GroupVideo - Distributed EMS for Small Groups

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Abstract
Globalization and networking will change managers work radically. The rapid rise of business travel costs and a need for quick distributed decision making, make organizations to seek new ways of working. Changing old communication and decision making habits is not easy.

Groupvideo (GV) project sought answers and questions related to implementing distributed EMS [6] in different organizational settings. Article describes the social, technological and procedural changes that has to go through when using videoconferencing and computer conferencing as a new media for distributed decision making and communication. The paper shows some hard figures as an example, what are the costs and benefits of using EMS in Finland.
Keywords: CSCW, multimedia, EMS, groupware, remote meetings

1. Introduction

Over the past years research on computer supported cooperative work (CSCW) [16], [2], [1] has profilerated. Technologies that support group work in meetings are defined as one of the key aspects to improve the efficiency and effectiveness of the organizations [18], [5], [4], [10]. In 1990s distributed meeting technologies become a necessity, because dispersed organizations operate more globally with dispersed groups and turbulent business environment demand rapid response. Organizations will cut expenses and their reaction time.

A vast majority of electronic meeting system research has been carried out in laboratory settings [19] and it has ignored the real world constraints (tight budgets, no one shot meetings, varying personal commitment etc.) [14], [15]. Our work attempted to build a realistic picture of how dispersed meetings could operate in business settings. The GroupVideo (GV) research project reported here forms a part of a larger research project to study groupware design, adoption and usage in real organizations.

During the years 1991 and 1992 a computer supported meeting system prototype was built [14], [15]. The project succeeded and the prototype was installed in the VTKK in Espoo, Finland. Soon after the adoption of the prototype, a need was perceived to connect meeting rooms that were geographically distant. The aim of this project was to develop a distributed electronic meeting system (EMS) [6], which incorporates meeting support software, audio and full-motion video to support geographically distributed meetings.

The study seeks to find answers to the following questions. What kind of groups are suitable for distributed meetings? Group size and task were seen as important factors affecting to the need and usability of distributed EMS [18]. Does the type of organization affect to the use? What are the preconditions (technical, ergonomic) of use? How does the dispersed meeting differ from face-to-face meeting? What are the costs and benefits of the system?

It is important to deepen by knowledge of the group work [18] and to understand the long-term effects of using hybrid EMS systems in dispersed settings. EMS is a hybrid medium that exhibits some aspects of lean media, such as computer conference and e-mail, and some aspects of rich media, such as group meetings [3]. The purpose is also to find the problem areas of the group work and try to find solutions for those problems and develop better tools to support distributed meetings in the future.

According to Pinsonneault and Kraemer [19] several electronic meeting systems are supporting the communication processes of the group, not only the decision making. They divide the computer support for Group Decision Support Systems (GDSS) and Group Communication Support Systems (GCSS). The nature of the GroupVideo project is more communicative, because we are adding a new medium for supporting the dispersed group interaction - videoconferencing. And there is a new dimension when planning and scheduling meetings. Traditionally we have to agree *where* and *when* we have the meeting, now we have to think also, *how* we are going to meet (face-to-face, video-, audio- or computerconferencing). The new participants (e.g. facilitator and extra meeting room) will make meeting scheduling more difficult.

The second section describes the research questions and methodology. In the third section we describe the procedures and organizations participating to the project. The next sections tells our experiences of how personal, group and organizational characteristics affects the use. In the chapter seven we portray the technical preconditions for use. Next we describe the meeting practices that we found important and section nine tells the costs and benefits of our prototype system. The conclusions are in the end.

2. Research questions and methodology

In implementation research the personal factors and technical characteristics are found important factors in successful implementation of the information systems [13]. Because the technical characteristics affect the clients' attitudes toward the system, we were interested in what kind of technical features are important, acceptable and desirable.

The research method was case study research. The reasons that lead to this methodological choice were natural. Using the survey was not applicable, because there were no companies in Finland using distributed EMS in their same time - different place meetings. Experiments with control groups and different treatments are not acceptable in real work environments. However, the different organizations formed a kind of natural variation in context.
The data for analysing was gathered using triangulation as a rationale for multiple sources of evidence [22].
The results are gathered from observations, meeting logs, other archival records, questionnaires and over twenty broad open-ended interviews, that were held before the pilot test and from more focused interviews after the pilot testing phase in pilot companies. In pre-pilot interviews we collected the requirements for a system from the potential users who were selected among the employees of the corporations according to intense travelling or because they were working in dispersed project teams (the communication charts were created and extended while the research went on). Post-pilot interviewees were actively involved in pilot testing phase and the questions ranged from the feelings of the pilot system to the improvements that should be made. All the interviews were taped and transcripted. We also followed the meetings when the pilot groups allowed it.

There are at least six questions that the GV project addresses. First, what personal attitudes affects to the use. The common effects of the GV system are the decrease in travel (effects on environment) and the increase of versatility and effectiveness of the group work. This will reduce the fragmentation of the working time and ease time management. But interviewees attitudes towards decreasing of travelling, for example, varied a lot and some participants did not see it as an improvement in their work.

What kind of groups the GV system can support efficiently, i.e. when it best facilitates the group. Questions like teambuilding phase of the group, tasks that groups had to accomplish, types of previous interaction between the group members and the size of the group were seen as important factors when introducing new modes of communication and decision making [10], [18].

Third, does the type of organization affect to the use. This is related to previous questions about groups. What is the attitude towards information technology in an organization? What are the abilities of an organization members to use sophisticated information technology and how the upper level management was used to utilize latest information technology?

The network infrastructure in Finland is on a high level that it supports technical experiments with different kinds of network configurations. GroupVideo systems are LAN-based, but we tried also ISDN-based videoconferencing and combining audioconferencing with modem based meeting system software. In the future ATM technologies provide more efficient opportunities to utilize existing infrastructure. The fourth question was, what are the minimum physical and ergonomic requirements of the GV -system to fulfill the users' needs. What were the important technological features according to users and what kind of technical improvements were needed.

The fifth question was, how do the new tools and the new

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technology change the behavior in meetings and how can those changes be taken into consideration when developing better tools for supporting meeting participants.

Organizations base their decisions and judgments about usefulness of the systems often to financial impacts of the system. So the last question was, what were the financial effects of the system for the organization/s and how large those effects can be.

The findings reported here are exploratory in their nature and further research using different methods will be needed to make results more generalizable.

3. What happened?

There were three pilot companies who took part to the study. One organization was a software house and IT vendor (ITV). They have many dispersed projects going on and the project teams needed more communication support. The organization had gone through extensive reengineering during the last years and the shape of the organization had changed dramatically.

The second organization was a telecarrier company (TCC) with dispersed project teams, comparatively small software projects and typically 2 to 3 member project teams. The shape of the organization was largely affected during the last years because of the intensive reengineering.

The third company was a machine maker company (MMC) with large installation and maintenance projects. They operate internationally, had less experience of information technology than ITV and TCC and the organizational structure was more rigid than the other two companies. The ITV was the leader of the GroupVideo (GV) project and responsible for installing the group support software, GroupSystems V™, to the pilot companies. The TCC company, as a specialist of audio and video communication, was responsible for implementing data transfer. The MMC was interested in decreasing the costs of their meeting travel and the time spent in meetings and a videoconference environment for the company was recommended as a substitution. All three companies were pilot companies when observing the use of the system, but MMC company decided to use only videoconferencing.

The project plan was divided into three main parts: *planning, construction and evaluation*. The first part, planning, was due by the end of the year. Construction was finished in December. The third part, pilot testing and evaluation, was finished by the end of March.

As a first step, we identified the most important features of the product concept and analyzed its underlying assumptions. The second step included specifying the requirements for the equipment (video, audio, data), clarifying the security needs of the data and determining the data transmission protocols (speed, routes, etc.) The general plan of their meeting room technical setup is representative as in what kind of environments we were working (picture 1.)

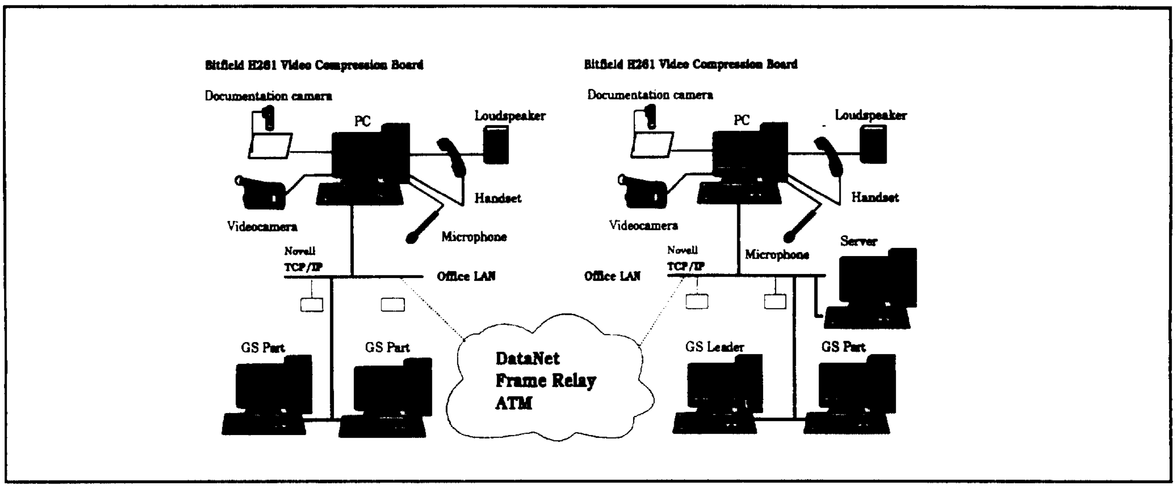

Figure 1 The technical plan of the GroupVideo system.

The goal of the construction part was to deliver and install the devices and software. We constructed a test environment and executed a number technical tests. As a result we installed an operational conference rooms with data, voice and video links. In the IT vendor company a distributed conference environment is operating between Espoo and Jyväskylä (200 miles distance). In Espoo there are up to 17 workstations (picture 2) and in Jyväskylä usually three workstations.

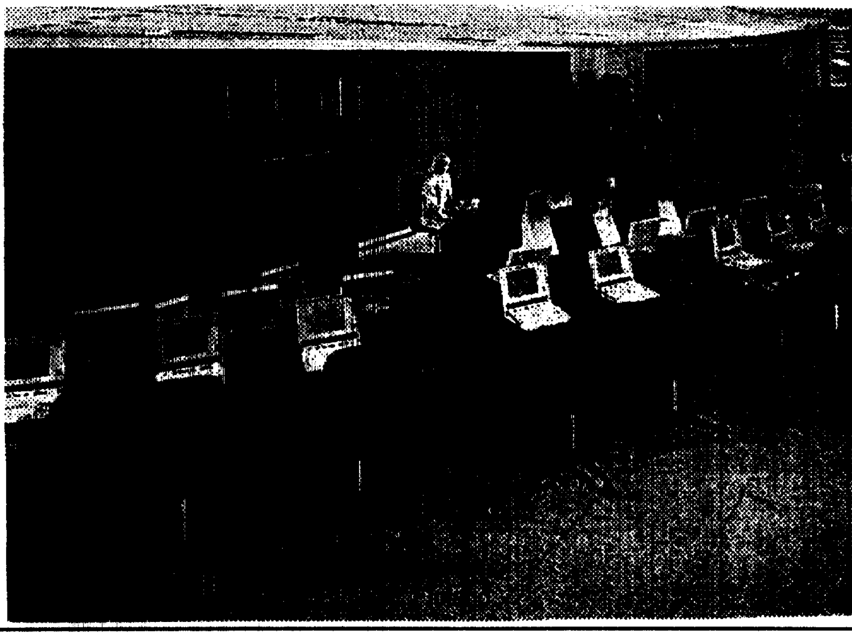

Figure 2 A view of the Helsinki meeting room.

The Helsinki Room (in Espoo) was designed for face-to-face meetings, but some technical aspects to support remote meetings were included in room design. The seating and public screen arrangements, the location and the type of the camera used, had remarkable effects for the hearing and seeing conditions. In the TCC, conference rooms were located in Helsinki and Lappeenranta (appr. 100 miles) in normal meeting rooms and there are three workstations in both ends.

We also constructed videoconference linkages between Jyväskylä, Helsinki and Charlotte, (North-Carolina, USA) in the MMC.

The construction was demanding, because we built the videosystems from the beginning in two companies and one used commercial 'off-the-shelf-package'. The shortage of system integrators slowed the progress. There is plenty of work to do when changing the 'traditional' face-to-face electronic meeting room to distributed environment. Problems to be addressed include: how to accommodate public screens, arrange suitable lightning and acoustic qualities of the room, conform the datasecurity and soundproof the meeting rooms.

4. Personal attitude

Personal characteristics of managers have an impact in IT implementation [13]. Among these, there are the managers' decision style and approach to management, education, age and attitudes. However, it is difficult to predict in which direction these factors influence [21]. We discovered some user resistance toward the system before the project was in pilot testing phase. The reasons vary from lack of suitable tasks to personal dislike of the system. Anyhow, the resistance diminished considerably after users have tried out the system.

The personal attitudes toward the GV system differed considerably. Some users were delighted and saw the potentials of the system immediately, but many of them were cautiously inclined toward the use of the system. For some user's point of view we implemented actually two new media contemporaneously to support dispersed cooperation. It was too much of a change for some users compared to manual meetings they were used to.

To accept a distant meeting system (a videoconferencing system combined with an electronic meeting system) seems to be a very personal thing. In the interviews, three main issues that affected the acceptance of a system were detected:

-Does the person like travelling (affects the use of videoconferencing systems as such)? Some people who do not travel on every week basis consider travelling exiting and a part of reward system of the company.
-Can the person express him/herself by writing or does he/she rather only speak? Written and spoken texts can have different "readings" and written text is more of one-directional [14].
-Is the person an innovator or an imitator (of what the others are doing)? We did not do any serious personal tests, but the interviews showed that some persons are much more willing to try something new than others.

5. Groups and Tasks

The groups that the electronic meeting system (EMS) supports were, in the beginning, intraorganizational that were distributed to two or more locations. In such a case, all the workgroups within a department or an organization can hold their meetings via EMS. If the system was easily available it appeared to improve meeting practices within the organization by reducing scheduling problems and travelling overhead, that causes work time fragmentation.

During the two and half months pilot testing period in ITV we had 20 videomeetings of which 9 were remote meetings with the GroupSystems V. The following list of tasks, that we performed in the ITV, is preliminary, not exhaustive: board meetings, regular project meetings, R&D project meetings especially for requirements analysis, meetings with the customer (selected customers only), making offers of IT products and other group writing exercises.

Those groups that were not so established (i.e., people have not met each other before) did not believe they could benefit from using EMS. Typical examples were selling occasions and product demonstrations for customers. Potential situations for using EMS in interorganizational groups could be auditing occasions or defining requirements or any other processes where the participants have already met before and know each other already.

In continuous processes, the same people gather frequently during a short period of time. In particular, continuous processes such as strategic planning or budgeting were seen as promising targets for pilot testing and use.

6. Organizational questions

We find it interesting to analyze differences between the three pilot organizations: information system specialists (different kinds of people but experts of the field, medium size to large projects), technologically oriented engineers (small groups, small projects) and a large machine factory (medium size to large groups and fairly large projects) with old traditions and habits of working.

There are several questions to be explored. How much do the pilot groups use the video connection only and not the EMS? If they do so, why? Dennis & al. [6] claim that the group size is an important factor, when studying EMS. Does the usage differ between organizations due to the group size, lack of suitable tasks, or what do the users think as effective reasons.

In our project only the ITV (suitable teams, used to IT) used the GroupSystems rather regularly. The other organization, R&D engineers from the TCC (small teams, no suitable tasks) tried it out once in a brainstorming session. The MMCs upper management was not used to IT, but there exist a clear need for videoconferencing to substitute travelling. They refused to try GroupSystems at all, because they were afraid, that it might be too risky to implement videoconferencing system and GroupSystems simultaneously. The ITV had two years of experience of using GroupSystems in face-to-face meetings. The TCC organization had no experience of GroupSystems but they were used to videoconferencing. The last organization had no experience of GroupSystems nor videoconferencing.

7. Preconditions for use

The technical and physical environment must be reliable and functionally operative. If that is not the case, users do not feel that EMS supports and facilitates their work. Video and audio quality must be satisfactory and audio quality is the most important. Even small problems in audio quality can soon deteriorate the whole meeting.

The procedures for engaging the meeting rooms must be planned carefully and the rooms should be easily available. Time delays can be critical if the users have to wait for days to use the system. The users get frustrated, and time delays can decrease the benefits of a distributed meeting system. Also, it should be possible to engage all the necessary meeting rooms simultaneously.

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The locations of the meeting rooms must be easy to reach and not geographically far away from the potential users. The EMS room can look like a normal meeting room and the size of the room should match with the teams using it.

To become widely accepted in global use GroupVideo and PC-based videoconferencing systems demand also a possibility for multipoint meetings. There are already some products for multipoint meetings on the market, but they are expensive and will create some security problems when they come into general use.

There must be a way to show slides and other documents to remote participants. In many meetings, transparencies or other documents form the core of a presentation. If the remote party was not able to see the same information as those on the spot, they got frustrated. Document cameras or fax machines are solutions for that problem.

In the interviews, a need for a computer support for concurrent drawing emerged. During the pilot testing phase, however, the need for concurrent drawing did not occur even though it was the most often mentioned requirement.

The groupware tool should be modular so that the organization's own tools (spreadsheets etc.) could be integrated into the system. GroupSystems V was the electronic meeting support tool that we used in our pilot project. It seemed reliable and fast enough for remote meetings. It has an impressive set of group support tools for idea generation, idea organization, voting, group writing etc. It also has an option feature that allows other software tools to be integrated. In the market there exists many potential software products which can help participants in remote meetings.

If the EMS tools want to gain wider acceptance in organizations, the general knowledge about the electronic meeting system tools and the possibilities they offer should be enhanced. This is easiest to do by generating simple applications (templates) that many users can utilize, and thus to realize the benefits of EMS (combined with multimedia).

PC-based videoconferencing systems operating in LAN environment have an Achilles heel, however. Transmitting audio in a packet switched network (such as Ethernet) is very difficult. When packets collide to each other and sometimes require resending, it is impossible to quarantee that the packets will arrive at the right time, and consequently, the sound will deteriorate. Speaker phones with good echo cancellation system and full duplex speaking facilities are useful.

If there are several participants in one meeting location it may be necessary to employ more than one microphone per location. Audio quality is of greater importance than video quality. Even if the video was sometimes inaccurate, it did not bother the participants.

8. Meetings

During the pilot testing phase, we frequently discovered that users were willing to try out new working methods and tools that could ease the burden of everyday work. The problem, however, seemed to be that they did not have enough time to think and plan their meetings [9] in such a way that the best features of the EMS could be employed.

By expanding the desk-top videoconferencing system for group meetings, we soon found out that it worked best only for small groups. If there are too many participants in a meeting, it will disturb the hearing and seeing conditions. The maximum number of participants will depend on the interior design, quality of audio system and the possibilities of moving the camera. The maximum number of participants when using fixed optics is 3-4 persons per meeting room. If the number of participants is greater than four, there should be several microphones so that the audio quality will not deteriorate.

It is often necessary as well as polite to introduce all the participants in the beginning of the meeting, especially if the group is so large that all the participants do not appear in the picture sent by fixed camera. Remote meetings should not last longer than two hours. Following a remote meeting is often more taxing than following a conventional meeting.

To use EMS, it is often helpful to have a facilitator available on both meeting locations. It makes meeting planning and conducting much more flexible. It is of vital importance to hear clearly what the facilitator is saying. Otherwise the participants do not know what is going on in a meeting.

9. Costs and benefits

The trend in videoconferencing is toward cheap and easy-to-use PC-based systems. The future is unknown, though. A fierce struggle is going on in the standardization market. There is one international standard for

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transmitting video and audio (H.320), but Intel is coming forcefully into the market with its own Indeo standard that they claim is much better than H.320. Intel is now marketing (Indeo based) Videoserv 200 product (cards, camera and software) for $2,500. The retailers, such as Bell South, will sell the same packet to the customer for $1,000 [7]. As usual, H.320 and Indeo will not be compatible.

Cost of videoconferencing only

Our GV system was built over the Bitfield H261 Video Compression Board. The expenses were over the above mentioned figures. On our level of expenses the system will pay itself in three years, if an organization can save one domestic meeting trip per week (appr. $ 200). If an organization uses the system for holding meetings abroad, for example between Finland and United States, the system will pay itself if the organization can save one meeting trip per month.

Cost of GroupVideo system

The costs can vary a lot depending on the size of the system (e.g. number of workstations needed, software installed, etc.)

In ITV organization, to save one domestic trip per day or four trips per week will pay the investments back in three years. If the facilitator's salary is counted as a fixed expense for GroupVideo, then the system should save around two domestic trips per day to become profitable.

We must remember that using the GDSS itself will speed up the meetings and save the total meeting time [8], [17], [20]. Cutting down travel hours diminishes working time fragmentation and will eventually improve workers performance. To calculate these savings is much harder than counting straightforward benefits and costs. The effect on the company's public image of using the latest communication channels and groupware solutions are also difficult to measure.

By using videoconferencing instead of travelling will open up new modes of communication. For example, earlier it was not easy nor cost efficient to hold instant meetings between Finland and the USA. These types of new working methods will open up new horizons for international cooperation hierarchical organizations.

10. **Conclusions**

Academic research so far has mostly focused on improving productivity of "business teams" and we have the same goal. Our project environment covers different kinds of business teams in different types of organizations. We believe that the joint effort with academic and business community will lead to better understanding of the true nature of the dispersed team work, its requirements and barriers.

The research model adopted is based on ethnographic studies on EMS. It offers a solid base to build the cumulative knowledge in the area. Because we have the opportunity to operate with real organizations, our study differs from the main stream of the studies done earlier, which were mainly experiments with artificial problems and students as users. We may have lost some rigor of positivist quantitative methods, but we still believe our research have revealed some of the difficulties and possibilities of introducing new modes of communication to real teams.

The nature of the work will change due to globalization and it will affect managers' work radically [10], [11]. The questions of control and coordination will be seen in a new light. Maybe the managers should be the first ones to try out new methods and tools in these environments. The rapidly changing working environment will also raise the question *what is work*? How does the managers work change when s/he is managing a virtual global organization from remote workroom utilizing dispersed teams? The question is of a crucial importance for designers of CSCW applications, because it makes also the work design part visible and of equal importance than the technological design.

Even though the amount of distant work will increase in the future, we will need face-to-face meetings to retain social contacts and the feel of closeness. One of the questions for the developers of remote collaboration techniques is, how can we create an atmosphere and feeling of closeness in distant collaboration. New larger screens and the sophisticated room design will, in all probability, help users to adapt to the changed nature of interactions. But the high-tech is not enough, we believe that the task oriented approach will yield good results. By choosing suitable tasks like strategic planning and using tested templates (with meeting support software) the users can easier realize the benefits of the EMS.

Our application areas included, but were not limited to: idea generation, group writing, quality team, requirements analysis, project manager and concern manager meetings. Only the limit of imagination hinders the use of the system. Some application areas demand new tools for

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distributed work. For example design of information system usually involves different kind of drawings which usually evolve during the project and accordingly there is often a need to change these drawings during the meetings.

The challenge in a real working environment includes that the system has to be technically reliable, otherwise the users would not try it out the second time. The early comments confirm that the audio quality is of utmost importance, but clients will forgive a lot of inaccuracy in moving video-image. This seems to hold at least when talking about electronic meeting environments. The situation may be different in other videobased applications, like remote maintenance etc.

Changes in the telecommunication infrastructure will also affect to the utilization level and use of the distributed systems. We are in a very happy situation in Finland, because our telecommunication infrastructure is fairly developed. In our project it is possible to try out different kind of telecommunication protocols. Our strategy is based on LAN, but the ISDN is also applicable. In the near future the ATM transmission protocol will give us new opportunities, because it will allow to transmit huge amounts of data across wide area and local area networks [12]. It can open the whole new world for telepresence. The questions will rise that, which is / are the prominent telecommunication network or protocol? We believe that in the future all networks and protocols will work together supporting each other - cooperating.

The continuous trend toward globalization and turbulent business environments demands new tools and methods to control and coordinate distributed work. The pace of technological evolution is so fast that people and organizations must stay alarmed that they do not stay in the rear. We claim that the type of organization and the environmental pressures (questions like group size, task importance and task-technology fit) will mold the adoption of distributed systems. For example it is totally different to offer a new method for the meetings to a dynamic IT vendor than to a traditional and well established machine maker organization.

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References

[1] Bair J.H., Supporting Cooperative Work with Computers: Addressing Meeting Mania, In Proceedings of the 34th IEEE Computer Society International Conference - Compcon Spring, p. 208-217, San Fransisco, CA, February 27 - March 3, 1989.

[2] Bannon L.J., Schmidt K., CSCW: Four Characters in Search of a Context, In Proceedings of the 1st European Conference on Computer Supported Cooperative Work (ECSCW89), Gatwick, U.K.,Computer Sciences House, Sloug, UK, September 13-15, 1989, p. 358-372.

[3] Chidambaram L., Jones B., Impact of Communication Medium and Computer Support on Group Perceptions and Performance: A Comparison of Face-to-Face and Dispersed Meetings, MIS Quarterly, December, 1993, pp. 465-491.

[4] Dennis A.R., Craig K.T., Vogel D.R., Nunamaker J.F., An Evaluation of Electronic meeting Systems to Support Strategic Management, in Proceedings of the Eleventh ICIS, Copenhagen, Denmark, December 1990.

[5] DeSanctis Gerardine, Gallupe Brent R., A Foundation for The Study of GroupDecision Support Systems, Management Science Vol. 33, No. 5, May 1987, 589 - 609.

[6] Dennis Alan R., George Joey F., Nunamaker Jay M. Jr, Vogel Douglas R., Information Technology to Support Electronic Meetings, MIS Quarterly, December 1988, 591 - 624.

[7] Gold Elliot.M., PCS Rewrite the Rules for Videoconferencing, Data Communications, March 1994.

[8] Grohowski Ron, McGoff Chris, Implementing Electronic Meeting System at IBM: Lessons Learned and Success Factors, MIS Quartely, December 1990, 368 - 383.

[9] The 3M Meeting Management Team, How to Run Better Business Meetings, McGraw-Hill Book Company, New York, 1979.

[10] Johansen Robert, Charles Jeff, Groupware, Groupware: Computer Support for Business Teams, Free Press, London, 1988.

[11] Johansen R., DeGrasse Robert, Computer-Based Teleconferencing: Effects on Working Patterns, Journal of Communication, Summer 1979, 30 -41.

[12] Kerr Susan, ATM:Ultimate Network, Or Ultimate Hype, Datamation, April 1, 1993.

[13] Lucas H. Jr., Implementation The Key to Successful Information Systems, Columbia University Press, New York, 1981.

[14] Lyytinen Kalle, Maaranen Petri, Knuuttila Juha, Why Groups are not always the same an assessment of twelve believes in GDSS, Proceedings of the 26th Hawaii International Conference on System Sciences, 1993, 189 - 198.

[15] Lyytinen Kalle, Maaranen Petri, Knuuttila Juha, Unusual Business as Usual: An Investigation of Meeting Support Requirements in Multilateral Diplomacy, Accting., Mgmt. & Info. Tech., Vol 3, No. 2, 1993, 1 - 23.

[16] Lyytinen K., Ngwenyama O., What Does Computer Support for cooperative Work Mean? A Structurational Analysis of Computer Supported Cooperative Work, Accounting, Management and Information Technologies, vol 2, No 2, 1992.

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1060-3425/95 $10.00 © 1995 IEEE

[17] Martz William Benjamin, Jr., Vogel Douglas R., Nunamaker Jay F., Jr., Electronic Meeting Systems: Results from the field, Decision Support Systems 8, 1992, 141 - 158.

[18] Nunamaker J.F., Dennis Alan R., Valacich Joseph S., Vogel Douglas R., George Joey F., Electronic Meeting Systems to Support Group Work, Communications of the ACM, Vol. 34, No. 7, July 1991,40 - 61.

[19] Pinsonneault Alain, Kramer Kenneth l., The effects of electronic meetings on group processes and outcomes: An assessment of the empirical research, European Journal of Operational Research 46, 1990, 143 - 161.

[20] Post Brad Q., Building the Business Case for Group Support Technology, Proceedings of the 25th Hawaii International Conference on System Sciences, 1992.

[21] Tan B. C. Y., Watson R. T., Wei K. K., Raman K. S., Kerola P. K., National Culture and Group Support Systems: Examining the Situation where Some People are More Equal than Others Proceedings of the 26th Hawaii International Conference on System Sciences, 1993.

[22] Yin R.K., Case Study Research: Design and Methods, Second Edition in Applied Social Research Methods Series Volume 5, Sage Publications, Inc., 1994.

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