Improving Continuous Improvement with CATeam: Lessons from a longitudinal case study

Barent, Volker; Krcmar, Helmut; Lewe, Henrik; Schwabe, Gerhardt

Universität Hohenheim, Lehrstuhl für Wirtschaftsinformatik (510H)
Postfach (P.O. Box) 700562, D-70593 Stuttgart, Germany
Tel. 49-711-459-3455
E-Mail: {barent, krcmar, lewe, schwabe} @ruhaixl.rz.uni-hohenheim.de

Abstract
Continuous improvement is a well known method for improving an organization step by step. This paper shows that with computer support even an improvement process can be improved. It presents a long-term study of GSS use in the Hohenheim Computer Aided Team (CATeam) room. Over two years the authors observed a natural group performing a continuous improvement process to improve their own work. The paper discusses four improvement meetings by combining case descriptions with analysis of the observed meetings. Chapters of this paper deal with anonymity, voting, managerial issues, organizational change and effects of the overall process on the group itself. Finally the authors conclude with some lessons on how to perform improvement meetings with computer support and give some basic success factors.

1. Introduction

Many experimental studies about the effects of computer support to the meeting process and the meeting outcome have been published [4], [7], [13], [14], [16]. Whereas these studies produce results with high internal validity, it is questionable, if these controlled experiments, mostly performed with student groups without any history of collaboration really capture the richness of natural organizational groups. Qualitative studies of Group Support Systems (GSS) use in natural settings are needed to capture the richness of group interaction with technology. They can paint an overall view of technology use, that the software designers and managers need. Qualitative studies serve as a basis and a check for quantitative empirical research. For these purposes particularly the observation of long-term technology use and adaptation is valuable. Also, they try to understand, not to evaluate, what was going on. The case study approach differs from ethnographic research in one important aspect: They are based on different premises [20]. The case study tries to

2. Methodology

In our study we used an ethnographic approach. This approach is widely used in the CSCW-research community (see e.g. several papers in [18] and [19]). In many aspects, ethnographic studies are like case studies. Bonoma [21] advocates the use of case study research in environments "where the existing body of knowledge is insufficient to permit the posing of causal questions, and when a phenomenon cannot be studied outside the context in which it naturally occurs" [21, p. 207]. Yin [20] advocates the case study approach when "how" and "why" are the leading research questions and when contemporary events are examined, but relevant behaviors cannot be manipulated. Case studies typically combine different data collection methods such as archives, interviews and questionnaires and the evidence may be qualitative or quantitative [22].

Ethnographic studies look at "work-in-practice". They have as a necessary requirement not to do laboratory studies but study work in progress of natural groups. Also, they try to understand, not to evaluate, what was going on. The case study approach differs from ethnographic research in one important aspect: They are based on different premises [20]. The case study tries to
define specific questions ahead of time and carry out fieldwork in a targeted fashion whereas the ethnographic approach seeks to gain a detailed picture of the real world and encourages fieldwork to continue for long periods of time in an unstructured manner [20]. Using case studies, researchers emulate logical positivism in developing rival hypotheses while researchers following the ethnographic approach challenge the logical positivist position by claiming that all evidence is relative and therefore cannot be independent of the investigator.

The case descriptions are based on observations of the meetings, notes on the meetings, interviews with meeting participants, statistical analyses of the meeting output and copies of all other meeting material. All meetings were observed by at least two researchers. After completion of this meeting series the results presented in this paper were distributed to the participants. There was widespread agreement with the observations and no participant objected. As some of the described observations are sensitive, the description of the setting had to be made anonymous.

As tool appropriation was a major topic for this study, interference from the Hohenheim support staff had to be minimized; the Hohenheim facilitator therefore brought only a minimum of technical support (e.g. starting the system, starting a tool). In correspondence with the ethnographic approach, the group's working process was influenced or prescribed by the observers as little as possible. Therefore this study cannot rival laboratory studies in terms of its procedural control and internal validity. We however believe that the depth of the observations and their external validity make this study worthwhile, particularly because we know very little about computer supported CI meetings in Germany up to now.

3. Continuous improvement

Today small steps of internal improvement inside an organisation become more and more important. Continuous improvement (CI) "means improvement of the status quo in little steps as results of ongoing efforts" [6]. There are three continuous improvement segments:

1. Management-oriented CI focuses on strategy and logistics. Typically it is implemented via project teams.
2. Group-oriented CI concentrates on working methods, working morale, participation and learning. It is put into action in small group meetings.
3. Person-oriented CI concentrates on self-fulfillment, improvements of the individual work environment and a CI-spirit [6]. A formal proposal process serves as its outlet.

Japanese experiences show that a group can generate a tremendous number of improvement ideas in a short time[6]. Research on computer support for meetings has shown that by introducing computers into meetings the amount of generated ideas can be multiplied [14]. This was reason enough for us to promote supporting the continuous improvement process and to observe a natural group to gain deeper insight into the relationship of continuous improvement meetings and computer support.

4. Cases and analysis

4.1. Background information

A research group of an organization in Germany had grown from 4 persons in the middle of 1990 to 10 persons in the beginning of 1992. As this growth had not been accompanied by a reorganization of the group's structure, a lot of tension had built up within the group. The tension was heightened by a looming relocation that affected each individual's private future plans. A growing need for release of tension came together with an interest to try out computer support for meetings. The manager of the group contacted a Hohenheim CA-Team Facilitator, who suggested to have a series of GroupSystems meetings in the Hohenheim CA-Team Room. As most of the group had an uneasy feeling that there was a definite need for an open discussion and an improvement of the group's collaboration it was quickly agreed that the group should meet for a one-day meeting. Meeting with GroupSystems was attractive for the participants, because it promised to protect their anonymity and it allowed for parallel input.

4.2. Kick-Off-Meeting Spring 1992

4.2.1. First day

4.2.1.1. Meeting Preparation

There was little preparation for the first meeting: The technical facilitator and the manager met once before the meeting. They decided to use GroupSystems in its typical sequence: First idea generation, then idea organizing and finally voting on the measure to be taken. Then they took some time to formulate the brainstorming question and came up with: "What can we do specifically to improve our group?".

4.2.1.2. EBS-Session

The group met in the Hohenheim CA-Team Meeting Room using the GSS (Group Support System) GroupSystems. After a brief introduction, the group started brainstorming with EBS. EBS models the original Brainstorming Idea by Osborn [15]. Initially all participants get one (computer-based) "sheet of paper" with the brainstorming question written on top. An additional sheet of paper is "placed in the middle". The participants are asked to write one idea regarding the brainstorming question. Then they took some time to formulate the brainstorming question and came up with: "What can we do specifically to improve our group?".

As collected by the GroupSystems statistical monitoring package.
In this session EBS was not primarily used to come up with creative ideas for improving the group. Instead the group used the enhanced communication facility to engage in several heated discussions heavily criticizing the manager. The manager had expected some criticism, but was taken by surprise by its fundamental nature and its quantity. Skimming the sheets, he tried to keep himself up to date on the discussions, asking for clarification and examples. He was able to solve some problems in the discussions, but after an hour of discussion he had to take a break. The 10 participants had generated 334 comments in 57 minutes. This is equivalent to a total of 26 DIN A4 pages of paper or more than two pages per person. Even if one counts that some lines were filled only with only a few words, the total amount of writing indicates intensive work by the group. After the brainstorming, a subgroup was selected to come up with categories for the comments, while the other group members took a break.

4.2.1.3. IO-Session
Half an hour later the group reassembled and began categorizing their comments with the Idea Organizer tool. The subgroup had ended up with 14 categories, some of which had subcategories. Because there was no way for the whole group to jointly categorize one comment after the other, each participant was given one electronic brainstorming sheet and was shown how to categorize the comments on his own. During the next 35 minutes of categorizing the group added additional seven categories. By categorizing the brainstorming comments in parallel, some structure was given to the output. Afterwards the group discussed the most important issues for an additional 45 minutes and dissolved.

4.2.1.4. Postmeeting Activities and Preparation of the Final Session
After the meeting, it took the manager a few days to "recover" from the meeting while the rest of the group was waiting for things to happen with a mixed feeling of relief and tension. In the meanwhile the manager had decided that he needed to act. He analyzed all the comments and came up with an extensive list of 38 measures to be taken.

4.2.2. Second day
4.2.2.1. Voting Session
The group met again two weeks later. The manager's measures' list took the group by surprise. After a general introduction to the group's mission he distributed the list to the participants. Then the group discussed and evaluated one measure after the other in a two-hour voting session. For each measure the group first decided, whether the measure was worthwhile. The group used a quick vote utility which gave an instantaneous feedback on the groups opinion on a public screen. After the group had decided, if the measure was worthwhile, an individual, a subgroup or the whole group was charged with implementing the measure. As the group became faster and faster with voting and deciding the manager became more and more enthusiastic about the working speed. At the end of the session, the manager was in high spirits and the group was overwhelmed.

4.2.2.2. Postmeeting Activities
After the session the manager distributed a list with all measures to be taken to the group. As a protocol, the manager had noted for each item who was responsible for fulfilling the measure.

4.3. Anonymity
Anonymity was crucial for the success of this continuous improvement meeting. Anonymity was the single most important feature for the participants. It allowed them to lead a very open and direct discussion, surfacing problems that had existed for quite a while. Anonymity removed status differences for the duration of the session (see also [17], [26], [27]). Lower status participants were not judged by their status, but by the value of their contribution. Higher status persons were not hindered by their status. As Krcmar et al. [8] and Schwabe [24] show, a high status may also hinder a participant contributing as he or she wants, because sometimes he or she does not want to put the thrust of their authority behind some vague idea. The manager learned to use the anonymity feature to test ideas that he did not want to put his authority behind, either because he was not sure on these ideas himself or because he wanted an open feedback.

Most of the participants where overwhelmed by the wealth of problems that were brought up and everyone (maybe initially except for the much criticized manager) was relieved, because he or she was finally able to voice his or her opinion. As for most of the voiced concerns there could be found a constructive solution even the manager learned to like the anonymous discussions in the course of the meetings. However, the influence of anonymity turned out to be more complicated than first expected. The group went through a learning process how to adapt the anonymity feature to their needs. Several problems handling anonymity surfaced already in the course of the brainstorming the issue of anonymity, if the feature was hindered; how to maintain task focus; how to avoid flaming and how to react to leaks in anonymity.

Whereas anonymity was beneficial for many contributions, it turned out to be hindering in those comments where the authorship was necessary to understand its meaning or implications. An obvious example are contributions by the group's manager. He had the authority to make decisions during the discussion. For example in the course of the brainstorming the issue of how to charge private telephone calls came up. Because

3 In a negative sense.
4 The questionnaire contained 107 items. For a discussion of the questionnaire see [23].
the problem was not very important (in comparison to other problems) the manager proposed a solution on the spot in writing. Knowing that a favorable solution has just been proposed by the manager made any further discussion unnecessary. Participants learned to identify their authorship just by putting initials behind their contribution.

Maintaining task focus was another problem. One can basically say that the group has not yet found any means to force people to stay focused. Just the opposite happened: In the first meeting the group more or less ignored the brainstorming question that asked them to look for solutions and they brought up any problem that came to their mind. If the problem looked interesting to the others, a new string of discussion was started and continued, until everything that deemed necessary had been said.

Flaming is a well-known problem in E-Mail [25]: Because the author of a comment does not see or sense the person he or she is writing to, people become much more outspoken and aggressive hurting other peoples' feelings. As there is no immediate check by the other persons reaction people allow any anger to grow in an uncontrolled way. There was more flaming in the anonymous brainstorming sessions than there is in oral conversations, but to the authors' impression not as much as it is known from E-Mail. The reason for the increased flaming may be the fact that the participants could still detach themselves from their comments by communicating via the computer and that there was no immediate feedback. The reason for the participants' hesitancy compared to E-Mail appears to be the fact that the criticized person is still in the same room. There were reactions to personal attacks and those reactions turned out to be sufficient to check flaming.

There is no absolute protection of anonymity, if people contribute in a computer supported meeting. The authorship can be traced back by technical means or by the content of a contribution. Technical leaks are mostly due to weaknesses of GroupSystems: The facilitator can see the participants' contribution as they are sent off, because copies of the contributions appear on his screen in the order they are sent away. There may also be means to reconstruct a person's contribution by looking to GroupSystems low-level internal data. One can trace back an author by the content of the contribution, if one knows the particular style, a person articulates his or her thoughts with: Some participants are known to write rather long comments, other participants are known to write rather short comments; some people have a known background-knowledge, interest or position that others do not have; some participants have typical spelling errors and so on.

If people use GroupSystems over a longer period of time, they learn the leaks to anonymity that exist in computer-supported meetings and they learn to deal with them. They react differently upon these leaks:

Some participants sensed danger and did not trust the protection of anonymity. They did not openly bring up their concerns in order to avoid possible consequences if their identity should be uncovered. Other participants strove to protect the anonymity of their critical comments by writing it from a different perspective, with a different wording or with artificial spelling errors in them. There were moments in the meetings when a sportive atmosphere came up, when some participants were openly trying to uncover others comments while the others had their fun hiding them in an increasingly sophisticated manner. A third group of participants openly ignored the leaks. They calculated: "Maybe somebody else can uncover that I made a given contribution. But the rules of the game are that this discussion is supposed to be anonymous. Therefore even if the other participant knows that I am the author he cannot make any open use of this information, because the rules of the session require him or her to behave as if he or she did not know.'

Although anonymity has leaks, it still fulfills its basic function for these participants: protection from (openly) being made personally responsible for criticism.

4.4. Summer meeting 1992

4.4.1. First day ("Voting CI Session")

4.4.1.1. Meeting preparation

This session started with a surprise for the whole team: Instead of doing EBS and IO the manager chose to evaluate 40 measures from the last session according to fulfillment up to the present (fulfilled/partly fulfilled/not fulfilled) and relevance for the future (remains relevant for future/needs to be discussed/stop). Some problem areas were addressed by questions like "How important is this problem at the time?". No discussions with the facilitator took place how to use GroupSystems in an appropriate way. Instead the manager decided to use the mood meter from GroupSystems and instructed the team. He had prepared a list with measures and conducted the voting tour by reading them to the team. In turns the group voted with the mood meter on the fulfillment of a measure and on the relevance for the future. The system displayed how many persons chose in what way and the mean value of the whole voting process.

During the session the group ran into trouble using the mood meter for continuous voting on 40 issues. Only the manager wrote down all results, so the team had no overview during the process. On one hand this offered the chance to vote on in a very efficient way, on the other
4.2.2. EBS Session

4.2.2.1. Meeting Preparation

The main reason for this session was an original CI idea. Even if there were no obvious reason for an improvement session, one should continue to offer places for such activities. Therefore little preparation for the meeting was needed.

4.2.2.2. EBS Session

It was a relaxed and good atmosphere on this CI meeting. Making a list of remarks demonstrated a clear need for further discussion outside the CI environment. The list of comments showed disagreement in the team concerning the degree to which these agreements were kept. The controversial opinions demonstrated a clear need for further discussion outside the CI environment.

4.4.2. Second day ("Computerized/Isolated CI"

The list of ideas was distributed among the team. NC 10 participants generated only 164 comments in approx. 4 minutes. In a normal discussion this would have never been possible in such a short period of time. The 10 comments dealing with this topic were generated in approx. 4 minutes. In a normal discussion this would have never been possible in such a short period of time.

4.4.2.3. Postmeeting Activities

The manager initiated an EBS on the question "What can be improved for discussion. Therefore little preparation for the meeting content took place.

4.5. Voting in CI Sessions

Voting was used in two ways for deriving tasks: Either the group mood meter was used to vote on the group mood meter or the group mood meter was used to vote on the mood meter opinion. The manager decided to discuss some of the topics that were derived after an EBS. In both tools the voting speed was very high. Irrespective of the team size voting speed was very high. Irrespective of the team size. One of the last measures was the voting session. Measures need to be discussed in the voting session.

4.5.1. Postmeeting activities

The results were distributed to the whole team. The manager that added a short summary of the topics from the voting session ensured that the voting session could be performed in the future and some new improvement measures. No further activities concerning this special point were not treated by the manager during EBS or later in discussions.

4.5.2. Computerized CI

The manager initiated an EBS on the question "Should we continue with computer support?". The manager decided to discuss some of the topics that were derived after an EBS. In both tools the voting speed was very high. Irrespective of the team size the voting speed was very high. Irrespective of the team size. One of the last measures was the voting session. Measures need to be discussed in the voting session.

4.5.3. Postmeeting activities

The list of ideas was distributed among the team. No further activities were observed.

4.5.4. Voting in Conventional Meetings

The manager initiated an EBS on the question "Should we continue with computer support?". The manager decided to discuss some of the topics that were derived after an EBS. In both tools the voting speed was very high. Irrespective of the team size the voting speed was very high. Irrespective of the team size. One of the last measures was the voting session. Measures need to be discussed in the voting session.

The list of ideas was distributed among the team. No further activities were observed.

4.6. Voting in CI Sessions

4.6.1. Postmeeting activities

The list of ideas was distributed among the team. No further activities were observed.

4.6.2. Voting in Conventional Meetings

The manager initiated an EBS on the question "Should we continue with computer support?". The manager decided to discuss some of the topics that were derived after an EBS. In both tools the voting speed was very high. Irrespective of the team size the voting speed was very high. Irrespective of the team size. One of the last measures was the voting session. Measures need to be discussed in the voting session.

The list of ideas was distributed among the team. No further activities were observed.
Some people voted tactically. The tried to anticipate a result and included the expected in their voting decision. If for example one expects that a special topic will be ranked by the group at a very high position, he could try to manipulate this by putting it on the last position. Since it is impossible to distinguish between 'political' and 'correct' votes, even if nobody knows, who voted in what way, this phenomenon is difficult to analyze. But the authors believe that voting in an electronic way supports political behavior.

To avoid some of these problems, the importance of the voting process (and competence in tool use as well) need to be increased. The number of measures should be kept as small as possible. Or one should split the list of measures into two groups according to their importance for the success. Finally electronic support offers the opportunity to vote in an asynchronous way. While political voting was known to the group, all results were accepted and no discussion was observed that tried to repeat a certain voting. The more the group got familiar with the mood meter, the more people wanted to use it. Especially in the last meeting participants called for this tool. Due to technical problems the mood meter wasn't available in all improvement meetings. In these cases the team performed no voting since all members were focused on computer support.

4.6. Third meeting: Routine-centered CI meeting Spring 1993

4.6.1. Meeting preparation

The third meeting was scheduled two months before it actually happened. It was planned to finish it within one day but a strict meeting agenda was not preplanned.

4.6.2. FRS session

The meeting started with a 45 minute review of the goals presented in the CI meeting one year ago. The new goals for the next year were presented then for review by the work group members.

In the next two hours of the morning session the group brainstorming on the same well-known brainstorming question as in previous CI meetings. 200 comments were generated. On average approximately 15 comments per person were made. The maximum number of comments was 31 and one person made only two comments. A high number of "read only" accesses to the different brainstorming idea lists were monitored. Anonymity was removed from comments by adding initials of the author in five percent of the contributions. Ideas were often referenced.

4.6.3. IO session

Because the group was unhappy with prior parallel categorization they organized the brainstorming

This time a fourth follow-up CI meeting was an undisputed thing to come and an approximate date set. Participants were so fatigued that they cancelled the plan to meet in a bar afterwards. A summary of the meeting results was prepared by the manager and distributed among the group members within two weeks. For more long-term oriented future planning extra meetings with CI meeting character of one and a half hour on the organizational unit's primary task and reason for existence were planned on two dates until the next CI meeting.

4.7. Managerial issues

A key person in the CI process was the team manager. This chapter summarizes the manager's impressions and interpretations. It was written in close cooperation with the manager.

From a managerial aspect the introduction of meeting technology such as GroupSystems into a continuous improvement process presents a number of obvious and more subtle issues. We will first look at the sequences of meetings from that perspective in hindsight and then pinpoint some issues, that need to be considered.

In hindsight, the first meeting was started with a rather naive perspective, namely "to do continuous improvement". The interaction between technology and group process, especially the importance and effects of anonymity, the issues of time and the task orientation as
well as the complexities of the improvement process were not foreseen. The first meeting had the function of opening a large number of issues. Some of these issues and even more the web of issues had been surprising for the manager. In the words of the manager: "From each individual’s point of view the issues might have been known. Yet the frankness, the overall impression came as a surprise to me. I did neither anticipate the content nor the structure of the issues mentioned as a whole. It then became very hard to react to the statements as this was unknown and therefore was difficult to keep the process managed. That is why I took a 'time Out'."

The second and third meeting were initiated with a strong technology perspective. It was intended to use more of GroupSystem's functionality in various phases of the improvement process. The description of the cases shows that the group dynamic aspects of the improvement process as such were not really taken into consideration; therefore the meeting as such was broken into various, loosely connected phases. This tayloristic approach to the improvements process presented itself as an own management problem: that of focusing attention, preserving motivation and keeping momentum. In all three aspects the meetings two and three were not seen as perfect. The fourth meeting then was not just occurring. As the manager explained: "I had sensed, that motivation and momentum were weakening. I started to interpret the meetings as structured episodic events in the ongoing organisation and reorganisation of my department. I also realised, that careful planning and preparation could help."

Therefore care was taken to prepare the third meeting from the technology usage and from the group dynamic side. Possible changes that could come up during the meeting were discussed in advance. It turned out that some changes have already been discussed widely; the meeting turned out to surface them. A whole day was reserved well in advance. This reservation was used to highlight the organisation's awareness that this episode would take place. At the same time a full day was reserved to have enough time to conclude the process and close the episode without leaving to many open issues. Still, there were open issues that could not be dealt with during the day; proposals for action were proposed shortly after and a protocol was delivered at the same time.

From an managerial point of view using GroupSystems in continuous improvement has various impacts. The evaluation partly depends on whether explicit debate about conflicts is valued positively. The possibility for managers to obtain unfiltered comments from the organisation, where the "agent" tells its "principal" anonymously and without possible retaliation what is on his/her mind, can be seen as a major improvement, especially if looked at from a participatory management style. The open discussion can help to identify issues and will allow the different members of the group and team to really tackle those, if wished. Also, anonymity plays a role in the other direction of the hierarchy. It becomes possible from a managerial purpose to test ideas, to find out whether the team members are 'ready' or not. "To be able to have your own ideas as a manager discussed as "normal" ideas, gives much better feedback. It allows to better gauge, whether a certain corridor of action will be done, whether group members are really committed or truly against it."

If frank and open discussions are not appreciated, if certain issues are lurking and still are not supposed to show up, then anonymity as well as the use of technology make it hard to control the process. Due to the parallel work, a group manager cannot simultaneously react to all comments. Therefore the timing of the different brainstorming and consensus phases becomes a major issue, also for the content steering, if possible at all, of the group. It should also be noted that a different style for leading groups becomes necessary. The job of manager as a moderator, not necessarily as the dominating manager becomes obvious. However it presents problems, if this moderating role is interpreted as a not leading, hierarchical one.

Also other elements of the overall management system, such as use of words and symbols, rewards, sanctions, and hierarchical distances play a major role. In this instance there exists a relatively high hierarchical distance and a different timing of interest for the different members of the organisation. Whereas the manager stays with the institution for a long time, the individual team members usually leave the institution after some years. Therefore an improvement process is certainly influenced by the conflicts of interest in the relevant group.

For managers continuous improvement processes are difficult to lead as such. Even without technology they present learning needs for managers as well as for all other team members. GroupSystems open new issues (that of frank mentioning of issues). Managers need not only to understand the group dynamics of the continuous improvement process, they also need to take the technology effects into account.

4.8. Fourth meeting: CI Meeting centered around political issues Fall 1993

4.8.1. Preparation

The exact date for fourth CI meeting was again scheduled long before it actually happened (two months). The chance was taken to preplan it carefully. The CI meeting was planned for one day with hardly any chance to separate out parts of it to a later date as it happened in former CI meetings.
4.8.2. Voting session

A new procedure on how to perform a CI meeting was developed based on past experiences and better tuning of the CI meeting process to the GroupSystems tools. The CI meeting started with two votings on all measures from earlier CI meetings. The participants received the list a day before the CI meeting. All in all there were 40 measures which were rated by agreement or disagreement concerning their fulfillment in the past first and concerning their need for future consideration second. Ratings were performed on all measures at once, before results were presented. The results of the vote were discussed briefly and analyzed concerning important prospective measures that were not fulfilled in the past and measures with high disagreement by the raters. Less than 60 minutes were used for the voting process and it was highly efficient especially compared to the multiple mood meter votes used for measure review in former meetings.

4.8.3. EBS session

After the review of the measures another brainstorming session on what needed improvement started. With a total of 255 comments and more than 23 comments per person it was quite productive brainstorming. Only the first CI meeting brought forward more comments. Read only access to brainstorming cards was lowest but signed comments reached their maximum with 10 percent of all comments.

4.8.4. IO session

After brainstorming a break was used to obtain copies of the print out for everybody and to let three members of the group pre-categorize the comments. The group then split into subgroups of two persons each. Each of the subgroups was assigned the task to categorize certain parts of the brainstorming result, thus speeding up the categorization process by parallel work. Eighteen distinct areas for improvement were identified this way. Previous meetings had shown that only the first categories were thoroughly discussed as the group became increasingly tired. Therefore the group voted on the order of items to discuss. Since only one day was available for the CI meeting the first issues on the list were about to be discussed only. Measures to improve the current situation could jointly be developed for these important issues alone. Discussions and measure development were continued until all important issues were discussed.

4.8.5. Postmeeting activities

The manager announced to provide a summary of the meeting results and a list with the measures already agreed upon. For the remaining issues not yet discussed he announced to develop measures on his own. This way a set of 22 measures was generated to improve the work situation. As in previous meetings most of the measures were formulated as tasks. All or certain work group members were assigned to it and all measures were provided with a deadline. In the next general meeting of the group the manager went through the list of measures and interpreted a missing disagreement as consensus of approval of a measure. Only minor changes of the measures appeared.

4.9. Organizational Change

Organizations change permanently to adjust to a changing environment. CI initiates changes and can be the response to changes. Many changes in organizations happen unintended, by chance or without notice, while others are carefully planned. A well-known strategy how to introduce changes is to "unfreeze" the organization and make it open to changes, then to "move" this organization thus introducing the new concept for the organization with regard to e.g. structures, tasks, technology and personnel, and finally to "refreeze" it to recover stability afterwards [12]. This process often is accompanied by a change agent. General goals of organizational change are higher performance of the whole organization, better integration of structures, tasks, technology and personnel, participation of those affected by the change, to strengthen confidence and often to provide for a perspective of self development for the employees [5].

In the case observed each CI meeting and the whole CI process were accompanied by many organizational changes. In the first CI meeting change for the organization resulted from creating a forum allowing for mutual openness between the organization's members concerning needs for change with the help of technology. Furthermore, by reducing status influence and insights in controversies it enabled a better integration of junior personnel into the group. As the group had learned from the first meeting that many small obstacles in their organization needed improvement by providing a clear policy how to deal with them, the second meeting shifted with its focus from collecting improvement suggestions towards direct improvement-task and -project planning activities. More continuous engagement in CI marked the development experienced after the third CI meeting. Several additional meetings on selected improvement issues and some interdependence with the weekly or biweekly coordination meetings of the group were established. The fourth CI meeting primarily introduced changes in management structure while the group continued to initiate suggestions for change. The smooth introduction of a new management level as a major organizational change was enabled by waiting for the right time to present it as the solution to problems. The introduction of the new management structure was planned for the very end of the CI meeting to avoid that
its announcement would superimpose all other conversations. Still much time was left for a discussion of its consequences. Probably brainstorming made everybody open for changes since the need for such a change became obvious to everybody during brainstorming and consequences were acceptable at first sight. So the CI meeting was a suitable platform to provide for a better tolerance of the major organizational change.

While the amount of organizational change experienced during CI was large in and after the first CI meeting, consolidation of organizational change activities marked the second CI meeting. The joint review of organizational change measures as experienced in the follow-up meetings of the initial CI meeting is indispensable to jointly supervise actual achievements. Once a group starts with CI meeting it cannot stop. The group must continuously meet to provide for continuity in organizational development. By the fourth biannual meeting CI has become an element of the organization. The CI meeting had gained importance since attendance is important. Reactions to the organizational changes necessary for improvement as experienced by the group members decreased with each CI meeting. The group members were better prepared and consequences were seen less dramatic. Although the CI meetings have helped the group to initiate, introduce and deal with organizational changes there still is a potential to increase general satisfaction with the CI meeting and the organizational change processes in the future. Although it is not easy for CI participants to learn their roles in CI, the group realized that twice a year there is an outlet for improvement ideas and a chance to collectively get a feedback on the group's situation.

4.10. Learning how to perform CI meetings

According to this study anonymity, voting, managerial issues and the need for organizational change have been identified as key factors to allow for successful CI meetings. The following table summarizes the findings:

<table>
<thead>
<tr>
<th>Anonymity</th>
<th>The role of anonymity changes over time of the group development process.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voting</td>
<td>Use computerised voting for fast decisions on measures if not political. Even with computerised voting limit the number of decisions.</td>
</tr>
<tr>
<td>Managerial issues</td>
<td>Take into account that the manager is the target of personal offenses. He looses control in electronic communications but by anonymity gets better insights into the group's status.</td>
</tr>
<tr>
<td>Organizational change</td>
<td>CI meetings initiate and must be accompanied by organizational change. CI must be a planned and repeated action in an organizational change process.</td>
</tr>
</tbody>
</table>

Tab. 1: Lessons learned on CI meetings

One apparent prerequisite for a successfully pre-planned CI meeting is the advanced fixing of dates for the CI meeting so that everybody can attend, the manager reserves time and the meeting can start on time. This emphasizes the importance of the CI meeting and allows for participation of the entire team. Furthermore, this ensures that the CATeam room with its computerized meeting support could be properly set up in advance. As this room is separate from the organization's offices the CI meeting place allows for retreat with no interruptions from telephone calls and other disturbances. Plans for finishing a strenuous CI meeting day in a bar afterwards, thus restoring interpersonal communication and relations in-depth after having used the computer for communication seem to be a worthwhile add-on to CI meetings. But it was not observed in this group.

When planning for the length of time of the CI meeting it should be avoided that only parts of the topics can be discussed and the rest needs to be postponed for a follow-up meeting. The sequence of discussing the improvement issues becomes critical then, since only some topics can be debated at once while others need to be postponed to a later date. The disadvantage of postponement was that issues weren't presently in the minds of the meeting participants in the follow-up meeting. Meeting protocols help to remember. An advantage is that it provides more time for the manager and the team to consider appropriate consequences. By the third CI meeting it was intended to handle the CI process on one day completely, thus eliminating the need for postponement of certain issues. Everybody allocated time to attend until the late evening. Still it was not possible to discuss all issues and the remaining issues were converted into measures by the team manager alone until the next general meeting. In the fourth meeting rank ordering helped the group to democratically determine the sequence of issue treatment.

CI meetings have been planned with more or less flexible agendas. While the agenda for the first meeting was quite structured in the beginning with a plan about the use of GroupSystems tools and a pre-defined brainstorming question, this plan had to be modified after the very first session. The agenda was more vague in the second CI meeting, although it was clear to everyone in meetings after the first one that the computer would be used to anonymously brainstorm on things to improve, since it has been successfully applied before, then to cluster the issues and maybe to vote on the issues. By the third meeting it already had some routine character to incorporate this procedure in the CI meeting, but adaptations of GroupSystems tools usage caused some changes in this standard agenda. e.g. the start with voting instead brainstorming. Breaks were provided not only to provide relief and print outs of the session results but to
have selected members of the team pre-determine some categories for organizing issues after brainstorming. Measures especially task development, approval and assignment were highly efficient. After the third meeting most participants were already familiar with GroupSystems. CI meeting participants were in better shape to make good use of the system and to introduce their political interests in brainstorming. Much more than in CI meetings before colleagues criticized each other. The manager was less criticized. Selfish interests were much more a starting point and basis for argumentation in the comments. The participants learnt to use CI as a political instrument to initiate improvements vertically to the organizational roster and to initiate improvement horizontally to it, too. But finally, everything was under control by the group manager. Technically the last CI meeting was the most advanced meeting, in which a variety of GroupSystems tools were used in a sophisticated manner.

5. Summary

Based on our observations the authors conclude that CI, supported with CATeam is a way of getting quicker access to the advantages of improvement processes in companies. Anonymity is a way to allow for improvement issues to surface. Voting enables to quickly agree on a large number of improvement measures. Computer supported CI calls for an alert manager regarding his participation in improvement processes. If a team learns to perform CI effectively, technology speeds up the whole improvement process. The analyses paints integrating technology in the improvement process as a rather dynamic learning process. This learning concerns the adaptation to the improvement process as such on the individual and organisational level. It is also concerned with how technology could be used best.

The physical context of computer supported CI should not be underestimated. To reach a high degree of acceptance of CI activities among the persons involved, computer support needs to be combined with activities 'outside' technological driven meetings. Management has to take care of the acceptance of the overall CI process as well as of the computer usage during meetings. CATeam supported CI is more complex than normal CI activities. However, the obtained results indicate the need for further investigations and for a rather positive evaluation of the CATeam-technology intervention into the CI process.

6. Literature