Internet Groupware Systems for Project Management: Experiences from an Empirical Study

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ABSTRACT

The paper describes and analyzes the practical experiences made with different groupware systems over a period of three years. The experiences were drawn from empirical studies carried out as part of a long-term research project. The findings are based on surveys conducted each year among the project participants.

The most recent groupware system used in 2002 offers numerous services of which almost exclusively the central document database, the group calendar and the to do list were used. From the user's point of view the main advantages of the use of groupware can be found in an improved access to information and increased control of the performed work. On the other hand, the use of the system consumed an additional amount of time and the personal contacts among the users were reduced. Overall, the users see more advantages than disadvantages. They state that they would use a groupware system in future projects again.

The comparison of the observations made during the last three years shows that usability and reliability of the user interface are factors, which are decisive for the perceived usefulness and the acceptance of a system. The user interface and the technical reliability of the systems have improved over the years.

1 INTRODUCTION

In recent years, an increasing number of Internet-based groupware systems have been created for the support of distributed workgroups. The support of cooperative work processes with information technology has been studied by researchers in the area of computer supported cooperative work (CSCW) [cf. Kies et al. 1998, Kamel/Davison 1998]. The most widely used information systems for CSCW are groupware [cf. Lewe/Krcmar 1991] and workflow management systems [Ellis et al. 1991]. In this paper we follow Greenberg's definition [1991] who uses the term groupware for all kinds of information systems which support workgroup computing. Due to the increased use of standardized Internet-based applications these systems are not limited to the deployment within organizational boundaries or to close relationships between co-operating enterprises but their use is also getting more common in open, market oriented forms of cooperation.

At the University of Applied Sciences Basel, Internet groupware has been used for the coordination of project work for the last three years [for a similar project see Pape et al. 2002]. All full-time business students have to realize a project in which they consult companies on a current company problem. The projects last for seven months and are carried out by student teams of four to five students. A professor coaches the teams. A representative of the company instructs the students and guides their work in accordance with the objectives of the company. The Internet groupware platform facilitates the coordination processes among the project participants.

The paper describes and analyzes the practical experiences made with three different groupware systems over a period of three years. The findings are based on surveys conducted each year in which the project participants were asked about their expectations and experiences. Our statements are based on a total of approximately 300 questionnaires.

The focus of the paper is the analysis of the use of the tool in the third year (2001/2002). The study examines three different areas. In the survey, participants had to indicate their most popular services. We then asked them about the main advantages and disadvantages regarding the use of the platform. In a last step, we took the findings of the three years and compared them with each other in order to study trends and developments.

The paper is structured as follows: We start our analysis by presenting some hypotheses which were drivers for our research. We then describe the background of the surveys and the research design. The main part of the paper is dedicated to the analysis of the survey. The last chapters describe conclusions and future research.

2 HYPOTHESES

At the beginning of our research we developed some hypotheses about the expected use of the Internet groupware system which we put to the test over three consecutive years. We came up with the following statements:

2.1 Which services are most popular?

H1: Services for archiving and project documentation are the ones which are most likely to be used by the project team members.

We wanted to identify the services which were used most frequently by the users. The students are required to use document templates provided by the University which are made available on the Internet platform. Project-related documents have to be archived in a way that each project participant – students, professors, and company representatives – can access the current version at any time. We expected that people would use the platform mainly for documentation and archiving purposes.

The Internet groupware also offers a discussion forum. Since students meet every day at school we thought it unlikely that they would use this asynchronous service. We were curious to see if meetings would be supported by the calendar option.

2.2 Advantages and disadvantages of the platforms

H2: Even if the number of physical meetings among the project team members is high Internet Groupware can still effectively fulfill supporting tasks.

The second hypothesis was targeted at the special setup of our projects. Since the students meet each other during the week a lot of interaction takes place in the school building and is not artificially transferred to the electronic realm.

2.3 Development of Internet groupware over time

H3: The maturity of Internet Groupware systems evolves over the years and has now (in 2002) reached a level of maturity where they can effectively support collaborative processes among project team members.

The third hypothesis deals with the development of Internet groupware over time. In the year 2000 when we performed the first survey Internet applications in general where still in a phase of "exploratory design". Users had to deal with slow applications which were error prone and mostly not very reliable. After three years of application improvement and much higher bandwidths we expected users to show a higher degree of satisfaction.

3 BACKGROUND OF THE RESEARCH PROJECT "LEARNING COMMUNITY"

The project-related working processes are characterized by distance from the principal (the company representative) and asynchronous access to information. Students require most coordination because they are the ones that do the work and they have to write a joint project paper. The exchange of jointly produced documents is of special importance. The availability of the latest version of a document and the avoidance of save conflicts have to be guaranteed. The principal requires transparency of the project advancements and the understanding of the project steps. The University as the overall coordinator of the projects is confronted with difficult communication processes with the broad, heterogeneous group of users.

The groupware system thus has to support a number of processes for communication and coordination within the scope of the consulting jobs. After some first experiences with the use of a tool called "VEGA" [Suter 2001] in 1999/2000 [Schubert/Dettling 2000] and a second one called „plenaxx" [Leimstoll et al. 2001] in the third year the choice fell on "webcorp" [Leimstoll/Wackernagel 2002]. Webcorp is an Internet groupware tool which was developed at the University of Applied Sciences Aargau in cooperation with a software engineering company.

Compared to its two predecessors, webcorp represents a new generation of groupware tools. Security, scope of services and ease of use have clearly improved. Webcorp supports the collaboration in different communities and projects. The *community area* allows to share documents and discuss ideas. *Projects* supply additional functionality for the administration of projects. Users dispose of a group calendar, a project plan and a to do list. E-mail addresses are accessible in dedicated E-mail lists. A controlling tool allows the precise logging of the work time and the project budget. Webcorp offers a public space as well as closed user groups. Each project team has access to such a closed user group.

4 RESEARCH DESIGN

The survey was realized in two steps. In the *first survey* at the beginning of the project time all participants where asked for their expectations towards the use of such a tool for the support of their work. In the *second survey* at the end of the projects the participants were asked the same questions again but this time about their experiences and the perceived benefits of the use of Internet groupware. The aim of this procedure was to compare the initial expectations with the ultimately perceived benefit.

5 ANALYSIS

The results of our surveys presented in this chapter are mainly confined to the descriptive evaluation of data. Due to low user numbers in the user groups "professors" and "company representatives" the calculated mean values and frequencies have to be carefully interpreted. The underlying sample size (n) is always named.

Summary of the research design:

| Type of survey	Standardized questionnaire with mainly closed questions.
Time frame	Three consecutive years (1999-2002).
Time of survey	Once at the beginning of the project. Once at the end of the project (7 months later).
Target group	Approx. 70 students, 15 professors, 15 company representatives (principals) per year.
First survey 2001/2002	EXPECTATIONS towards the tool
Second survey 2001/2002	EXPERIENCES with the tool
Structure of sample	The population is composed of all participants of the projects (a total of 300 questionnaires in three years).
Return rate of first survey 2001/2002	82 percent of the students 93 percent of the professors 75 percent of the principals
Return rate of second survey 2001/2002	92 percent of the students 93 percent of the professors 88 percent of the principals

5.1 The use of the platform

This chapter describes the behavior in the use of the webcorp platform. Due to the varying involvement of the user groups in the consulting projects we expected that the acceptance and the level of experience with webcorp differs among the groups. In the end, 97 % of the students followed the recommendation of the university and used webcorp during the project. 86 % of the professors and 64 % of the principals used the platform. The overall acceptance level is very high.

With a monthly average of 10.9 accesses per person the students use the Internet tool most frequently. This is not astonishing because the students carry out most of the work in the projects. They work approximately one or two days per week on the project. The corresponding figure for the corporate representatives is somewhat surprising: it indicates that they accessed webcorp only five times a month. The professors used webcorp seven times a month.

The behavior in the use of webcorp varies strongly between the users. The high values for the standard deviation supply evidence for that. The frequency of use in the group of the students ranges e.g. from 1 to 35 times of access a month. These extreme variations are by no means statistical outliers. 20 students use webcorp five times a month or less, 11 students use webcorp 20 times or more often. In the other two user groups the access rates are unevenly spread in almost the same manner.

Analyzing the degree of intensity of use of single groupware services leads to a clear picture (fig. 1). On average, users access services for document management 5.7 times a month and services for the delivery of mail to members of the community 2.8 times. Other frequently used services are the to do lists (2.4) and the calendar (2.2). The intensity of use of the remaining services is very low: link collection, news board, project controlling und the publication of Web pages are services which are used only once a month at most. The discussion area has never been used by any of the participants.

Fig. 1: Use of basic groupware services

Average number of utilizations per month and person
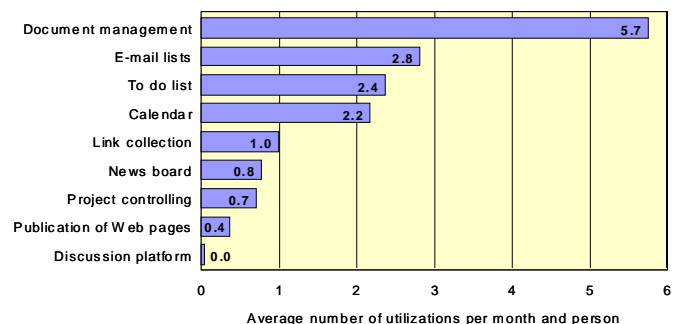
We can thus confirm our first hypothesis to be tested:

H1: Services for archiving and project documentation are the ones which are most likely to be used by the project team members.
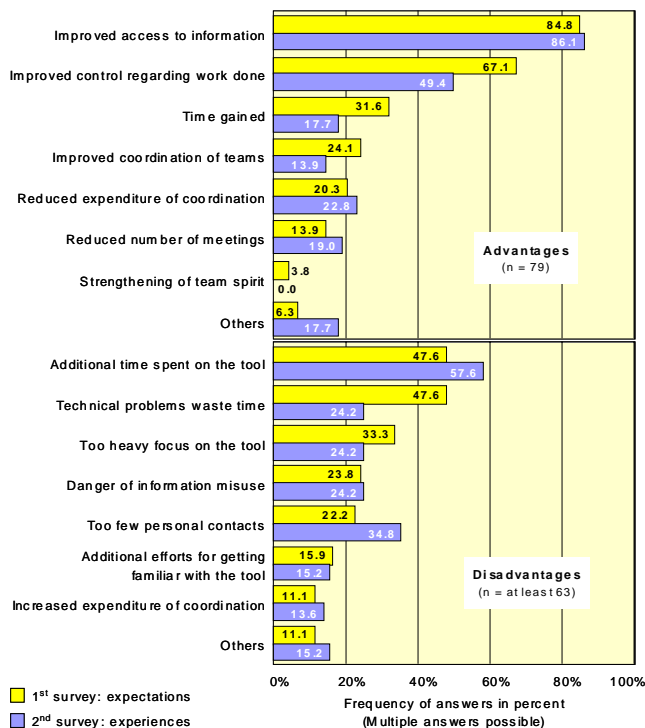
5.2 Advantages and disadvantages of platform use

Using a groupware platform entails advantages and disadvantages. The main advantage expected by the participants was an *improved access to information*. As fig. 2 indicates, these expectations were completely fulfilled and even topped by the experiences the users made with webcorp. In second place, users expected *improved control regarding work done*, which was not completely met by webcorp. The same applies to the hopes for *time gained* where the improvements in time management were obviously not completely achieved. In the case of the criterion *improved coordination of teams*, *reduced expenditure of coordination*, and *reduced number of meetings* the actual experiences made with webcorp more or less match the original expectations. Only the *strengthening of team spirit* was not perceived by the users at all.

The main disadvantage of using webcorp lies in *additional time*, which the users have to spend on the tool (fig. 2). Roughly 58 % of the answers account for this disadvantage. Users had already foreseen this concomitant factor of using an electronic platform in the 1st survey. Their predictions were even exceeded by the experiences reported in the 2nd survey. On the other hand, the participants were afraid of *technical problems* which in the end seemed to be a smaller problem than expected (roughly 48 % foreseen against roughly 24 % experienced). The concerns regarding a *too heavy focus on the tool* remained mainly unconfirmed (roughly 33 % against roughly 24 %). *Personal contacts* were clearly reduced with of the use of the tool. In this category users were suspicious but expectations were not exceeded by experiences. The values for the remaining number of perceived disadvantages *danger of information misuse*, *additional efforts for getting familiar with the tool* and *increased expenditure of coordination* correspond with the expectations.

The overall rating of expectations versus real experiences is positive. The participants received what they expected and in some cases their expectations were positively exceeded. As a result of these statements we can also confirm our second hypothesis:

H2: Even if the number of physical meetings among the project team members is high Internet Groupware can still effectively fulfill supporting tasks.

5.3 Development of Internet Groupware Systems over the last three years: an analysis of selected differences between VEGA, plenaxx and webcorp

The analysis of experiences with VEGA in the first year of this study showed that users called for a simpler system with optimized document management services and an integrated E-mail tool [Schubert/ Dettling 2000, 23]. The platform "plenaxx" was introduced as an answer to these requirements. The corresponding analysis of the second year indicated that plenaxx was indeed a simplified and better suited tool [Leimstoll et al. 2001, 24]. The general satisfaction of the users was higher than in the previous year. Plenaxx became a victim of the Internet doom and had to be replaced by a new platform namely webcorp. With the help of webcorp the third year again showed an increase in user satisfaction [Leimstoll/Wackernagel 2002, 31]. Overall, the webcorp platform produces a higher benefit for the project teams than the former platforms.

The acceptance in the use of a groupware system increased over the years and reached a very high level. This can have several reasons: With the introduction of the webcorp platform users could quickly be convinced of the usefulness of the system. Benefits can already be identified in early stages of the process of getting acquainted with the platform. This is also shown by the fact that actual experiences often did not differ much from the initial expectations towards the system. Another possible reason for the increased acceptance on the part of the professors is the existence of a competence center for e-business at the University which increasingly penetrates daily business. On the side of the company representatives the increased acceptance comes along with progresses in the diffusion of Internet technology in Swiss companies [Leimstoll/Schubert 2002].
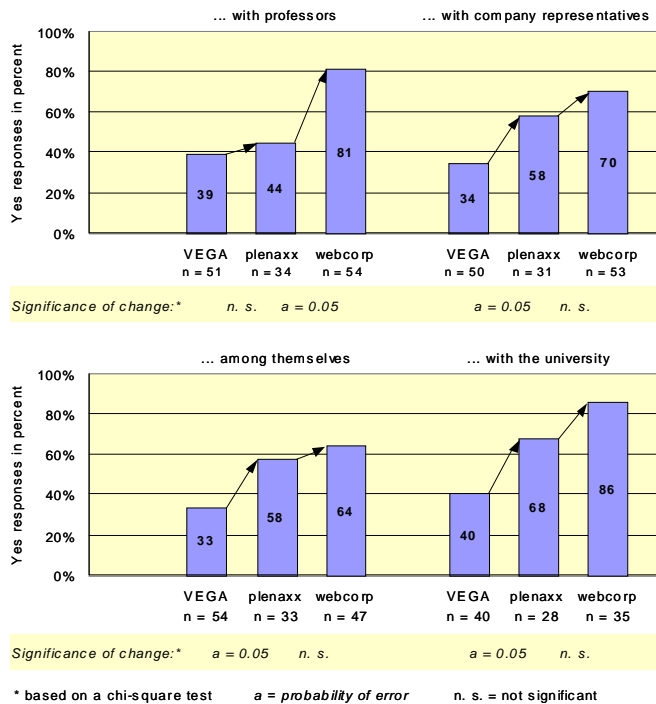
The transition from VEGA to plenaxx made the communication for the students much easier (fig. 3). The differences in the evaluation of VEGA and plenaxx were statistically significant in the case of the communication of students among themselves, with the company representatives and with the university. Only the communication with the professors was not improved significantly from the students' point of view. In the latter case the null hypothesis of homogeneity cannot be rejected based on a chi-square test with a required significance level of 5 %.

The use of webcorp leads to the effect that an even bigger proportion of the students perceives a facilitation of communication with all user groups. This change – compared to plenaxx – is not statistically significant in the case of the communication of students among themselves, with the company representatives, and with the university (fig. 3). It could be an accidental observation. The null hypothesis of homogeneity cannot be rejected based on a chi-square test with a required significance level of 5 %.

However, the communication with the professors changes fundamentally with the use of webcorp: compared to 44 % in the previous year now 81 % of the students state that webcorp facilitates the communication with the professors (fig. 3). The use of webcorp apparently leads to a "catch up effect". This could be explained by the fact that the professors developed a much higher level of acceptance regarding webcorp as compared to plenaxx. In fact the results show a correlation between the degrees of use of these two user groups. But the correlation is not statistically significant due to the low sample size.

The perceived advantages in using the tool remain nearly unchanged compared to the previous years: *improved access to information* and *improved control regarding work done* are still the main advantages (realized as well as expected). The plenaxx users perceived the *reduced number of meetings* more strongly which is actually one of the primary objectives when using a groupware tool. This advantage had obviously already been taken for granted in the third year and the attention to-

Fig. 2: Expected and perceived advantages and disadvantages of tool utilization (all user groups)

Fig. 3: VEGA, plenaxx, and webcorp in comparison: facilitation of communication ...

... with professors ... with company representatives

VEGA n = 51	plenaxx n = 34	webcorp n = 54	VEGA n = 50	plenaxx n = 31	webcorp n = 53
39	44	81	34	58	70

Significance of change:* n. s. a = 0.05 a = 0.05 n. s.

... among themselves ... with the university

VEGA n = 54	plenaxx n = 33	webcorp n = 47	VEGA n = 40	plenaxx n = 28	webcorp n = 35
33	58	64	40	68	86

Significance of change:* a = 0.05 n. s. a = 0.05 n. s.

* based on a chi-square test   a = probability of error   n. s. = not significant

wards this criterion moved a little more in the background when using webcorp.

The disadvantages show a more differentiated picture: while those participants who used VEGA or plenaxx most frequently stated *technical problems waste time* and *additional time spent on the tool*, the webcorp users only complained about the *additional time spent on the tool*. *Time wasted with technical problems* was pointed out less frequently than in the years before. On the other hand *too few personal contacts* are more strongly perceived. This factor is in second place in the list of disadvantages.

The overall trend towards a simplified tool continued over the three years of our survey. Based on the data collected it can be said that usefulness and usability have been rated higher in the last case of webcorp than in the previous years. This is clearly reflected in a higher acceptance of the webcorp platform. We can thus also confirm our last hypothesis:

H3: The maturity of Internet Groupware systems evolves over the years and has now (in 2002) reached a level of maturity where they can effectively support collaborative processes among project team members.

6 CONCLUSIONS

The study shows that the project participants are to a great extent ready to use an Internet-based groupware system for the support of their consulting jobs. The focus of their use is on the central document container, followed by the E-mail distribution lists, the to do list, and the calendar. A series of further webcorp services was only scarcely used.

On the one hand, the main advantage is an improved access to information. On the other hand, users deal with an increased effort for the orientation in the tool (learning process). The overall rating shows that webcorp facilitates the work in the eyes of the participants and the various gains in efficiency and effectiveness were assessed positively. The comparison between expectations towards the system and perceived experiences were mostly in accordance with each other and did not differ greatly. This shows that the tool is very intuitive and users can easily assess its value.

The empirical study about the use of an Internet-based groupware tool allows conclusions about the maturity of technology and the acceptance of the medium Internet within the professional world of student groups. It has to be taken into consideration that the students are mostly between 20 and 30 years old and thus not representative for the active population (employees). It should be assumed that students have a more than average qualification for the use of electronic media and have more experiences than an average person. Their acceptance is likely to be higher. We will have to wait some more years before the dissemination of Internet reaches the same level in everyday business life.

7 FUTURE RESEARCH

For the last three years we had to rely on the users' assessments of the intensity with which they used the groupware tool. In the coming year we are going to extend our research into a quantitative analysis of the use of the platform with the help of log file analyses. We intent to compare the real number of accessed services with the appraisal given by the participants. We should thus be able to verify their statements.

For the further development of groupware systems we draw the following conclusion: The use of the system should be very intuitive so that users who do not access the platform frequently (maybe only once a week) can easily navigate in the system. For frequent users (daily use) performance is of highest importance. Speed should not be impeded by an excess of additional services.

The handling of Internet groupware apparently implies a great learning effort. Nevertheless, this effort seems to be worthwhile for a well-engineered system. Three quarters of the participants indicate that they would use this platform for future projects.

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