DECISION FOLLOW-UP SUPPORT MECHANISM BASED ON ASYNCHRONOUS COMMUNICATION

Carla Valle, Wolfgang Prinz

Fraunhofer Institut - FIT, Schloss Birlinghoven, Sankt Augustin, 53754 - Germany

Keywords: Decision Support Systems, Asynchronous Communication

Abstract: Decision management and decision support systems are themes under investigation for several decades, and both research areas provided contributions for the quality of decision making processes. However, little work has been done in the aerea of decision follow-up, especially regarding decisions made during meetings. In this paper we analyse the concepts related to this problem and we propose a solution based on mechanisms supported by computer to assist the formalization of meeting outcomes, and to provide decision follow-up.

1 INTRODUCTION

One important area vastly investigated in the literature is the area of Decision Support Systems (DSS). The main goal of these researches is to improve the decision making process through the use of this technology.

One of its sub-areas is related to the follow-up process of decisions made. Once a decision is made, there is a lack of information about how its implementation take place, who is involved and making use of which resources and what are the current problems. As a consequence to this fact, decisions are wrongly implemented or not implemented at all. Often, decisions that are implemented without the necessary follow-up may generate outcomes, different from those planned at the time of the decision. Besides that, cultural barriers and the lack of appropriate tools induce just informal links. As a result, important decisions are not properly or timely implemented (Borges, 2002).

The mechanisms used nowadays to provide decision follow-up are more based on user efforts than on system efforts, like for example, informal conversations, free emails, project management tools, workflow systems and simple to-do list tools. However, a lot of data is constantly created by users, either through documents, electronic communication, phone calls, reports, and so on, which could be used to automatically provide some levels of follow-up to decision makers and to decision implementers.

Several initiatives were and still are done in the direction of capturing the rationale generated during meetings and interactions in a decision-making process (Keen,1987), (Kraemer,1988), (Kleidorfer,1993), (Santhanam,2000). This research considers another perspective, which is focused on the steps that take place after decisions are made during meetings. Our idea is based on the formalization of meeting outcomes with decisions made explicit and a set of automatic mechanisms to analyse, categorize and provide awareness information based on email content analysis related to the decisions made.

With these ideas we aim at improving the communication between decision makers and meeting participants with those people who really implement the decisions. We also consider that these types of automatic support can improve the track of decisions using the data users already generate "naturally", in order to improve decision quality, but also to make users aware of problems and decision's implementation.

This paper is organized in the following way: section 2 shows some related work, section 3 shows the problems handled in this research, section 4 presents the concepts used in this research, section 5 presents a set of mechanisms identified to solve problems presented in section 3 and, finally, in section 6 we raise some conclusions up to this moment.

2 RELATED WORK

In (Wiberg, 2001) the author presents a mobile physical/virtual meeting support system intended to support knowledge management (KM) in mobile CSCW, named RoamWare. One of the objectives of the project was to support the transformation from socialization to externalization so that informal meetings could be made explicit and used in knowledge processes. The Roamware system is designed to support people who are moving around and participate in different mobile meetings. The system is intended to be used in the background while walking around, collecting data about other co-located persons who also have the system running. The idea is that the collected information will be used in later setting when the users are geographically dispersed from each other.

In (Borges, 2002) the authors discuss the use of a post-meeting support workflow-like solution where working plans can be described and enacted. The proposed solution is a system combining a process design tool with a workflow enactment tool. However, given the ad-hoc nature of the processes described in the paper, the authors suggest that a commercial Workflow Management System (WfMS) alone would not be enough to support the requirements of the scenario of post-meeting phases. Even with the adoption of a WfMS for process enactment, additional monitoring tools are proposed.

In (Costa, 2000) the authors propose a solution for supporting meeting report processes, based on the notion of *genre* and systems of *genres*. The idea of this system is to support and help meeting participants in the process of creating and dissemination meeting reports. The system is composed by two tools, an analysis tool, which helps users identify meeting genres and a reporting tool that guides users in the production of meeting minutes.

All these approaches are valid and have considered different perspectives of the complex problem of providing decision follow-up related to meetings. In the following sections we provide more details regarding our solution.

3 DECISION FOLLOW-UP AND MEETINGS

Our proposal looks at decisions made only in meetings, since meetings are one of the most common practices where decisions are made (Simon,1966), (Stefik,1987), (Nunamaker,1997). Our decision follow-up mechanism is going to be related to post-meeting activities and our starting point will be the meeting minutes with decisions made explicit.

Decision meetings are not isolated events. They are part of a continuous cycle of premeeting, meeting and post-meeting activities (Bostrom,1993). The meeting itself is the most visible part of this cycle, but the other components are always present. Making premeeting and post-meeting activities explicit may be the first step to enhance the whole cycle and thus, to obtain better decisions as a final result. All the three phases can be considered equally important, since they deal with different aspects of a decision. Nevertheless, few tools have been proposed to support premeetings and post-meeting phases. In (Borges,1999) the authors detail the premeeting phase and its relation to meetings. While in (Hayne,1999) and (Nunamaker,1997) the authors discuss the meeting particularities.

The post-meeting phase is when the implementation of the decisions is executed. This stage contains activities to be carried out by people not necessarily present in the meetings. Its activities include dissemination, monitoring implementation of the decisions and clarification of ambiguous decision details. We believe this phase involves knowledge that can be useful in future instances of the cycle. Experiences of the implementation phase can provide indicators for new meetings, and stories about what was implemented with or without success (Valle,2002). And last, but not least, new decisions may appear during this phase. These decisions may or may not be related to other decisions made, but they should be observed and checked as those related to meetings.

Decision follow-up can be made through several management tools (e.g. project management tool, workflow systems, intranets, document management system), depending on cultural, organizational and financial reasons one or a combination of them can be used. But there is a common denominator for almost any modern organization, which is one of our beliefs to provide decision follow-up: the electronic communication. Communication is one of the richest components of the whole decision making process. It is through communication channels that people exchange knowledge and opinions, raise problems and solve them. Our proposal is based on the idea that formalizing decisions in an electronic format should be the first step to provide decision follow-up; and the second step should be the analysis of related electronic conversation.

Communication can be realized in different ways (synchronously, asynchronously) using different channels (text, voice and images) and supported by various tools (telephone, fax, email, chat, discussion forums, videoconference, voice conference, etc).

In decision follow-up, communication seems to be one of the most important aspects to be observed. Actually, formal or informal communication are used to transmit information an knowledge, to make new decisions, to externalize problems and successful stories, and so on. Since we aim at discussing how computers can support decision follow-ups, especially based on the information available in communication processes, our analysis will be restricted to the possibilities supported by computers.

4 DECISION FOLLOW-UP BASED ON ASYNCHRONOUS COMMUNICATION

Many users rely on emails to get up to date information about projects, tasks, responsibilities and track of on going processes. Email has great advantages over other tools. It is simple, not costly (except the storage costs, which are becoming very high), it is already accepted as a communication tool in most organizations and it supports asynchronous communication. On the other hand, e-mails are not easily structured. Some available tools provide basic mechanism to organize them in folders, sub-groups, by sender/receiver, incoming and outcoming messages, but the context of the messages and mostly their contents are not analysed by these mechanisms.

In the case of decision follow-up, emails can be very useful. Many project leaders, mainly of distributed projects, rely on email to catch up with information. Despite the information being there, its content analysis has to be made by users. If a user really desires to structure a conversation, not only based on the "subject" field of the email messages, the user would have to read each message again and create "artificial" structures to store them in a meaningful way.

This proposal aims at building a combination of mechanisms to provide decision follow-up looking at asynchronous communication based on e-mails. One reason for that choice is based on the fact that e-mails are one of the most successful electronic communication tools, with a stable utilization across organizations (Levitt,2003). In (Wired,2003), the study done shows that for power users, typically better educated and higher earners (managers), it is necessary to spend about 2 hours or more daily on e-mail, often beyond four, not only because of their direct participation in the communication process, but also as a person who receives copies of others'

emails to be aware about on-going projects they are involved in.

5 SYSTEM DESCRIPTION

The mechanisms proposed aims at providing four main groups of functionality: a formal documentation of decisions made, through the outcomes of meetings; the content analysis of messages related to decisions made; the categorization of messages related to decisions made; and awareness (notification and categorized messages) about the follow-up process of decisions made (Figure 1).
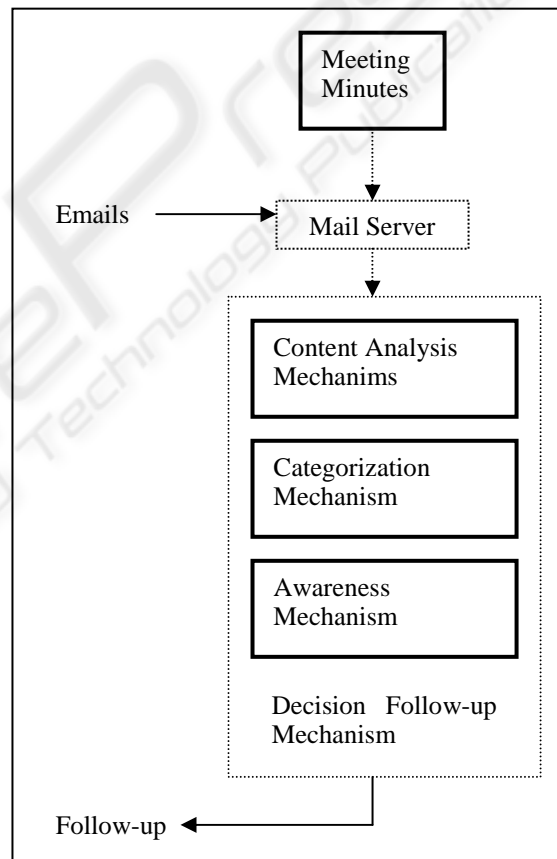

Figure 1: Components of the decision follow-up mechanism

Formal Documentation of Meetings: We are proposing for the starting point of decision follow-up, a mechanism to formalize the decisions or to make them explicit. We propose the use of a special type of email, based on a template, where a meeting participant writes the minutes in a semi-formatted

way, pointing out decisions made which are going to be used to trigger the decision follow-up process. The filling out action of this form should be done, ideally, during a meeting execution. The fields proposed in this email template are supposed to represent different categories of information. Firstly, general information should be provided, followed by the objectives of the meeting and the name of the attendees, or participants.

During the meeting activity, the noter should list each topic discussed, followed by any sub-topic, plus the details about the "to-do-list", and who is going to take the responsibility, when the actions should be done. And if applied, the noter could classify the type of topic/sub-topic and define if it should be followed-up or not. The template should contain 1 or N topics with 1 or N sub-topics. The number of them will be determined during the meeting execution. For each topic or sub-topic we propose the use of a "type" field, which will have as initial values: decision, idea/suggestion, simple presentation of a topic, simple comment, explanation, question, answer, not applicable; and other (with blank field).

Considering a participant of the meeting will execute the activity of taking notes and filling out the email template, the decisions would somehow become explicit, either in the explicit classification of topics and sub-topics, or in the "to-do-lists" or a combination of them.

At the end of the annotation process, a first parse could be made to create a summary of what was considered decision, what was not and ask for user confirmation. For this first parse tool, we consider to use the explicit fields values content analysis.

We would like to emphasize that in a real situation this effort of classifying meeting topics as decisions to be followed-up, may be more adequate to decisions regarding innovative ideas, projects, or decisions that demand high level interaction among different people, to decisions that offer high critical degree of implementation, or to decisions considered risky.

We are also considering that at least one responsible for each decision made must be assigned. This is the first user to be informed about a decision follow-up.

After the minutes are ready, the message should be sent via email to participants and to all people who should be informed about decisions, actions and needs.

Tracking of Messages: After the first step is done, with the triggering minutes email containing decisions made, users will start to send messages to each other related to those decisions. At this moment we need mechanisms to check the existence of new messages and mechanisms to categorize them, according to their nature (E.g. new decisions, problems related to decisions, new meetings, etc).

For this phase we plan to have agents working at the mail server side, analysing the entrance of new messages and their contents. It is predictable to be necessary to develop the following agents:

- *A content analysis agent*: this agent will be responsible to analyse each new message and separate them as a new input to the decision follow-up mechanism (E.g. message containing meeting minutes), or follow-up messages (E.g. messages related to meeting minutes or to the decisions made contained in any meeting minute), and finally, not related messages (E.g. messages out of context, or private messages).

- *A categorization agent:* after the first agent has done its work of filtering the different types of messages, a second analysis has to be executed to categorize the messages by another agent. This agent is supposed to create virtual links between messages, so that decision follow-up categorizations can be generated. Every message has to pass through this analysis and the agent will try to relate the message to one or more decisions made.

At this phase of the research, it is still not clear if it is going to be possible to allow free-mail text or if the messages in the context of decisions should be semi-structured to make the analysis made by the agents feasible and meaningful. Ideally, we would prefer to allow free-text.

Presently, there are several tools available to help us analyse the content and the categorization of messages (Xelda,2003), (Levitt,2003) and (Protan, 2003) are some examples. We plan to analyse a few of them and choose one for using in this research with the required adaptation implemented to support our objectives.

Awareness Mechanisms: as the final step of our proposal, we want to develop awareness mechanisms to provide the follow-up of decisions to those who are involved or interested in obtaining information about decisions made.

A decision can affect many people besides those directly involved in its conception and implementation. It may be of peripheral interest, for example, to high-level management. On the contrary, a decision will be of direct interest to people affected by it (Borges,2002). One way of providing the right information to the right person at the right time is through the use of awareness mechanism.

Considering that not every detail about a decision implementation is relevant to all participants or related people, the automatic mechanism should somehow filter the information to provide the right awareness. For the problem dealt in this research, we plan to develop the following awareness mechanisms:

- *Awareness about new decisions:* every time a new decision is made, people related to it should be notified. Based on our proposal on formalizing meeting minutes, the message where the meeting minutes are described will solve this first awareness need.

- *Awareness about a decision follow-up*: every time a message is sent to the system, after being analyzed, the system should provide awareness about the existence of a "follow-up" message related to a decision, if that is the case. At this moment, we think to use as content criteria, keywords related to the decisions made. The criteria used by the system to determine to whom it should send the follow-up is defined at the meeting minutes participants or involved people, combined with user preferences. The timing of receiving this awareness should also be user configurable. Some users may want to constantly receive information, while others may prefer to see them in a daily or weekly format, just to cite some possibilities. We plan to develop different ways of visualizing the follow-up, for example, in threaded messages or in graphic representations, again depending on users preferences.

- *Specific awareness based on decision life-cycle:* we plan to provide slightly different types of awareness according to the decision life-cycle: new decisions, problem related to a decision, decision being changed, decision being aborted, decision implementation ended, etc.

Besides the pre-determined awareness mechanism presented, the users should be able to query the message base in order to get historical information about decisions made and their respective follow-up, at any time.

It is also important to provide users with the possibility of aborting the decision follow-up. In this case, the responsible for stopping the specific service should inform related people, for example with a message, the justification for the cancellation. Or this "stop" mechanism can occur every time a decision is finalized, but in any case we think about using a human intervention for this procedure.

User interaction modes: we aim at having different user interaction possibilities:

- *Meeting interaction mode*: this is the mode where users will input data about decisions and meeting existence.

- *Email interaction mode:* this is the mode where users will send emails related to decisions. We are implementing this mode as an extension of an email client. The basic idea behind that is everytime a user wants to send an email, he can decide whether to send it with a low, medium or high level of contextualization regarding a decision being implemented. The user can choose to simply send a free message, which should not be parsed by the content analysis and categorization mechanisms, or he can explicit click on a check box, thus enabling the decision follow-up mechanisms, and allowing his email for being used (or not) as a follow-up to others.

- *Follow-up interaction mode*: this is the mode where the user will receive follow-up notification and will be able to have different ways of visualizing it. Again, this is being implemented as part of an email client, as an extension. This mode includes also functionality to enable users to configure their *follow-up profiles,* i.e., a profile where the user is going to define the rules he wants the system to follow to provide him with follow-ups. This includes the timing and format configuration the follow-up should be provided.

5 CONCLUSION

At this moment, many issues considered in this research are still open. We aim at solving them along the research activities so that we can provide a solution to check the improvements on the decision follow-up area. We are already conscious, beforehand, of some drawbacks predicted up to now. We will consider them during the activities, but we are not sure if they will be part of the research solution.

The first impact predicted from this proposal is the way people organize meeting minutes. Following the idea of creating the minutes during the meetings, make users use a form-based template, supported by a computer or similar (e.g. handheld) to document the outcomes and decisions. If it occurs of not, the other predicted impact is related to the way users

will organize the notes or even, the way meetings organization might be affected. We expect that with the proposed formalization, meetings become more documented as well as the decisions made. On the other hand, they can also start suffering from being too formal and organized.

Another predicted impact is the use of email in this scenario. Somehow we are changing the natural and comfortable way users use this tool. As a consequence of this proposal, we will have a social impact about the use of email tools. If we choose a "democratic" approach to send, analyze and receive notification messages, where every message is public, maybe users will feel constrained and so will be the information written in the messages. Users may not feel comfortable to have messages being parsed and used to provide follow-up to others. On the other hand, this change is just a matter of getting aware about a technology, since even today all messages running in organizational environments can be stored, parsed and categorized if this is the company policy. We also count on the idea that giving and receiving feedback can bring a socially related motivating and awarding perspective. Clearly, this proposal falls in the group of applications or mechanisms that need to be supported by high administration levels at organization in order to make people understand their usefullness and limitations.

Another question to be solved is the number of people who should be able to receive decision follow-up. Since we aim at improving the communication between decision makers and implementers. In this case, the number of people should be as big as users want or need.

Related to this topic, the overload of messages, decision follow-up or awareness has to be considered as well. An upper level manager would be, in this situation, a candidate to receiving follow-up about everything in the organization or in the group where s/he works at. But, actually, not all the information, and not all decisions should be of her/his interest.

Some positive results are also expected. We aim at having at the end of this work improvement about meeting' minutes communication, decision follow-up and awareness about on-going problems. Somehow we expect the proposed system should give users a payoff justifying the load they might have while interacting with it.

We believe that with the help provided by such mechanisms, better decisions could be made and the timing to react over problems could be reduced.

Looking at the related on going research, we see two interesting approaches to be investigated. One is the integration of this proposal to a DSS, in order to combine the decision follow-up with the rationale used to make each decision. Another approach can be a research looking at the possibilities of re-use of experiences gained through the decision implementation process and how this decision follow-up can be used as "lessons-learned".

This research is under development, and there are currently two investigations taking place: one related to the definition of the adequate form-based minutes with decisions represented explicitly, and the other the extension of the email client capabilities to support the mechanisms proposed.

REFERENCES

Balasubramanian, P, et al., "Managing process knowledge for decision support", Decision Support System, 27 (1999), 145-162.

Basoglu, A. N., et al., "A Framework for a Web-based Group Decision Support System", Informing Science, June 2001.

Borges, M., Pino, J.A., Fuller, D., Salgado, A.C., Key issues in the design of an asynchronous system to support meeting preparation, Decision Support Systems, vol. 27 no. 3, 1999, p. 271-289.

Borges, M., Pino, J.A., Valle, C., "On the implementation and follow-up of decisions" in Proceedings of DSIAge 2002, Cork, Ireland, pp. 366-376.

Bostrom, R.P., Successful application of communication techniques to improve the systems development process. Information and Management, 16, pp. 279-295.

DeSanctis, G. & Gallupe, B., "A Foundation for Study of Group Decision Support Systems", Management Science, 33 – 5 (1987), 589-609.

Dourish, P. , Bellotti, V., Awareness and coordination in shared spaces. In: Proceedings of CSCW'92, ACM Press, Toronto, Canada, November 1992, pp. 107-114

Gross, T. Towards Ubiquitous Awareness: the PRAVTA Prototype. In Ninth Euromicros Workshop on Parallel and Distributed Processing – PDP 2001 (Feb. 7-9, Mantova, Italy). IEEE Computer Society Press, Los Alamitos, CA, 2001. pp 139-146.

Gutwin, C, Greenberg, S., and Roseman, M. Workspace. Short Paper: Supporting Awarenes of Others in Groupware. In Conference Companion of the Conference on Human Factors in Computing Systems – CHI' 96. Vancouver – Canada, ACM Press

Hayne, S. C. The Facilitators Perspective on Meetings and Implications for Group Support Systems Design. The Data Base for Advances in Information Systems. Summer-Fall, 1999. Vol. 30. No. 3,4. pp. 72-91.

Intext - http://www.intext.de/eindex.html consulted in Feb 28th, 2003.

Keen, P.G.W., Decision Support Systems: The Next Decade, *Decision Support Systems*, 3 (1987), pp. 253-265.

Kleidorfer, P. et al., *Decision sciences: an integrative perspective*, Cambridge University Press, UK, 1993.

Kraemer, K.L., King, J.L., „Computer-based systems for Cooperative Work and Group Decision Making", *ACM Computing Surveys,* Vol 20., No. 2, June 1988, pp. 115-146.

Levitt, M., Mahowald, R.P., "There should be More to Collaboration than Email", an IDC White Paper Sponsored by Groobe Networks. Consulted in Feb. 2003, http://www.groove.net/extras/beyondemail/idc/

Power, D.J., "Web-based Decision Support Systems", Part I and II. The online Executive Journal for Data-Intensive Decision Support, August 18 and 25, 1998. Vol 2. Nos. 33 and 34.

Nunamaker, J.F., and Briggs, R.O. Lessons From a Dozen Years of Group Support Systems Research: A Discussion of Lab and Field Findings. Journal of Management Information Systems, 13, 3, 1997, pp. 163-205.

Protan, http://www.upso.ucl.ac.be/protan/protanae.html consulted in Feb 23rd, 2003.

Santhanam, R., Guimaraes, T., George, J.F. An empirical investigation of ODSS impact on individuals and organizations. *Decision Support Systems*, 30 (2000), pp. 51-72.

Simon, H.A. The New Science of Management Decision, New York: Harper & Row, 1966.

Simone, C. and Divitini, M., Integrating Context to Support Coordination: The CHAOS Project. Computer Supported Cooperative Work, 1999, vol 8, pp. 239-283. Kluwer Academic Publishers.

Shim, J.P et al., Past, present and future of decision support technology. Decision Support Systems, 33 (2002), pp 111-126.

Stefik, M. Et al. Beyond the chalkboard: computer support for collaboration and problem solving in meetings. Communications of the ACM. January 1987, Vol. 30, Number 1. pp 32-47.

Valle, C., Prinz, W., Borges, M., Generation of Group Storytelling in Post-decision implementation process. In Proceedings of the 7th Intern. Conf. on CSCW in Design. Sept. 25-27, 2002, Rio de Janeiro, Brazil / Shen, Weiming [Hrsg.], pp. 361- 367.

Valle, C., Raybourn, E., Prinz, W. and Borges, M., Group Storytelling to Support Tacit Knowledge Externalization. In Proceedings of HCI International 2003, Crete, Greece. June 22 – 27 (to be published)

Wired, News - Study Refutes Email Myth

http://www.wired.com/news/technology/0,1282,56781,00. html Consulted in Feb 7th, 2003.

Xelda - http://www.mkms.xerox.com consulted in March 4th, 2003.