risen in "her" organization she was not involved in. Thus, other than peer pressure (cf. Grudin and Palen 1995), the desire to follow up what ones subordinates are doing can play a role in groupware adaptation.

Social Aspects

The organizational changes also altered social aspects of work life. While the

local expert in our example agreed to his new role, the typists did not welcome the task shifts. Due to that development the last remaining typist regarded her position as endangered. To make herself indispensable she began storing macros and document templates outside the groupware application in local directories. That caused breakdowns in collaboration when she was on vacation, and endangered system security when computer viruses spread around and only the server had been cleaned assuming that this would cover all infected files.

Other effects came from the improvement in the Vote Preparation process. Usually, when the section heads went around to collect the votes, they talked to each other about private as well as business issues. This has been a valuable occasion for informal communication. Although there were still opportunities for floor talks, some staff members missed those occasions.

Removal Phase

Near the end of the project, the situation in the application field did get complicated. The state's government had changed, so that there was quite some fluctuation among staff members. In the State Chancellery the members of the IT department developed plans for a new unified groupware application for all state government authorities. The SRB still favored LinkWorks as their infrastructure, which resulted in an intra-organizational conflict. Additionally, the groupware system with its handling and interface, and even more the underlying hardware infrastructure, had grown out of date.

In that situation the head of the SRB, the State Chancellery and its IT department failed to agree upon a joint strategy to maintain or further develop the groupware infrastructure. Approaching the end of the project, in October 1998 the IT department of the Chancellery decided to change to another groupware platform, because it already relied on the network products of this specific groupware's manufacturer. It soon became clear that it would take some months until the infrastructure change was possible. It was considered as being too dangerous to rely on an unsupported groupware infrastructure, and so the SRB decided to work with a temporary solution, based on the existing hardware as stand-alone-PCs. The option to map the shared workspaces of the groupware to the shared directory service of the operating system was rejected. Parts of the network hardware had been de-installed, and it was considered too difficult to establish necessary conventions (e.g. that computers offering shared directories should be always online) and the access rights seemed to be too complicated to be handled by ordinary users.

We now describe some issues concerning the groupware deinstallation process and the new work situation in the application field.

Technical Issues

The biggest technical problem to solve was to assure availability of the

documents stored in the groupware server's database and file system. A project member wrote a program based on the groupware's application programming interface to export the documents, but due to different naming conventions between the groupware (long filenames) and the operating system (filenames restricted to eight characters) this turned out to be a very time-consuming process. The users had to rename files with long names before a project member exported them. In case they had not prepared the export well, he had to rename them individually. After all, documents are now stored on the PC of their creators.

Difficulties with Metaphor Transfer

Several problems occurred concerning application usage. The groupware worked with office metaphors like "desk", "cabinet", "folder" or "document". Some users were not able to abstract from these container metaphors and had significant difficulties using ordinary directories as a means for structuring their documents. Navigation in directories was also considered as being more difficult. The groupware also knew the concept of "document patterns" to be reused e.g. for standard letters. With opening those patterns, the pattern was first copied, than the copy has been opened. With the ordinary file system it was now possible to overwrite a pattern accidentally with an instance of it.

Communication and Collaboration Breakdowns

The PC at the registrar still serves as the X.400-Gateway of the organization. But since the groupware's messaging system is missing now, all information has to be printed before it can be passed on to the relevant sections. This took considerably more time, and the gateway became a bottleneck for inter-organizational communication. The section for European politics for instance had established an intensive document exchange with colleagues from the Representative Bodies of other German states which she now was not able to sustain. Other staff members returned to the former practice of faxing documents. They heavily complained about busy lines and clumsy handling of documents. With the lacking document sharing functionality the need for text retyping occurred again, but now with significant less support by typists. Collaborative text production survived somehow; some users were now using floppy disks for document transfer, which proved to be a continuous source of mistakes and misunderstandings.

The Breakdown of Process Innovations

Since the groupware's messaging service was not available anymore, in almost all of the four processes the procedures changed drastically. The Vote Preparation process is now mainly paper based again. The issue leader creates the form sheet on his PC, prints out a sufficient number of copies and distributes them to the other sections. When the sheets return, she types the remarks of all of his colleagues into the final version, prints it and passes it on. This causes an extra burden upon those section heads who have many issue leaderships.

Since all extra-organizational electronic documents had to be printed now, the staff member at the X.400-Gateway was not able to handle the full workload anymore. Information flows had to prioritized, and finally the only process which remained at least in parts supported by electronic document transport was the Issue Distribution, since the incoming papers from the Bundesrat still are forwarded to the State Chancellery. In all other processes, documents are now transferred via fax again.

Results and Related Work

Referring to the experiences made we now point out issues we consider important for discussing the relation between groupware and organizational change. We also relate our findings to the ongoing discussions concerning organizational change.

The other topic we discuss are the experiences which relate to groupware removal, which up to now has not been discussed in the CSCW community. We show which problems we have to face there and what new requirements for groupware platforms arise.

Introduction Phase

The main lesson learnt from the introduction phase is the need to prepare users for active participation in the introduction process. Ploeger (1996) reports of a failed introduction project due to lacking user involvement. Summing up the results of 24 Lotus Notes case studies, Whitehead (1996) points out the importance of user involvement in applying tailoring or (re)developing groupware. This point is supported by a large body of work in the CSCW literature (cf. Schmidt 1991, Okamura et al. 1994, Bardram 1996, Hepsoe 1997). The focus and the extent of user involvement vary largely within the different case studies. One can distinguish between direct and indirect involvement. Turrel (1996) presents a rather indirect mode of involvement with the help of user forums where representatives of different organizational units meet to select new fields of application, to drive joint application development and to monitor the progress of certain applications. Within each single organizational unit involved, promoters have been selected to push the application of Lotus Notes. Nevertheless, the selection of fields of groupware application often happened top-down without involving the end users. This strategy caused severe problems, because "... the gap between the way people work and the way they are supposed to work is just too great and the system fails" (Turrel 1996, p. 43).

Our experiences indicate that there is a strong need to directly involve all potential users of groupware especially concerning three issues: First, for choosing and reorganizing the work processes to support, participation is

necessary since only the users know how they really work. Second, user participation is needed to configure and further develop the groupware's functionality reliably. Although the electronic circulation folders feature the groupware offered was judged as "interesting" on the management level, the majority of users never felt a need for that since processes had been simple enough to maintain an overview. And third, user participation was crucial for sustaining a high level of interest in the ongoing change process. Even after their working hours, staff members of the SRB voluntarily participated in the evaluation of three research prototypes based on LinkWorks and suggested new modes to apply the groupware system. The employees have been prepared and motivated for participation throughout the first workshops and initial interviews. Workshops, interviews and site visits also provided social platforms where new ideas have been generated and continuous reflection on the way the organization worked has been stimulated.

Use Phase

Our findings confirm the importance of observing and stimulating organizational change processes accompanying groupware introduction. An integrated and evolutionary view on technological and organizational change leads to a more theoretical discussion. So we relate our findings to Orlikowski and Hofmann's (1997) "Improvisational Model of Change Management". Additionally, we discuss appropriate manners to handle productivity gains and inter-individually different views on "successful" groupware introduction.

Supporting Organizational Change with Persistence

In the CSCW literature, there are only few long term studies describing how the adaptation of groupware changed over time. Orlikowski (1996) gives an interesting example on how a Lotus Notes application evolved in the customer support department of a software company over time. She analyses that this evolution had not been fully planned in advance but was the result of emergent and opportunistic changes. Considering their experiences Ciborra (1996) speaks in this sense about the "drifting of groupware technology". Karsten and Jones (1998) report in their 3-year-study of a consulting company on how groupware usage differed in quality as well as quantity depending on economic conditions, management styles and role shifts. The greatest extent of collaboration has been achieved at the end of the study period in a situation of an advantageous constellation of those parameters.

In POLITeam similar observations have been made. For instance, first the available groupware workstations have been distributed according to tasks (the typists, the registrar) and interests (other users). Work processes improved by faster document transport and newly evolving collaboration patterns evolved concerning text production. After the electronic form sheet for the Vote

Preparation had been invented, the tight budget did not allow the purchase of additional hardware, and so the existing computers had to be redistributed according to the requirements of the process innovation. Throughout the following two years little by little other users have been (re-)integrated into the groupware network and a sustainable culture of collaboration evolved.

In the beginning the major obstacles were knowledge and perspective gaps between users and designers (Mambrey and Pipek 1999). Users did not know about the options groupware systems offered, and designers were not confident with the work processes and the organizational culture. Although the members of the project team conducted extensive interviews with almost all users of the SRB, they did not realize the application of the shared workspace to improve the Vote Preparation. Additionally, new cooperation partners may get access to the application and the organization's task can change over time (cf. Philipps 1996, Orlikowski 1996). Since not everything can be foreseen or analyzed, the adaptation of groupware has to be seen as an evolutionary process, which has from an action research point of view implications for training, system support and software adaptation.

Integrated View on Organizational and Technological Development

In the literature one can roughly distinguish between two different approaches on how to introduce groupware. The first one, which we have named "technology first", focuses on the new technological options groupware offers. The decision makers in the organization - often from IT departments - decide to employ the groupware technology mainly to gain experiences with a technology which is regarded as being important for the organization's development. An example for this approach is the adaptation of electronic calendars in two major computer companies (cf. Grudin and Palen 1995; Palen 1997).

In the second "organization first" approach, organizational goals are dominant. Groupware technology is introduced to support organizational goals with adequate information and collaboration structures. An example is presented by Turrell (1996). He describes how groupware has been used following the decision to reorganize a multinational company around profit centers.

Our project had a "technology first" perspective. The initiative was taken by the middle management a to learn about groupware technology. In the beginning of the project organizational change was not intended by the promoters.

Our experience indicates that for the introduction of groupware an *integrated* view on organizational and technological development is helpful. Technology-induced task shifts and new emergent collaboration patterns change work culture and qualification requirements. On the one hand, organizational structures have to be adapted to reflect these developments. On the other hand, organizational changes may require modifications of the technical infrastructure and its configuration.

Supporting these findings are the cases of the invention of the new Vote

Preparation process (organization adapts to technology); the redistribution of PCs among section heads following that invention (technology adapts to organization); or the task shifts following the easier text production and the need for computer support (organization adapts to technology). Another example for "technology adapts to organization" emerged from the handling of document sharing. Sharing started when the document's owner sent a link to the document to another user and could only be ended by the recipient. With the invention of the Vote Preparation process, that behavior became unacceptable for the section head responsible for the document transfer to the State Chancellery. He was worried that other section heads might change the form sheet document after the deadline set for completion. The program had to be extended to allow document owners to end document sharing.

Lacking attention towards organizational and educational problems can lead to severe problems in "technology first" projects (e. g. Rogers 1994). Examples from our context are lacking attention to task shifts, e.g. the management's denial to provide a UNIX course for the local expert, and the events that led to the groupware's removal. So options for organizational development should be considered from the very beginning of any groupware introduction. On the technical side, the groupware applications should offer the highest degree of technical flexibility possible, e.g. through tailoring functionality.

Consensual Handling of Gains in Productivity

Successful adaptation of groupware tends to increase the productivity of labor. This may endanger jobs as long as there is no increase in an organization's output. As successful groupware adaptation requires the direct involvement of users, the paradoxical situation might arise that users are required to participate in the elimination of their own jobs. In the POLITeam project, insecure job perspectives and lacking trust led to organizational complications when the remaining secretary tried to secure her position by storing macros and document templates outside the groupware on her PC. So when establishing a groupware project it is important to actively address this issue. A contractual framework on how to handle gains in productivity is a way to cope with that problem.

Different Perspectives on the Outcome of Organizational Change.

Improvements could be seen concerning the speed of the work processes and the quality of their outcomes. Two patterns led to these changes: parallelization and document transport acceleration. All processes have been boosted by the opportunity to transport documents electronically. The parallelization of the Vote Preparation process saved two days of work according to a staff member. Part of the time saved was used to extend negotiations on some Bundesrat issues. This could have been considered a quality gain in the outcome of the process. But it has quite contrary been considered as an unnecessary complication by some users. Similarly, a section head doubted the usefulness of enabling all users involved in

Vote Preparation to directly access the Webserver of the Bundesrat, which provided relevant documents for all issues. He expected the decision finding to be more difficult when all ministries had access to all issues. In his eyes the existing time pressure eased decision making considerably. Additionally, intense Webserver usage would endanger his and the SRB's position as "information gateway" considerably. So, judgements on the quality of groupware-induced work process changes are far from equivocal. Even in cases where improvements are obvious, these improvement may be judged differently by the different actors (cf. Bowers 1994). This fact supports the argument of Blythin et al. (1997) that contrary to earlier expectations (e. g. Grudin 1988) successes or failures of groupware adaptations are difficult to measure. Additionally, this finding pleads for a pluralistic interpretation of Button and Sharrock (1997) who asked the CSCW community to "...develop measures to the value of proposed systems for organizations and users that trades on the entwined relationship between technology and organization" (p. 14). According to our experiences, such measures will not be valid in a universal sense but strongly biased by the role played by those who define them.

Organizational Change revisited

Orlikowski and Hofmann (1997) suggested a weak categorization of technology-induced change processes which could help in change management. Categories are whether a change has been anticipated or not and whether it is planned and introduced purposefully or not. "Anticipated changes" are those which have been anticipated and planned and introduced purposefully. "Opportunity-based" changes occur unanticipated but are then planned and transposed in an organized way. "Emergent changes" refer to changes which are unanticipated and emerge in a more chaotic way. This "Improvisational Model of Change Management" is based upon two assumptions. The first assumption is that "changes associated with technology implementations constitute an ongoing process rather than an event with an end point after which the organization can expect to return to a reasonably steady state." The second is that "... all ... organizational changes ... cannot, by definition, be anticipated ahead of time."

The model is confirmed by our experiences in its assumptions as well as in its categories. The first assumption was underlined by the changes the work practice in the SRB underwent. The process innovation in the Vote Preparation process serves as an example for the second assumption. In POLITeam we found anticipated changes in the acceleration of document transport and the task shift concerning text creation. The process improvement of the Vote Preparation is a case of an opportunity-based change, because it occurred unanticipated, but was planned and introduced purposefully afterwards. An emergent change showed in the emergence of collaborative document production, which has been unanticipated and unplanned.

But our findings also show that for the goal of the change management model

to help to "effectively respond to change" (Orlikowski and Hofmann 1997, p.14) that categorization might not be differentiated sufficiently. The shift concerning typing tasks, which moved from the typists to the section heads, who produced the texts now by themselves, was clearly anticipated and planned. But the full extent of work shift could not be anticipated for two reasons. First, it was impossible to estimate how much of the work load would shift from the typists to the section heads, because the writers didn't know by themselves, how much work would be acceptable to them. In fact, there have been huge individual differences concerning this. Second, the extent of the work shift that occurred was dependent on the time saving resulting from the improvement of the Vote Preparation process, which was an unanticipated change.

Removal Phase

Groupware removal is an issue not yet covered in field studies. In our case the removal mainly resulted from management failures, but the technical infrastructure has also been outdated. The desire to have a uniform, organization-wide infrastructure, the urge to unite different organizations' infrastructures, being discontent with the vendor's service or with the product itself might be other reasons that cause an organization to change its groupware infrastructure. Supporting the deinstallation process is a yet not considered requirement for groupware products.

Support for Groupware Deinstallation

Clearly, the documents stored in the groupware system have to be made available for the users appropriately. The export of documents out of the groupware with its client/server architecture into structures of the underlying operating system should be automated by the groupware as far as possible. This should include document export to all users which had read access to a document and automated copying of the workspace structures to (shared) directory structures. Additionally, the organizational structures (workflows, roles, workspace structures, etc.) mapped in the groupware system should be exportable as text or graphics for documentation and conservation. Findings from the tailorability discussion indicate, that users want new program versions to be equipped with the screen design and menu structures they are already used to (cf. Mackay 1990). Presumably informal knowledge like group conventions (document naming, storing strategies) or individual habits will have to be newly developed with the introduction of the new groupware platform. Support for usage documentation could ease the transition.

For the technical aspects it would also be helpful if an interoperability standard would evolve, similar to the one of the Workflow Management Coalition maintains for workflow management systems. Since groupware products are more flexible in its different functionalities this standard would have to be extensible.

Sustainability of new Patterns of Collaboration

Surprisingly collaboration patterns sustained even when the infrastructure which enabled them was taken away. Users now operated with floppy disks to transport documents. In the new Vote Preparation process the pattern of parallelization has sustained even though the process now is mainly paper-based again. Although our application field was comparatively collaboration-friendly even before POLITeam, these developments show that groupware can strengthen collaboration in organizations and have an impact on organizational culture even beyond its physical presence. This finding is similar to the observations of Karsten and Jones (1998).

Intertwined Relationship between Technology and Organization

How intertwined technological and organizational issues really are can be studied to its full extend when observing the removal of the technology. In our case the interorganizational communication was narrowed significantly and shifted to older media (fax), leading also to qualitative loss. The staff members had serious problems to readapt to the old procedures, and several breakdowns have been observed. Especially the typist had to face an unmanageable workload. Just as the introduction, the removal of groupware has to be seen as an evolutionary process. Organization-internal and -external expectations concerning process speed and quality have risen during groupware usage, but those standards could not be matched anymore. These experiences also support our pleading for an integrated view towards technological and organizational development.

Conclusion

The introduction of a groupware application into an organization is often related to processes of organizational change. In fact, the intertwined relationship between technological and organizational issues makes appropriately facilitated organizational change processes a crucial factor for the successful assimilation of groupware technology. Describing and discussing some experiences from our four-year-study of an application field of the POLITeam project as well as experiences from related studies we traced the question, how organizational change and technology introduction influence each other and what obstacles to establish collaboration there might be.

We found that users should be motivated and instructed for participation from the very beginning of groupware introduction. They have the knowledge which is necessary to find out what work processes will especially benefit from groupware support. It is also important to maintain an integrated view towards technological and organizational development especially regarding organizational and educational measures. A consensual handling of productivity gains is needed to ensure user participation throughout the lifecycle of the groupware. The fact, that

even obvious process improvements might be judged differently by different users which might be a possible source of conflict and distrust, adds to the problem.

Relating our experiences to Orlikowski's, and Hofmann's, Improvisational Model of Change we found it would have been well applicable in our case though it might have to be refined to appropriately serve its goals.

Since our study gave us the opportunity to cover the complete lifecycle of a groupware application, we also took a closer look on the process of groupware removal at the end of the lifecycle. Additional requirements arose from our observations such as technical support for deinstallation. Surprisingly, we found that collaboration patterns, initiated during the groupware usage phase, now tend to sustain even without the underlying groupware technology.

Surely the re-introduction of another groupware platform into that application field is something to observe. If we can rely on the personal relations established to key users over the four years, we will report on this ongoing process. So watch for 'A Groupware's Life: The sequel'.

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