E-MAGINE

An Evaluation Method to Assess Groupware In Use

Mirjam A.A. Huis in 't Veld

Waar mensen centraal staan, kan ICT verbinden.

E-MAGINE
An Evaluation Method to Assess Groupware In Use

PROEFSCHRIFT

ter verkrijging van de graad van doctor
aan de Technische Universiteit Delft,
op gezag van de Rector Magnificus prof.ir. K.C.A.M. Luyben,
voorzitter van het College voor Promoties,
in het openbaar te verdedigen op maandag 29 augustus 2011 om 15.00 uur

door Mirjam Alida Antoinet HUIS IN 'T VELD

doctorandus in de Cognitiewetenschap
geboren te Almelo.

Dit proefschrift is goedgekeurd door de promotor:
Prof. dr. J.H.T.H. Andriessen

Copromotor:
Dr. R.M. Verburg

Samenstelling promotiecommissie:

Rector Magnificus,	voorzitter
Prof. dr. J.H.T.H. Andriessen,	Technische Universiteit Delft, promotor
Dr. R.M. Verburg,	Technische Universiteit Delft, copromotor
Prof. dr. ir. A. Verbraeck,	Technische Universiteit Delft
Prof. dr. M.H. Huysman,	Vrije Universiteit Amsterdam
Prof. dr. J. Jansz,	Erasmus Universiteit Rotterdam
Prof. dr. K. Lauche,	Radboud Universiteit Nijmegen
Prof. dr. J.M.C. Schraagen,	Universiteit Twente

This dissertation is financially supported by the Faculty of Technology, Policy and Management of Delft University of Technology.

Printing: GVO drukkers & vormgevers B.V. | Ponsen & Looijen, Wageningen
Cover design: Joke van Lavieren

ISBN: 978-90-6464-491-7

Table of Contents

1

Introduction

1.1 Introduction

The nature of work in current organisations is changing. Corporate activities have become more complex, dynamic and global, and there has been a continued shift from production-based to service-based and knowledge intensive work environments. Knowledge sharing and learning are increasingly seen as crucial to organisational success; these processes have therefore received much attention. Primary processes in organisations are (mostly) either knowledge processes or are strongly supported by these processes. In particular, knowledge sharing across departments, functions or geographical locations, is discussed as a core organisational competence for many (if not all) organisations, not just knowledge intensive companies (Newman, 1997; Davenport & Prusak, 1998). In addition, rapid market changes result in a constant need for updating and renewal of knowledge. In large organisations necessary knowledge is developed at many locations in the organisation and to be effective this knowledge must also be available at many other locations in the organisation. At the same time these locations are often dispersed, sometimes even worldwide.

Parallel to these developments are the rapid developments in information and communication technology, and especially in web-based technology. These developments have enabled employees to share knowledge and information, although they are geographically dispersed. In this way, internet technology overcomes many of the problems of communication associated with distance and time (Newell, Scarbrough, & Swan, 2001). The newly developed ICT applications support communication and interaction at a distance and central information storage for dispersed teams.

These changes have resulted in increasing attention for the field of knowledge management, and in the rise of dispersed groups. Knowledge management is the name given to the set of systematic and disciplined actions that an organisation can take to obtain the greatest value from the knowledge available to it (Davenport & Prusak, 1998). Dispersed groups form essential elements in the knowledge strategy of organisations and are important for organisational innovation. In most of these groups essential knowledge is exchanged and new knowledge is created as part of their collaboration processes or even as a main goal. The groups are known to exist in different 'constellations' with different names and different characteristics, but share their 'dispersedness' and their objective of knowledge sharing. As knowledge carriers, these groups contribute to the sharing of knowledge throughout the organisations. They can be virtual teams or knowledge (sharing) communities (also referred to as 'Communities of Practice' (Lave & Wenger, 1991)). In this thesis I will refer to these groups as *dispersed knowledge groups*.

Hutchinson (1999) presents a number of reasons for the rise of dispersed groups, or virtual groups as he calls them, in organisations. He mentions cost-reduction: teleworking and flexible workplaces are less costly for organisations than the traditional one-employee-one-desk strategy. Dispersed groups further help to handle globalisation, for they enable organisations to increase the geographical dispersion of activities. In addition, the groups are more flexible, and thus more responsive to market requirements. Hutchinson further mentions the organisational consequences: virtual groups are putting networks of experts at the centre of productive work, instead of the traditional bureaucratic hierarchies. In this thesis, however, the focus is on the more technical reasons mentioned by Hutchinson: the existence of enabling technologies and the possibility of information capturing. The current state of the art in information and communication technology enables team members to access one another easily, although they are dispersed. In addition, this technology offers the possibility to capture, organise, store, and reuse the information developed by the groups, even when their members are dispersed (Hutchinson, 1999). Davenport and Prusak also pinpoint the relevance of networked computers in advancements in knowledge management strategies: “The low cost of computers and networks has created a potential infrastructure for knowledge exchange and opened up important knowledge management opportunities. (…) the communication and storage capabilities of networked computers make them knowledge enablers.” (Davenport & Prusak, 1998, p. 18)

Software that supports collaboration in groups is often referred to as groupware. Or, as Coleman (1995) states: “Groupware is an umbrella term for the technologies that support person-to-person collaboration” (p. 3). The broad definition of groupware involves a wide range of applications such as e-mail and other internet communication tools, collaborative technology platforms, group meeting support systems, and videoconferencing support. In this thesis I use groupware to refer to *information technology platforms intended to support dispersed groups*. These applications supply a range of features united in one, mostly Internet-based, collaborative platform. Examples of services provided by these platforms are electronic message distribution, distributing and storing of electronic documents, scheduling, voting, and having off-line discussions.

Groupware has created many opportunities for groups to collaborate, but has also introduced many challenges. When to use what kind of groupware? And why are some groupware applications in one situation successful in supporting the group but not in other situations? Often much money and effort is spent on (the implementation of) a groupware application. However, in the end it may turn out that the application is not used at all. Users may complain about the application, about its features, about usability aspects, or about all of these aspects (Andriessen, 2003). As a result, there is a lack of clarity on how such technologies can be best deployed (Barret, Cappleman, Shoib, & Walsham, 2004). In this thesis I want to provide more insight into these issues by developing a groupware evaluation approach, because structured evaluation of groupware supports the formulation of answers to these questions and may prevent or resolve undesired outcomes in the early phases of implementation, or even later in the process. In other words evaluation of groupware can inform adjustments that are needed to successfully support dispersed groups. In this manner it can improve ICT support for groups. The groupware evaluation approach to be developed in this

There are several reasons why the evaluation of groupware applications is complex. “In principle, evaluation should be a significant check of a system’s capacity to deliver what is required of it.” (Twidale, Randall, & Bentley, 1994, p. 441). However, the important role of the (social) context in which groupware applications are used makes it impossible to evaluate an application in isolation (Grudin, 1994b). And, vice versa, the introduction and use of a technical system may have an impact on several aspects of the social system. It may impact on how work processes are organised and how people collaborate. Or, as formulated by Giddens, the social structures are both a condition for and a consequence of the social action (1984; DeSanctis & Poole, 1994). And, when social action refers to the collaborative use of the groupware application: the social system is both a condition for and a consequence of using this application.

Existing evaluation methods mostly focus on one aspect of this complex context, such as usability. Or the methods imply an ethnographic approach in order to identify all possible relevant contextual aspects (Crabtree, 2003). These ethnographic approaches are mostly very time-consuming. In their review of groupware evaluation approaches Pinelle and Gutwin (2000) stress the need for evaluation methods that are more practical in terms of time and costs. They further stress the importance of evaluations that involve a real world setting: the focus of evaluation should shift toward the users and the organisation. Existing evaluation approaches focus too much on evaluating the groupware system itself, their results are less useful once the groupware tool is implemented and used in an organisational setting. An evaluation approach should be able to handle the multitude and complexity of factors that may influence the successful use of groupware systems. This calls for socio-technical approaches which incorporate a socio-technical perspective, advocating the joint optimisation of the technical and social system. This view on evaluation is related to the socio-technical systems approach originated from organisational development and design. The socio-technical systems approach to complex organisational work design recognizes the interaction between people and technology in workplaces. It views the organisation as an open system that needs to be structured and designed in such a way that the two important subsystems maximally integrate: the technical (task) subsystem and the social subsystem (Moorhead & Griffin, 1995). Here, I apply the concept socio-technical to denote that not only technical but also social aspects, including their joint optimisation, are of importance when developing a software evaluation approach.

1.2 Research objectives

The aim of this research project is to develop an evaluation approach that supports dispersed knowledge groups in the assessment of the *usefulness* of a groupware application for sharing knowledge, where usefulness is defined as '*the quality of having utility and especially practical worth or applicability'* (Merriam-Webster Dictionary). Or, as Nielsen (1993) defines it: *'usefulness is the issue of whether the system can be used to achieve some desired goal'* (p.24).

The evaluation approach has to support dispersed knowledge groups in establishing a suitable, efficient, and effective way of using groupware in achieving their goals. Together these elements constitute successful use. Usefulness is thus assumed to be a predictor for successful use. The approach should enable dispersed knowledge groups to evaluate their current use of a groupware application with the support of a usability expert and decide on adjustments or alternatives. This implies that the evaluation approach does not focus on groupware applications under development. The name of the approach is derived from E-MAGINE, the acronym for Evaluation Method to Assess Groupware In Use.

In developing E-MAGINE this thesis contributes to the scientific body of knowledge on software evaluation approaches, especially on the question of how contextual factors can be integrated into these approaches. This integration will also entail an integration of disciplines, such as usability engineering, human-computer interaction, social psychology and organisational psychology. This interdisciplinary approach should lead to an integration of the knowledge from these disciplines on the facilitation of groups. Moreover, it aims to gain a deeper insight into factors that facilitate successful groupware support in the context of dispersed knowledge sharing groups.

This research project adds to existing approaches and literature by focusing on the practical usefulness of the evaluation approach and on an integration of disciplines. In this manner, the approach takes into account the diversity of factors that influence successful use of groupware.

In line with the research objectives, initial design requirements for E-MAGINE are:

1) concentrate on the support of dispersed knowledge groups
2) concentrate on groupware in use

These first two design requirements indicate the *focus* of the evaluation method, i.e. it concerns the WHAT of the evaluation method. Based on the literature discussed in the previous section, I will also apply the following design requirements for the evaluation method:

3) follow a socio-technical approach
4) be practical (cost-effective)

Design requirement 3 and 4 give direction to *process* aspects of the evaluation method, i.e. the HOW aspects.

1.3 Research strategy

All evaluation processes have common features: these all have a purpose, and in all cases there is an object being evaluated and a process through which one or more attributes of this object are judged and are given a value (Karat, 1997). The same holds for E-MAGINE, the evaluation approach that is developed in this thesis. In order to generate a complete evaluation approach all three components need to be defined or designed. The three components are highly interrelated, e.g., the object of evaluation determines which evaluation process is appropriate. The purpose of evaluation is described above, but needs further specification. Specification of the purpose has implications for the object and process of evaluation. This implies that an iterative and incremental approach is needed to develop a coherent approach. This iteration is preferable as it leaves more room for dealing with the complexity of the subject.

In first instance, my strategy for developing E-MAGINE is open and explorative. No predefined evaluation approach or structure guides the design of E-MAGINE. The assumption is that an open attitude in the development of the evaluation approach provides the best opportunity to make the approach meet its design, including the requirement to take the context-of-use into account. It is further assumed that input from practice and theory should be combined in order to come to a useful and valid approach. Input from practice increases the practical usefulness of the evaluation approach. Theory on the other hand contributes in two ways to the development of the evaluation approach. Firstly, developing the necessary knowledge for the evaluation approach in a scientifically sound way should result in a reliable evaluation approach. Secondly, with this procedural scientific approach the research is also expected to benefit the scientific body of knowledge on groupware facilitation (Limburg, 2002).

This research project consists of three phases in which input from practice and theory is generated in an iterative way. In the First Phase of research, input from practice and theory is applied to specify design requirements and to create a first outline of the evaluation approach. This first outline forms the structure of the evaluation approach that is assumed to meet the identified design requirements. The details of this outline are filled in and tested by observations in case studies and by discussing the outcomes with case respondents in the Second Phase of the study. In the Third Phase the evaluation approach is applied in a case study, after which the theory is used to reflect on the outcomes. This last Phase will conclude with a reflection on the final version of the evaluation approach. In all, the research strategy consists of an iteration of phases of analysis and design. Within each phase several steps are taken to achieve that phase's objective. For each step a more detailed research strategy is presented in the relating chapter(s). However, as case studies form a main element in the development of E-MAGINE, this research strategy is discussed in more detail here.

1.3.1 Case studies as a research strategy

The empirical body for the evaluation approach is mainly provided by case studies. This research strategy is chosen because case studies support answering 'why' questions (Yin, 2003), see also Table 1-1. To be able to develop a groupware evaluation method it is necessary to study why groupware applications support knowledge sharing well in one situation and not in other cases. Another reason for applying case studies as a research strategy is that I want to study groupware usage in daily practice. This implies that as a researcher I have no control over behavioural events (the second column in Table 1-1). It also implies that the research focuses on contemporary events: groupware usage in currently existing groups in organisations.

Yin (2003) also defines the scope of case studies. "A case study is an empirical inquiry that i) investigates a contemporary phenomenon within its real-life context, especially when ii) the boundaries between the phenomenon and context are not clearly evident." (Yin, 2003, p. 13). In other words, applying case studies is a suitable research strategy when a phenomenon needs to be studied in its real-life context. They are especially relevant when the phenomenon cannot easily be separated from its context. This scope is also relevant for my research purpose. Case studies allow a full and in-depth description and an understanding of complex and highly interrelated issues, or dynamics in their real-life practice. Since both the real-life context and the unclear boundaries between the phenomenon and its context are present in this project the need for case studies is evident. In this project the phenomenon studied is the dispersed knowledge group that has groupware at its disposal. As one of the aims of this thesis is to develop a practical evaluation approach, knowledge of groupware usage in common settings (in its real-life context) is relevant, and these dispersed knowledge groups need to be studied in their context. In addition, both the group and the groupware application, together constituting the phenomenon under study, can hardly be separated from their context. The group and its members are functioning in the context of an organisation and group members are members of other groups and structures in the organisation as well. In the same manner the groupware application is a component of a larger ICT system provided by this organisation. As a result the phenomenon studied here i.e., dispersed knowledge groups that have groupware at their disposal, cannot be strictly separated from its context in this research project.

Table 1-1 Relevant situations for different research strategies (Yin, 2003, p.5)

Strategy	Form of research question	Requires control over behavioural events?	Focuses on contemporary events?
experiment	how, why?	yes	yes
survey	who, what, where, how many, how much?	no	yes
archival analysis	who, what, where, how many, how much?	no	yes/no
history	how, why?	no	no
case study	how, why?	no	yes

Case studies can be used in many ways. The categorisation provided by Scapens (1990) (in his paper on case studies in the field of management accounting) is useful to structure the cases in this thesis. He distinguishes descriptive case studies, illustrative case studies, experimental case studies, exploratory case studies, and explanatory case studies. Scapens explains these categories using the setting of management accounting. Descriptive case studies are applied to describe accounting systems, techniques and procedures currently used in practice. Illustrative case studies attempt to provide illustrations of new and possibly innovative practices. Experimental case studies can be used to examine difficulties of implementing new accounting procedures and techniques. Exploratory case studies can be used to explore reasons for particular accounting practices. Last, explanatory case studies are applied when the purpose is to explain reasons for particular accounting practices. Scapens adds that the distinctions between these categories are not necessarily clear-cut. However, they are useful to denote the various uses of case studies. I will therefore use his categorisation to specify the different uses of case studies in this research project.

This research starts with three explorative cases. These case studies represent preliminary investigations which are intended to generate ideas and hypotheses on how the evaluation approach should be developed. Their purpose is to explore reasons for successfully using groupware to share knowledge in dispersed knowledge groups. The assumption is that factors determining successful groupware usage need to be identified which can then be used as input for the evaluation approach. The cases are used to gain a first notion of the enablers and barriers of using groupware in dispersed knowledge groups. They are further used to gain deeper insight into the context in which E-MAGINE is intended to be applied. In this First Phase several methods of data collection are applied. In most case studies interviews with facilitators and members are combined with observations at group meetings. In addition, organisational documents are studied; these describe the goals of the groups and the facilities provided for the groups amongst others.

In the Second Phase of the study, two case studies are used for an in-depth exploration of the enablers and barriers for using groupware in dispersed knowledge groups. So the case studies are used to specify and validate details of the evaluation approach. In this phase the same research activities as in the First Phase are applied. However, the Second Phase is more in-depth and builds on the results of the First Phase. The first list of enablers and barriers resulting from the First Phase of research is discussed with several group facilitators. Further, more interviews and more extensive interviews are applied. In addition, a small survey for group members is applied. The last case study in this phase is an experimental one: here first versions of the evaluation instruments developed for the E-MAGINE evaluation approach are applied in a dispersed knowledge community.

In the concluding phase of this research project, Phase III, the entire evaluation approach is applied in an experimental case study. In line with Scapens, the study is used to: "... examine the difficulties of implementing the new proposals and to evaluate the benefits to be derived." (p. 265). Here, all steps of the evaluation approach are applied and reflected on by the researcher. When applicable, the facilitator and group members of the group under study are involved in the reflection as well. In total the research project comprises 7 case studies.

1.3.2 Selection of case studies

A proper selection of case studies is important (Eisenhardt, 1989). The cases in this research project all concern groups in a dispersed setting facilitated by a groupware application. Further, in all groups knowledge sharing is a main goal or a prerequisite for achieving their main goal. The groups range from communities to teams; it is assumed that E-MAGINE will be suitable for this range of groups as a result. More details on the selection of the cases are discussed in the chapters that present the case studies. These chapters also present the research approach in more detail, as this approach varied according to the availability of groups and individuals, as well as other data sources, such as company documents.

Access to some of the dispersed knowledge groups was generated in the context of the research project 'Knowledge Sharing in Telematics Supported Distributed Teams and Communities of Networked Organisations' (CommShare)[1]. In this project the concept of 'knowledge sharing communities' was thoroughly studied. It focused on the identification of conditions for success of knowledge sharing communities. These conditions were derived by comparing communities to task teams and by studying them in practice.

1.4 Thesis outline

The outline of this thesis follows the line of activities of this research project as presented above. In general each step in the development of E-MAGINE is discussed in one chapter, see Figure 1-1.

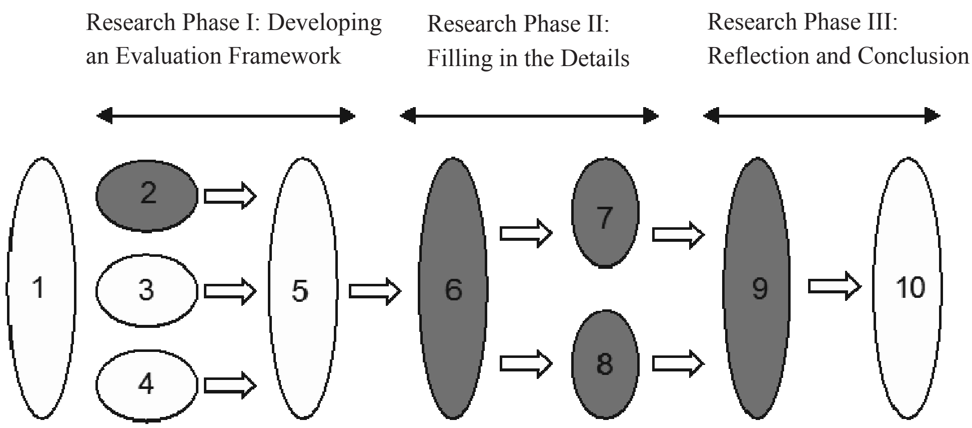


Figure 1-1 Outline of this thesis; grey ovals depict chapters that present case studies

Discussion of Phase I of the development of E-MAGINE starts in Chapter 2 and ends with Chapter 5. Chapter 2 presents some explorative case studies executed in order to gain insight into the practice of using groupware to support knowledge sharing. Successful and less successful examples are discussed. Insights from these cases will be used as input for a first framework for E-MAGINE. Chapter 3 describes the context in which groupware is used in more detail. It provides more insight into the concepts of knowledge management, distributed work, (virtual) groups, and groupware. Specific attention is given to the challenges related to the ICT-facilitation of knowledge sharing processes in dispersed

[1] Prof. dr. J.H.T.H. Andriessen supervised the three year project in which several researchers participated. The CommShare project was part of the 'Telematics Innovation in the Networked Economy' programme and was sponsored by the Telematica Instituut in the Netherlands. The Telematica Instituut is now referred to as Novay.

groups. This chapter also delivers input for the design requirements for E-MAGINE. Chapter 4 starts with an overview of the developments in the field of software evaluation. After this introduction existing evaluation methods and their shortcomings with respect to the design requirements as identified in Chapters 2 and 3 are presented. The chapter concludes with the full list of design requirements for E-MAGINE. Chapter 5 presents the first framework of E-MAGINE. The insights from the explorative case studies and literature are used as a starting point. This chapter concludes with a strategy for the Second Phase of the research project: filling in the details of the framework for E-MAGINE.

The Second Phase of research consists of three chapters. In Chapter 6 two case studies are applied to fill in the details of E-MAGINE. In Chapters 7 and 8 the outcomes of these case studies are applied in order to develop two separate evaluation instruments that will be part of the E-MAGINE evaluation approach. The E-MAGINE evaluation approach is presented after this Second Phase of research.

In the Third Phase of research the evaluation approach is tested and refined. In Chapter 9 E-MAGINE is applied in a new case study. Implications of this test are used to improve the approach. The concluding chapter, Chapter 10, consists of a reflection on the research project and concludes with strengths and limitations of the evaluation approach presented.

Research Phase I:

Developing an Evaluation Framework

2

Meeting Practice

2.1 Introduction

This chapter presents the first case studies of this research project. These case studies represent preliminary investigations which are intended to generate ideas and hypotheses on how the evaluation approach should be developed. Their purpose is to explore reasons for successfully using groupware to share knowledge in dispersed knowledge groups. The Chapter starts with a description of the applied research activities in the case studies, after which an overview of the groups studied is provided. It subsequently discusses the cases one by one. The cases are all presented using the same structure (a similar structure is used to describe the case studies in Chapter 6): The sections first provide a description of the context, subsequently the applied research approach is presented, with a specification of the number of groups studied and the number of interviews that were conducted. In the ensuing section the groups are described in detail. The case descriptions conclude with the most important observations. This chapter ends with a list of the identified enablers and barriers in successful use of groupware to support knowledge sharing.

2.2 Research approach

2.2.1 Objective

The objective of the first step in the development of E-MAGINE is to gain more insight into the reasons for successful and non-successful use of groupware in dispersed knowledge groups. The case studies are explorative in nature and focus especially on the opinions of users on these groupware applications. Observations are used to gain a first notion of the enablers and barriers for successfully using groupware to share knowledge in dispersed knowledge groups and to gain insight into the dynamics of these groups. In a later phase the enablers and barriers will be validated and extended in other, in-depth, case studies. These other case studies are presented in Chapter 6. As is explained in the Introduction Chapter of this thesis, a basic principle for E-MAGINE is that it should support dispersed groups in practice. Therefore, the case studies are further used to gain insight into the context in which E-MAGINE will be applied, i.e., dispersed knowledge groups.

2.2.2 Strategy

The cases in this research project concern groups in a dispersed setting which are facilitated by a groupware application. Further, in all groups knowledge sharing is a main goal or a prerequisite for achieving the group's main goal. The same holds for the cases in this chapter. Besides these commonalities, the groups studied were very diverse, as was the context in which they operate. The cases were selected because of their diversity, this diversity fits the explorative nature of this first research phase. In addition, as the evaluation approach aims to support diverse dispersed knowledge groups, its content and its design requirements should be based on the input of diverse groups. The main characteristics of the groups are summarised in Table 2-1.

Table 2-1 Overview of the case studies

	Case I	**Case II**	**Case III**
Groups	Student teams INTEND	Communities at Unilever	Communities at Delft Cluster (consortium)
Groupware application	TeamScope	Quickplace	BSCW and other
Members (number)	Students (4-8)	Experts; employees of Unilever (20-25)	Experts, employees of the participating organisations (15-100)
Goal/Task	Assignment for study credits	Develop innovative processes for product development	Share knowledge between organisations
Physical setting	The Netherlands and America	Internationally dispersed	Regionally dispersed in the Netherlands

The first case study focused on student teams. Access to the student teams could be gained as the Delft University of Technology, the institute facilitating the development of E-MAGINE, also was one of the initiators of the research setting. Further, data collection in this case study was extensive, standardized, and most of the data were automatically generated (e.g. log files). In addition to these standardised methods I observed the groups myself and held interviews with the team members. In that manner I could collect additional data to better inform my own research questions as well. The second case study consists of communities in an organisational setting. With the aim of diversity in mind, these groups form an interesting and relevant contrast with the first type of groups. The organisation at hand had several examples of successfully functioning communities and was willing to share its experiences. The third case study focuses on starting communities functioning in a network organisation. These communities thus not only functioned in a different organisational setting than the communities in the first two cases, but also were in a different phase of a group life's cycle.

The research approach and number and types of groups studied within each company varied according to the types of groups present within the companies, as well as the availability of groups and individuals, and organisational and management requirements. In most case studies interviews with facilitators and members were combined with observations at group meetings. These interviews and observations focused on gaining an overview of the group and its activities in general and more specifically on its use of groupware. The objective was to gain insight into aspects such as the type of groupware that was available, group characteristics of the group under study, motivations of group members to use the groupware, kinds of tasks the groupware is applied for, the type of support for the group and the type of support in relation to the groupware provided. This information was asked for in interviews, derived from observations at group meetings, or specified by studying the groupware application. In the next sections the case studies are presented and discussed.

2.3 Virtual teams in the INTEND consortium

2.3.1 Context

The first dispersed group was studied in the context of the INTEnD (International Networked Teams of Engineering Design) consortium. INTEnD was a distributed research project involving multiple longitudinal case studies of geographically dispersed teams conducted by an international team of researchers. It was initiated by Michigan State University (MSU) as an open consortium of universities for the purposes of cooperating on the formation and study of global virtual teams (see Huysman et al., 2003; Steinfield et al., 2001). During spring 2000 I was a member of this consortium and I cooperated in the study of virtual teams. I observed one team myself and shared my observations with researchers who had studied similar teams working in the same research project and therefore under similar circumstances.

Virtual team formation in the context of this consortium occurred as follows. One or more engineering faculties at each of the participating universities recruited students to become a member of a virtual design team. Students were typically senior undergraduates or junior graduate students in various engineering majors. Students had to possess English language skills to be allowed to work on the projects. Whenever possible, the faculty also recruited industry partners – firms with an engineering design project that they were willing to be performed by a student team. Groups consisted of internationally dispersed students who had to collaborate for study credits. All teams were zero history teams, formed at the start of a semester. Most teams consisted of four to eight members from two different locations, with a minimum of two from each location. They worked over an approximately four month period to complete their designs. Only by sharing knowledge were the students able to complete their assignment, as knowledge and information was intentionally dispersed over the locations.

A subset of teams consisted of students from Delft University of Technology (TU Delft) in the Netherlands and students from MSU. From the beginning of 1999 until June 2000 there were 5 teams of this composition. These teams were provided with an ISDN desktop video conferencing system for the duration of their project. These systems integrated real-time audio and video with Microsoft's NetMeeting conferencing software. Hence teams could establish chat sessions, shared whiteboards, and application sharing during their video meetings. In addition, MSU developed its own groupware system called TeamScope (Team Software for Collaborative Project Environments) which included a shared file system, calendar, message board, and a chat application for real time text interaction (see Steinfield, Jang, & Pfaff, 1999 for an overview of TeamScope). TeamScope also provides team members with certain types of so-called awareness information, including notification via the browser or e-mail about recent team-related activities monitored by the system. Examples of such activities are file uploads and downloads, message postings and calendar entries, and real-time information on login status to support the chat feature.

2.3.2 Research approach

Together with a colleague I observed and studied the ways of working of one specific student team in the context of this consortium. The team was called LadderMill C, as they were the third group working at a design by that name. The team consisted of two Dutch and five American students. We observed their video conferencing meetings and interviewed both Dutch members of the team. Furthermore all team members were asked to fill out questionnaires during the project. Three questionnaires (at the beginning, halfway, and at the end of the project) focused on general team-related issues. These questionnaires assessed 1) the extent to which group members achieved real consensus on their designs, 2) the extent to which group members trusted their local and distant team mates, and 3) the extent to which they liked and felt comfortable interacting with their local and distant team mates. In addition, all activities of the students using the groupware platform were logged. During the existence of the LadderMill C team, we, being researchers from the Dutch side, discussed our findings with two colleagues who had applied the same research activities at the American side. To support these discussions we shared our observation notes and interview transcriptions.

The other student teams in the consortium were studied in a similar way. The multi-faceted research approach applied in the consortium enabled researchers to study the distinct collaboration processes from various sites and depths (Steinfield et al., 2001). At the end we had the opportunity to compare our observations for LadderMill C with the findings of other researchers within the consortium who had studied other student teams. In this manner we gained more insight into factors that influenced groupware use.

2.3.3 LadderMill C

The LadderMill C team was formed during spring 2000. Its assignment came from a Dutch industry partner. The team had to design a cable-to-cable connection and a cable-to-wing connection of a wind-driven energy generator 'flying' in the sky, called a ladder-mill. In order to achieve this goal the team members organised video-conferencing meetings and used the TeamScope collaborative tool. The first meeting started somewhat chaotic. It was the first time the team-members communicated using video-conferencing and most students had to learn from scratch how to work with tools like Vtel and Netmeeting. In addition, the Vtel audio connection was not working, so the subteams had to make a phone call to establish an audio connection. After these problems were solved the meeting proceeded smoothly. The students even took some time to socialise and exchanged some jokes. They concluded with scheduling an appointment for the same time a week later. Apparently this time and frequency suited the team, for in the second week they agreed to meet each other every week at this hour.

The weekly meetings became the main way to interact and communicate for the subteams. The number of e-mails sent was very low during the project. The team-members mainly used video-conferencing and TeamScope to communicate with one another. This communication mode resulted in a low level of trust, as was shown by the results of the questionnaires. We used the interviews to find out how this low level of trust had developed.

The mix of socializing activities with task-oriented communication lasted for several video meetings. In the first four meetings the team members seemed to get along really well, as a lot of joking and socializing took place. However, after a while frustrations arose at both sides of the team. The American students were frustrated because they thought the Dutch students kept changing the parameters of the design without involving them in these changes. One of the American students said the following about this:

> *"We worked the first six or seven weeks. The big thing that got us frustrated was we worked with these physical constraints, measurements, and then they called us and they said we have to change what we worked with because they've changed their theory on how it's going to work. [...] We wasted quite a bit of time, the brainstorming, the energy towards stuff that was not ever gonna be used." (American team member)*

In spite of their frustrations the American students agreed in a local meeting to remain nice to the Dutch students. In a later phase they told their observers that they remained polite because they knew the project was almost over. Another reason for not arguing became clear in the last interview with the American students. The American students did not always understand what the Dutch meant. Both groups attributed this to differences in style of education.

The Dutch students on the other hand, were frustrated because they felt the American students did not keep their promises about uploading files on TeamScope. The Dutch students found it hard to say something about it to the Americans because they were not sure whether the Americans kept their promises or not. The Americans reasons for not uploading files were diverse: they started with saying that virus problems bothered them, subsequently they were on a holiday, after that there were technological problems and so on. All reasons provided by the Americans were plausible; the Dutch however were not able to verify whether they were speaking the truth. In the last interview one of the Dutch students said that when they showed the Americans something they had made, the American students would say: “We have exactly the same”, but never showed anything themselves. The Dutch student added that such issues probably would have been easier to discuss if they could have met face-to-face. The student teams however did not have the possibility to meet face-to-face, since they were not provided with a travelling budget.

2.3.4 Use of the application

The LadderMill C team was provided with a range of ICT tools to support their interaction processes. For the aim of this project, I focused on their use of the TeamScope system. This system went down several times at the American side. However, the American subteam mostly waited until the day of the video meeting (Thursdays, 17:00 European Central time zone, which is 11:00 Eastern Time), before they downloaded the files of the Dutch subteam. As a result they did not have any time margin in case the system was down at that moment.

Another typical aspect of using TeamScope was that the American subteam had appointed one of their members as the ‘communication person’. He was responsible for setting up the video-meetings and for uploading and downloading files on TeamScope. In other words, he functioned as a communication node between the American and Dutch students. As a result the American students stayed unfamiliar with the TeamScope and VTel systems and were depended on their communication person to interact through the systems.

Both ways of working created problems in the collaboration with the Dutch students. One type of functionality which was provided by the TeamScope system was ‘awareness’. The system showed a project file activity list, which team members would see when they logged in (e.g. who downloaded which file, who uploaded which file, who commented on which file, etc.) This feature showed that the American students neither downloaded nor uploaded any files before the weekly video-meeting, although the teams had agreed to do so. The second aspect made that the American team members were lost when their communication person was absent. They did not know exactly how to use TeamScope and they could not arrange a video meeting without help from others (support personnel at the American faculty). Still, the team 'sticked' to their way of working.

The Dutch team members had the opinion that some communication processes would have developed better if the team had had the possibility to meet face-to-face. They thought that at least some of the frustrations and resulting distrust might have been resolved in face-to-face meetings.

In the discussion with the observers of other student teams, it turned out to be typical for our team that its members did not talk with each other about their frustrations and growing distrust, at least not inter-locally. Other teams were able to speak out more about delicate issues, although they were physically separated as well.

Students at both sides of the LadderMill C had some remarks about using TeamScope for the storage of their documents. Uploading and downloading files was not easy, and they would have preferred a more user friendly interface. In addition, they lost track of the files they had stored. With hindsight they argued that active structuring is needed to retain an overview of all available documents.

> *"But then it [the file] was located within another folder and I never quite figured out where that is." (American team member)*

> *"At one moment we had many files and they were all put on TeamScope, and no-one felt responsible for structuring these files.(..) Such a structure was definitely needed." (Dutch team member)*

2.3.5 Observations

Although the student teams completely depended on ICT to cooperate between subteams, the groupware application provided was only used in a limited way. It further appeared that, although the starting conditions of the five dispersed project teams were more or less comparable, the teams each developed unique styles of interaction and technology use. They evolved into five completely different teams in terms of their media selection, communication patterns and underlying reasons for enacting their particular communication patterns. In addition, the communication patterns evolved in the early phase of the project. For example, the LadderMill C team established a routine of having a videoconference once a week in the second week of their project. And just as it applied for LadderMill C, although some communication patterns appeared not to be so effective, the teams studied in this consortium did not reflect on it, let alone change it. A final interesting observation is the fact that in the opinion of the team members not all tasks can be performed as well via ICT as in a face-to-face setting. In Steinfield et al. (2001) we present possible explanations for these findings: "In general there appears to be a mutual dependency between team cultures, and the way that the communication technologies are used. These styles of use of technology appeared to be persistent, and such 'media-stickiness' could be a result of teamlearning processes. (…) We observed that teams learn to use a tool and subsequently mutually adapt the tool and the tasks so that they do not need to diverge much from their past experiences. Because of this past learning, path dependency in terms of tool-usage sets in." (p. 9) The observations in this case study will be further discussed in section 2.6.

2.4 Unilever

2.4.1 Context

Unilever is a multinational company specialising in consumer products in the areas of food, cosmetics and detergents. At the time of my study, the company had subsidiaries in approximately 90 countries worldwide and a turnover of roughly 58.8 billion US dollars. Its products were sold in over 150 countries. Investment in research and product development amounted to 1.4 billion dollars in 2002. Unilever had a highly decentralised organisational structure: although corporate decisions were made mainly in London and Rotterdam, the dispersed factories were responsible for operations.

The organisation felt driven to shorten the innovation cycle of its consumer products. For several years Unilever Research had focused on knowledge management as a way of enabling people within the organisation to exchange knowledge quickly. This was mainly delegated to the Knowledge Mapping and Structuring Unit (KMSU) within Unilever. One example of their initiatives to stimulate the exchange of knowledge can be found in the area of food: a few years before our study, Unilever faced problems in the processing of tomato sauce. The company set up a 'knowledge workshop' with experts to deal with this specific problem. The workshop proved to be very successful and the members kept in touch after the event. The workshop appeared to give birth to a so-called 'Community of Practice' (CoP), an unforeseen phenomenon (see Huysman & de Wit, 2002 for a description of this development). A Community of Practice within Unilever is a group of experts that continuously exchanges knowledge and information and in that way intends to keep up to date and to develop new knowledge. The successful interaction of this first group of experts led to the initiation and facilitation of other communities within Unilever. Access to this organisation and its communities was generated in the context of the CommShare research project (see Andriessen, Soekijad, Huis in 't Veld, & Poot, 2001).

2.4.2 Research approach

In this case study I collaborated with two junior researchers and one senior researcher. In order to gain insight into the communities within Unilever we conducted one orienting and three in-depth semi-structured interviews with employees working for the KMSU. Our respondents had initiated and facilitated several CoPs and were therefore familiar with various CoPs within Unilever. However, interviewing these facilitators instead of the actual members meant that we received indirect information on the communities. The semi-structured interviews lasted about 1.5 hours. They were taped, transcribed and subsequently analysed. In the interviews we addressed general aspects of the communities, using a community scan developed in our research group (see Appendix I, in a later phase this list of questions has evolved into the Community Assessment Tool (Verburg & Andriessen, 2006)). I especially addressed aspects of the ICT facilitation of the communities in more detail.

2.4.3 Description of the communities

The communities within Unilever were initiated and facilitated to share and develop knowledge. In general the communities within Unilever focused on developing innovative production processes. The communities had a quite formal structure, several roles were assigned in the community: a group leader, a facilitator and a champion. In addition, the members were selected in a very structured way. Employees were only invited to become a member when the knowledge practice was part of their daily work and when they had proven to be experts in the domain. In this way joining a community became an honour, raising the status of the individual in his own department.

The communities at Unilever had face-to-face meetings on a regular basis. The social part was also a very important aspect of these meetings which did not need extensive facilitation. The members, experts in the field, were so much involved in their ‘practice’ that they could not stop talking about it. They exchanged ideas not only during the official part of the meetings, by giving presentations to each other for example, but also ‘late at night sitting at the bar’. During the meetings communities often initiated subgroups that worked together on a specific assignment, such as the development of a manual to improve the production process.

The members of most communities were divided over areas as large as continents, so Unilever offered its communities the Quickplace groupware tool. Quickplace has a shared directory, a contact list, personal homepages of its members, and a-synchronous discussion possibilities. But it appeared that this platform, or other ICT applications, were hardly used in the communities. Interaction between members mainly took place during the face-to-face meetings, with some exchanges through e-mail. In addition, these e-mails were mostly exchanged just in advance of, or immediately after a meeting and mostly between members that had received a specific assignment during the meetings and thus functioned as a subgroup of the community.

2.4.4 Use of the application

Based on the interviews it can be concluded that most of the communities within Unilever hardly used groupware. The reasons for this were diverse. It was however not the lack of interest of the organisation in facilitating its communities with ICT. On the contrary, as most communities consisted of dispersed members a groupware tool was considered an important supplement to face-to-face meetings. It could support the community to be active between these meetings. A second motivation was that such a tool can support the reduction of costs by reducing travel expenses of the community members.

Despite these insights, Unilever was not pushing the use of groupware platforms at the moment of study. According to the facilitators of the KMSU unit, awareness on the potential contribution of ICT was growing within Unilever. More and more the organisation explored ways to strategically deploy ICT. The KMSU unit took up with these developments by further developing the Quickplace groupware tool and offering the application to communities that asked for it.

When supporting the communities the facilitators of the KMSU unit encountered several technical obstacles. Firstly, it was hard to identify or develop suitable tools. Unilever was divided into different regions: each region had its own software standards and strictly stuck to these regulations. A community dispersed over such regions often ran into the trouble of coping with several different software programmes that were used by their departments. It was one of the reasons to apply Quickplace, a Lotus software product, as most regions had used other Lotus products. This strategy however did not completely solve the compatibility problem. Individuals still complained that making the applications work was harder than ‘just flying there’.

Secondly, the groupware tool could not be too sophisticated, as the internal network infrastructure did not support this. Especially synchronous features such as a videomeeting application could hardly be used, as this demands large bandwidths. For this reason the developers focused first on supplying a-synchronous features in Quickplace.

Most communities (or their facilitators) never asked for a collaborative application that could support the group. Group members did not recognise the added value of such a platform, and stuck to the communication media they were familiar with. They mainly used the face-to-face meetings to interact, and between these meetings they used telephone and e-mail. Actually, these communication tools were mainly used by subgroups which had to prepare an assignment for the next community meeting and needed to interact between meetings.

The interaction patterns in the communities were the reason for one of the facilitators to state that ICT could never replace the face-to-face meetings. These meetings functioned as 'deadlines for actions' and brought 'new life' into the community. Most members had demanding jobs in their daily lives and as a result active participation in the community could not be their number one priority.

Another way to support a community is central storage of community documents. Some communities tried to build such a knowledge repository in different manners. One simple way was storing all emails in one folder. This turned out to be ineffective: active filtering and some sort of structure was needed. In another community the facilitator took care of the storage of documents; a group member needing a specific document could ask him. As a result the central folder not really became a 'community folder'; one always needed the facilitator to gain access to documents.

All in all, although Unilever had taken some first steps in facilitating the communities, groupware platforms were hardly used. As a consequence, there is no knowledge about whether groupware could have had added value to the communities in Unilever, but they did provide insight into a number of barriers for the facilitation of communities with groupware.

2.4.5 Observations

The communities within Unilever developed as a spin-off of a successful workshop, a face-to-face meeting. It seems that this start resulted in communities that focused on interaction in face-to-face meetings. A parallel lesson was identified in the INTEnD case study; groups tend to stick to their initially established interaction pattern. The communities were able to continue this way of working as they were provided with travelling budget by the organisation. In addition, during the face-to-face meetings the community members were detached from their daily working environment and as a result could devote their full attention to these meetings. This way of working suited the communities well: its members had demanding jobs in their daily work-life and found it hard to devote time to the more long-term goals of the communities in this context.

The Unilever organisation however saw added value in facilitating the communities with collaborative platforms. These platforms could increase the frequency of interactions between members and also reduce travelling cost. Despite the recognition of this potential added value of collaborative platforms, the organisation did not push their usage. The potential users did not perceive this added value. Even more, community members often did not interact at all between meetings, except for members active in subgroups working on an assignment for the next community meeting.

A community platform enables not only interaction support but also the central storage of community documents. This functionality was not successfully applied. It appears that just storing all e-mails or documents is not good enough; filtering and structuring activities are needed, an opinion that was shared by the INTEnD team members. Additionally, it seemed that central storage is more likely to become a success when the central folder is accessible to group members without facilitation by a central contact person.

Some technical barriers can be identified as well. It appeared hard to develop a tool that was compatible with other applications that were applied in Unilever. In addition, the available infrastructure was limited, so synchronous features could not be supplied.

2.5 DelftCluster

Communities within a recently established consortium were studied in the third case. The consortium had the ambition to develop into an internationally renowned knowledge centre in their sector. They therefore initiated new communities, and intended to facilitate knowledge sharing in these and existing communities with a groupware application.

2.5.1 Context

Delft Cluster (DC) is a regional network of five knowledge institutions in Delft, the Netherlands, that focuses on research into sustainable river delta development. All of the participants work in the civil and hydraulic engineering sector. The network was formally established in 1999 and was sponsored by the Dutch government for at least four years (with a long-term plan of 12 years). At the moment of my study the organisation consisted of a Supervisory Board, a Board of Directors, a Communications Department, a Programme Directorate (with at least a Scientific Advisory Council and Programme Management), Theme Management, and Project Managers and members. It was a rather formally structured network organisation.

DC had the ambition to develop into an internationally renowned knowledge centre in their sector. To achieve this goal, DC needed to focus on the management of knowledge, in particular knowledge sharing and creation. Several strategies were initiated in order for knowledge to flow among the various organisations – and particularly between knowledge institutions and sector organisations. One initiative was the project called ‘Knowledge sharing in Delft Cluster Communities of Practice’. I joined this project with two colleagues in order to learn about the communities within Delft Cluster. We intended to study the communities in order to identify the conditions that enable or hinder successful functioning. I focused specifically on the technical support and therefore stayed in close contact with two other project members, who aimed to facilitate Delft Cluster communities with a collaborative ICT platform.

2.5.2 Research approach

As a first step data on Delft Cluster communities were collected through document analysis. At that time DC had not created any formal knowledge communities yet. We therefore had to find out ourselves whether these communities existed. We studied several brochures, flyers, and documents such as project proposals and reports, as well as websites. Also, orienting interviews were conducted with researchers dealing with Knowledge Management issues within Delft Cluster. The goal of these initial interviews was for us to become acquainted with the Delft Cluster organisation and the field of civil and hydraulic engineering and to identify the communities that existed in Delft Cluster.

We learned from the initial set of interviews that an extensive survey, referred to as KnowMe, was set up within the context of Delft Cluster in order to gain an indication of its existing knowledge activities. We had the opportunity to scan the answers to this survey. It appeared that ‘communities’ as a term was rather ambiguous, with as many representations as respondents. This led to a diverse list of networks, organisations, and groups that respondents considered communities (or knowledge networks). Despite the ambiguity of terminology, we used this list as an entrance to select respondents for in-depth interviews during the orientation phase. We contacted respondents who had indicated that they participated in several communities (that were not merely organisations) or who had made many comments concerning this item. We tried to select people from various institutions and themes within Delft Cluster. Six respondents were immediately willing and ready to cooperate. Most of these respondents discussed several communities during the interview. Again we used the community scan developed in our research group (see Appendix I) to gain a general overview of the communities. In addition, I focused on respondents’ motivations to use groupware for sharing knowledge with other community members. The interviews were semi-structured and usually took one and a half hours. They were taped, transcribed and subsequently analysed.

In this first round of interviews I found out about an interesting initiative within the consortium. Delft Cluster had launched a collaborative ICT platform in collaboration with one of the communities that was related to the consortium. I interviewed the facilitators of this community and became a member. I further subscribed to the collaborative platform provided to the community in order to observe the activities and interactions on that platform, visited a community meeting, and contacted some members that had subscribed to the collaborative platform as well.

2.5.3 Description of the communities

Based on the interviews we could conclude that the communities that were identified through the KnowMe survey were very diverse indeed. The communities were not exclusively related to the Delft Cluster organisation. Mostly, their members had participated in these communities for many years, even before the official start of DC. As a result we could not identify general characteristics of the communities within Delft Cluster. However, we could learn about conditions that facilitate and hinder the sharing of knowledge within groups (see also Soekijad & Huis in 't Veld, 2002). And I could learn about my focus in the project, the technological conditions that facilitate knowledge sharing.

Respondents discussed their membership of both intra-organisational and inter-organisational communities. Most intra-organisational communities were facilitated by the organisations the respondents worked for. Most inter-organisational groups resembled professional organisations. Researchers who were members used the group to stay up-to-date with developments in their field of research. All members had the same profession and they met at annual conferences. Members of this type of community sometimes join their forces to put their topics on the agenda nationally or internationally. Other inter-organisational groups were less visible however: these groups more resembled ‘old boys networks’. They too shared their profession, but they stayed in contact in informal ways. Members of these groups did not need to formalise these contacts as they met regularly at conferences, in committees and collaboration initiatives such as Delft Cluster.

One specific example of an informal inter-organisational network was a group of about two to three hundred researchers and engineers in hydrology who appeared to have cooperated for many years. They knew who could be considered a community member, they all built on their practice of hydrology in general, and they aimed to develop and share knowledge about their practice. They were often highly expert people in their field. The members met at annual conferences.

A particular initiative in the large community of hydrologists was the development of NHP, a platform for hydrologists in the Netherlands. This platform was created (at the end of 2001) as a virtual platform, supported by an ICT tool (BSCW groupware application), which was developed in order to share knowledge and experiences, to make useful contacts, and to contribute to the acquisition of projects or customers for their members. The platform was developed and supported in collaboration with Delft Cluster. Members were institutions or organisations active in this field of research. I studied this community in more detail. It appeared that although approximately 80 representatives had subscribed to the ICT platform, it was rarely or never used.

2.5.4 Use of the application

Delft Cluster is a consortium that inter-relates a complex network of communities, subgroups and workforces. Most of the senior workers in the consortium have their own relations in the field and use their networks to stay up-to-date. This networking is important and is typical for the knowledge workers participating in the consortium. In facilitating these groups with an ICT platform the facilitators of Delft Cluster encounter several challenges. Some general examples based on the interviews are presented here.

First challenge was that many of the relevant networks were latent and were invisible to non-members. Their boundaries were vague and as a result it was hard to identify the networks and their members. Who should be facilitated? To which goal? The group in itself had no goal, although at an individual level its members aimed to share knowledge, and they used their regular informal meetings to achieve that goal.

One could neglect these latent knowledge networks and decide to facilitate the different subgroups (workgroups) that were active in the consortium. However, it appeared that this led to complicated situations for the individual members. Most participants in the consortium were members of both intra-organisational as well as inter-organisational knowledge groups. If any platform at all, the intra-organisational workgroups mostly used an internal platform (an intranet-like application) provided by their organisation. Inter-organisational groups mostly could not be supported by the same platform, as different organisations often applied different collaborative platforms. As a result, a member of different knowledge groups in the consortium was provided with a number of different platforms. As a consequence he had to learn how to work with different software environments, maintain a personal homepage (curriculum vitae and contact data) at different places, and remember different login credentials for each group. At the same time, as the workgroups in Delft Cluster had overlapping memberships, this employee may need the different platforms to stay in contact with the same people: an unworkable situation according to the respondents. In addition, these subgroups often interrelate in the latent networks and mostly had applied a certain setting of communication tools to interact with one another.

All these interrelated groups and subgroups result in complex individual memberships and in all kinds of different groupware systems: the company intranet and the intranet of Delft Cluster to start with. Respondents argued that they did not have time to learn to work with all these platforms, let alone to regularly check the platforms or upload relevant documents.

Another barrier was created by the firewalls implemented in many organisations. Respondents explained that they were often working at the customers' place, and, as the ICT platform was only accessible from inside their organisation, they could not access it regularly. These restrictions in access are quite common when a firewall is used. This implies that a firewall not only hinders the facilitation of inter-organisational knowledge groups, but also the facilitation of intra-organisational knowledge groups.

Other remarks concerned usability and usefulness aspects of the collaborative platforms. A specific example was uploading a Curriculum Vitae. One respondent had tried to upload his CV to the collaborative platform provided by Delft Cluster. However, despite several trials, he did not succeed and became so frustrated by the user unfriendliness of the ICT platform that he never accessed it again. A senior member of the consortium told he knew he was expected to upload his CV, but in his opinion this was not useful. He knew everyone he needed to know and vice versa. An opposing remark was made by a respondent who was less senior in the field. He mentioned that an overview of group members would be very useful for him to learn about the experts in the field. Unfortunately, CV and contact data were hardly provided by group members, and certainly not updated. An imbalance in needs of community members can be observed here.

Respondents further argued that the ICT platform mainly provided features that supported the sharing of documents. In the opinion of some of the respondents such a feature was not suitable for the type of knowledge they wanted to share. It was hard to make their knowledge and insights explicit by writing it down, and they preferred to share it face-to-face. Respondents were not unwilling to use documents – and thus ICT platforms – to share knowledge, but they argued that it would take a lot of time to make this workable. Central storage of experiences needs some standardisation first in order to make them accessible and readable for all group members. So far no one had taken the time to perform this task.

Some findings only concern the NHP community described above. This was an interesting community as Delft Cluster had tried to use it as a pilot for their community platform. All members of the NHP community were invited and around 80 members had actually subscribed to the platform. I had also subscribed as a member and had observed that there was hardly any activity on the ICT platform: hardly any postings, no reactions to the few postings, and no discussions. Therefore I contacted some members. I sent out a questionnaire to all members of the community, but I received only two responses. In my subsequent telephone calls to some subscribers of the platform they explained that they had only subscribed because they were expected to represent their organisation in the NHP community. However, individually they were not interested in interacting with the whole community, only with certain subgroups. And within these subgroups they had developed their own communication channels. The NHP platform in general was considered a manner to gain an overview of the members and research activities within the consortium. But members were not interested in discussions or other close interactions with colleagues in such a large community. It was sufficient to visit the annual conference. Meanwhile they preferred interacting within the more focused other research groups they were a member of. These reactions formed an unexpected answer to the question of the facilitators of the community. They thought it was the look and feel of the platform that had resulted in its low use rate.

2.5.5 Observations

The Delft Cluster consortium appeared to be a complex context to support knowledge groups. A number of groups are latent and therefore invisible. They overlap with the groups which are formally established, which themselves overlap. Collaborative platforms that are provided to support these groups often require from their members that they change existing interaction patterns and technology use. We have seen in INTEnD and Unilever that groups tend to stick to these interaction patterns and this norm seems to hold for these invisible groups as well.

Knowledge groups in the consortium can be inter-organisationally or intra-organisationally embedded. The five different organisations participating in the consortium have their own intra-organisational collaborative platforms, and because of firewalls they are not suitable for application as a supportive platform for inter-organisational knowledge groups. However, employees of the participating organisations frequently work at the customer’s place: as a result these platforms are not very suitable for their own, intra-organisational, groups either.

To support the knowledge groups in the Delft Cluster consortium, the consortium provided a collaborative platform. It appears that employees in the consortium perceived the platform as competing with all kinds of other knowledge sharing tools available in the consortium. These tools comprise the Intranet of their own organisation, collaborative tools available in their organisation, portals of professional networks they were members of and, last but not least, Delft Cluster's own Intranet platform. All these platforms require that the user learns how to use them, regularly checks them and uploads information.

An interesting finding was the opposing view of two group members on the perceived usefulness of a specific feature of a collaborative platform. A senior member did not want to supply his personal data as he knew everyone he needed to know and they knew him. An opposing remark was made by a respondent who was less senior in the field. In his opinion an overview of all group members would be very useful. As members did not provide this information this feature was not useful for him either, as information was out-dated or lacking altogether.

Another aspect was the perceived suitability of the platform for the task of knowledge sharing. Respondents were not unwilling to use documents and use ICT platforms for sharing knowledge, but they argued that it would take much time to make this workable. Just as in Unilever, active filtering and structuring seems to be needed to make central storage successful.

A final lesson was identified in the NHP community. The platform was not used, which led facilitators to believe that the platform was not sufficiently usable. It appeared however that its members were not interested in interaction with this specific community; they were only interested in interacting with subgroups focusing on more specialised research topics. As a result they simply did not use the platform.

2.6 Conclusions

The goal of this chapter was to explore how groupware is used in practice and to identify barriers and enablers. The case studies presented were applied to identify barriers and enablers of groupware use for knowledge sharing. Several conclusions can be drawn based on the observations of these groups.

Complete dependency on ICT does not lead to intensive use

The groups within Unilever and the INTEnD student teams differed largely in their dependency on a groupware application. Unlike the members of the communities within Unilever, members of the student teams could not meet face-to-face. The students completely depended on ICT for their interaction processes. However, it appeared that even if groups completely depend on ICT, they do not fully use available applications and features. What are the reasons for not using ICT for sharing knowledge? In the next sections a few preliminary answers to this question are formulated.

Groups tend to stick to initially established interaction patterns and technology use

In all three case studies examples could be found of the tendency of groups to stick to initially established interaction patterns and technology use. The communities in Unilever continued their focus on interacting in face-to-face meetings and the INTEnD teams stuck to their developed way of using the available technology. Even the established interaction patterns in the latent networks present in Delft Cluster seemed to interfere with the usage of new available technology.

Technology barriers

A few technical barriers could be identified. The collaborative application was incompatible with other applications used in the organisation. Not every group member could be supported by the application. In another instance the infrastructure had limited bandwidth, disabling the application of synchronous features. Another aspect concerned the firewall which caused limited access to the groupware application. This was especially a problem in inter-organisational groups, although intra-organisational groups with individuals regularly working at the customer's place may be hindered by such fire-walls as well. Providing secure external access to internal (groupware) systems requires additional effort in protecting the organisation. It is easier to apply a strict firewall that denies all external access.

Usability aspects sometimes cause lack of use of the application as well. In other cases the application was not considered useful. Individual users had different opinions on the usefulness of an application.

Barriers not application related

Several non-technical reasons could be identified that functioned as barriers for the use of collaborative platforms to share knowledge. In Unilever, for example, use of the collaborative platform was not 'pushed' by the organisation. As a result some groups were not aware of the potential added valued of these tools.

Another barrier was time related: group members did not have time to learn how to work with the application, much less to regularly check it or upload information. In this respect tools provided by different organisations or different groups were even perceived as being competitive. This perception is especially present when individuals are member of different groups that use different applications, a likely situation in network organisations.

A last barrier was that group members were not interested in interacting with other group members. Facilitators were not aware of this barrier and thought the low usage level was debt to usability problems. However, increased usability of the platform is not likely to increase its usage level in such situations.

No fit between application and task

A last aspect that impeded technology usage was a perceived mismatch between the task of knowledge sharing and the available application. Knowledge that is embedded in experiences is hard to share using a central storage approach, according to the respondents in Delft Cluster. The communities focused on sharing experiences, and their supporting tool facilitated the sharing of documents. In their opinion it was hard to translate these experiences into documents that are as insightful as the experiences. In Unilever a similar barrier was identified. The communities focused on having interactive brainstorm sessions, which also gave life to the communities. In the opinion of community members ICT application were unsuitable to for this task.

2.7 Input for E-MAGINE

The goal of the research activities presented in this chapter was to explore reasons for successful and non-successful use of groupware in dispersed knowledge groups. It appeared that the use of groupware in the groups studied is limited. The cases especially made clear that pitfalls for successful groupware use can be categorised in three groups:

1) factors related to the application;
2) factors related to the group and its context and
3) factors related to the fit between application and task.

Some factors hinder the use of the application; other factors hinder successful use. One factor may have different implications in different settings. In addition, the factors may have moderating and mediating relations. An evaluation method that focuses on the identification of the usefulness of a groupware application should take these findings into account. These barriers hinder the success of the groupware application, but improving the application will not always solve its lack of usefulness. Only when barriers for tool use are dissolved can the groupware application be valued in relation to its usefulness for the group. Textbox 1-1 provides an overview of the barriers for successful groupware support for knowledge sharing identified in this chapter, categorised in the above three groups.

In Chapter 1 initial design requirements for E-MAGINE were presented:

1) concentrate on the support of dispersed knowledge groups
2) concentrate on groupware in use
3) follow a socio-technical approach
4) be practical (cost-effective)

It appeared that a focus of the evaluation approach on groupware in use (design requirement 2) goes well with a socio-technical approach of evaluation (design requirement 3). For, the analysis of groupware usage in practice, as applied in this chapter, indicates that indeed social as well as technical aspects are relevant. In addition, the case studies in this chapter indicate that aspects of these two subsystems should match each other.

The next step in developing the E-MAGINE evaluation method is to build a theoretical framework that comprises the factors identified in this chapter. Chapter 3 is dedicated to this aim.

Findings in Case Studies Chapter 2

General

- Full dependency on ICT is no guarantee for full use of available applications and features.
- Teams tend to stick to initially established patterns of interaction and technology use.
- A groupware application may support interaction between members and central storage of knowledge.

Barriers for groupware usage

Technology

- Applications were not compatible (This was especially a problem in groups that cross organisational barriers).
- Infrastructure was limited.
- The groupware application was perceived as not user-friendly.
- The groupware application was perceived as not useful.
- Easy access to the application was not always enabled.

Tool – Task Fit

- Groupware applications focused on the support of entire communities, whereas in some cases only subgroups were active between meetings.
- In the opinion of users some tasks or interaction processes are not suitable for ICT mediation, e.g., the knowledge sharing task of 'sharing experiences'.
- A groupware application seems more likely to be successful as central storage of knowledge (information or experiences) if active structuring and filtering activities are applied.

Group and context

- Groupware usage was not 'pushed' by the organisation.
- Group members did not perceive added value in using the application.
- Group members were not interested in interaction with other group members.
- Group members did not have time to learn to work with the application.
- If groups cross organisational barriers; group members may be hindered by firewalls to collaborate (this may hold for large organisation with different departments as well).
- Group members may be member of several groups or institutions with separate facilitating platforms. The members perceive these tools as being competitive.

Textbox 2-1 Overview of barriers for successful groupware support for knowledge sharing identified in this chapter.

3

Knowledge Sharing in Groups through Groupware

3.1 Introduction

The aim of this research project is to develop an evaluation approach that supports dispersed knowledge groups in the assessment of the *usefulness* of a groupware application for sharing knowledge. In this chapter the object of evaluation, 'dispersed knowledge groups that have groupware at their disposal', is specified. As indicated by the case studies in the previous chapter, it is not always clear how dispersed knowledge groups can be facilitated optimally using ICT. Chapter 2 also showed that in order to gain more insight into these challenges it is not always sufficient to investigate the available groupware applications to support these groups to interact and share knowledge. Knowledge of groups and group dynamics as well as the context of these groups is relevant. It was learned that all these aspects play an important role in the successful adoption and use of groupware by dispersed knowledge groups.

In this chapter literature on the above-mentioned aspects is introduced. First an overview of group characteristics and group dynamics is provided. Several models that describe groups are discussed: one model is chosen to describe the dispersed knowledge groups studied in this research project. This section is completed with a discussion on virtual and dispersed groups. Subsequently the chapter provides a short introduction into knowledge management and it describes how dispersed groups can be applied as enablers for sharing and creating knowledge in organisations. The subsequent section presents the ICT applications that can be provided to facilitate dispersed knowledge groups. The chapter continues with a presentation of dilemmas and challenges in facilitating these groups using ICT. It concludes with an overview of definitions used and factors influencing the successful use of groupware in dispersed knowledge groups.

3.2 The dynamics of groups

Dispersed knowledge groups provided with a groupware application form the object of evaluation of E-MAGINE. In order to be able to evaluate whether groupware supports dispersed groups in achieving their goals more efficient and effectively, a structure is needed that enables a systematic discussion of these groups. How can groups be defined and what are their characteristics? This section provides an overview.

McGrath (1990) defines a group as "…an intact social system that carries out multiple functions, while partially nested in and loosely coupled to surrounding systems…" (p. 26). This definition can comprise many types of collections of people. They can differ in size, in task focus, in dispersedness, in the manner they interact, in the degree of formality, and in other aspects. Examples of groups are: project teams, workgroups, communities, collections, etcetera. These groups differ in the extent to which their group members depend on each other for achieving the group task, the intensity of their collaboration, the frequency of meetings, the duration of their existence, and so on.

Based on work of several authors Andriessen (2003) refers to 'groupness' as a dimension. Several factors affect this level of groupness, e.g.:

- interdependency of goal and task performance
- duration of the interaction
- intensity of interaction
- continuity of membership
- formality of membership
- number of people involved

The more a collection of individuals have a common task, the longer and more often they interact, the longer and more formal their group membership and the smaller the number of members, the higher their level of groupness. The two extremes of the continuum are formed by 'collection' and 'task team'. In line with Andriessen (2003) three broad categories on this dimension are discerned here: collections, communities, and teams.
Collections: loosely coupled individuals that exchange information on an ad hoc basis. Membership and commonality of interests may be rather vague. Vast numbers of people can be involved, such as thousands of users of an Intranet.
Communities: a group of people that have a common interest and, therefore, interact over a period of time. See the section on Knowledge Management in this Chapter: often communities are considered important knowledge carriers; they are referred to as Communities of Practice.
Teams: including task forces and committees: a group of people with a common goal, high formality and interdependence, co-operating during a clearly delineated time period.

In this project we will focus on the last two smaller types of groups. These types of groups are more common in organisational settings. In addition, the low interdependency between members of collections implies that there is a low relevance for intensive knowledge sharing activities in these groups, which makes them less interesting for E-MAGINE.

In the literature, groups, and especially teams, are mostly described using input - process - output models (see for example Andriessen, 2003; Essens et al., 2005; Forsyth, 1990; Kraemer & Pinsonneault, 1991; Rasker, 2002; McGrath & Hollingshead, 1994). The line of argument in these models is that through group processes, task activities, and group maintenance activities the group contributes to its outcomes. As 'effectiveness' is an important requirement for groups (and especially teams), these models are mostly developed to specify and analyse factors that influence group effectiveness. A recent example of the application of the IPO-model is presented by Carillo & Okoli (2011). They apply the model to examine the relation between input factors, process factors and group effectiveness in a subgroup of the Wikipedia open content community.

Definitions of group effectiveness have been the subject of much debate. Group effectiveness is often measured at two levels: task-related outcomes and group-related outcomes (see e.g. Kraemer & Pinsonneault, 1991). The task outcomes refer to task performance, task effectiveness, quality, innovation, etc. In addition to the task outcomes, the group-related outcomes are considered relevant as they contribute to the well-being and continuation of the group. Examples are group vitality and group cohesion. However, not all authors agree on these two types of outcomes. Hackman (1987) and McGrath (1993) both state that in determining the effectiveness of groups it is not only important to consider task and group related outcomes, but also outcomes on the individual level. McGrath (1993) refers to these outcomes as member support functions; they concern the degree to which participation in group activities is rewarding for the individual group members. Examples are satisfaction, learning and new knowledge, payment and feeling of belonging. These types of outcomes should satisfy rather than frustrate the personal needs of group members. In that manner, the individual is motivated to (further) participate in and contribute to group activities.

A consequence of defining three levels of outcomes as criteria for estimating group effectiveness is that social group processes become as important as task related group processes: both types of processes contribute to group-related as well as individual outcomes. In some definitions of effective teams, these processes are even part of the definition.

The main clusters of factors influencing group outcomes are specified as aspects of the environment, group characteristics and group processes. They form respectively the input and the process factors. On the input side of the model, factors such as individual characteristics (e.g. motivation), group characteristics (e.g. group size), and/or task characteristics (e.g. complexity) are specified. In some models organisational factors are added as well. For organisational factors affect groups and their outcomes as well: For the group it is for example relevant whether the organisation is supportive versus hostile towards it. The group processes form the centre in input – process – output models, examples of group processes specified in these models are communication, coordination, and cooperation.

In this thesis a model is needed that can be used to describe dispersed knowledge groups using groupware. Although the group related aspects referred to in input - process - output models are inseparably intertwined in practice and are not static, they are analytically distinguishable and, therefore, useful for the purpose of this research project. Essens et al. (2005) review several models in their book on team effectiveness. I compared these models with the models of Hackman (1987) and Andriessen (2003). This comparison showed that only the latter model explicitly incorporates a technology factor. Some other models refer to material or team resources in general and some include organisational support as a factor that incorporates technology support. In addition, only two of the models reviewed specify the degree of geographical distribution of group members as a relevant factor, the models of Blendell, Henderson, Molloy and Pascual (described in Essens et al., 2005) and the model of Andriessen. In the other models, this aspect falls within a broader characteristic such as team organisation, or is not referred to at all. For these two reasons, I will use the model of Andriessen to characterize the dispersed knowledge groups in this thesis.

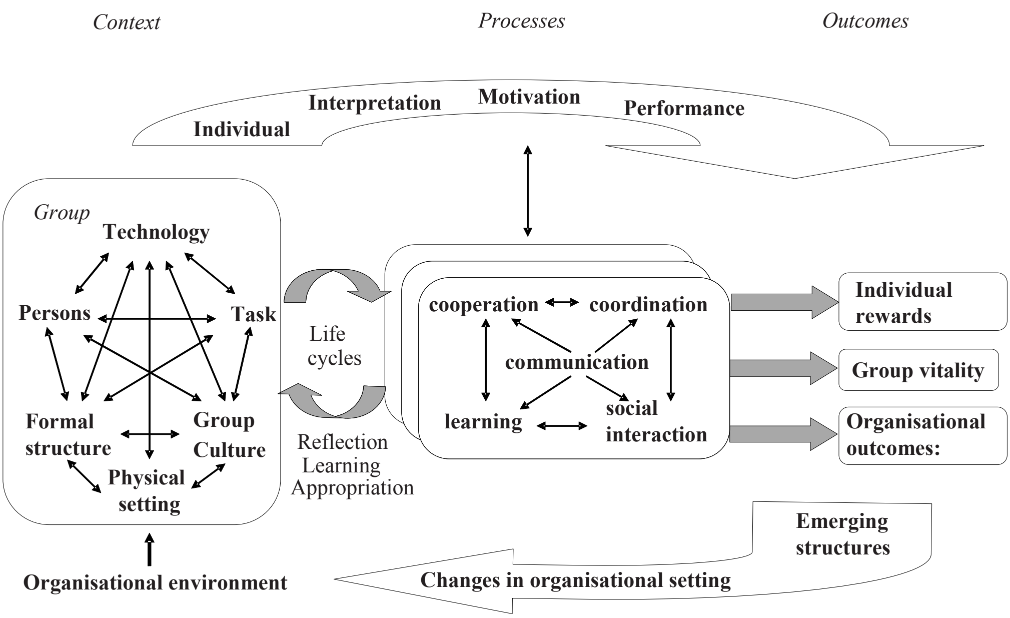


Figure 3-1 The Dynamic Group Interaction Model (Andriessen 2003)

Andriessen (2003) refers to his model as the Dynamic Group Interaction (DGIn) model, it is depicted in Figure 3-1. The model is developed to describe groups in organisations facilitated with technology. It underlines that groupware applications or other available technology are adopted by the group members and adapted to their ways of working through interaction processes and feedback, it is therefore referred to as *dynamic.* This notion is depicted by the arrows between the box input factors and processes, and the several process boxes (see Figure 3-1). The model follows the ideas on relevant group outcomes by McGrath (1993) and Hackman (1987) described earlier and discerns three types of outcomes: individual, group and organisational. It not only incorporates group dynamic theories, including the general notions as described above, but also theories on (individual) technology use and technology acceptance. In the following sections the different aspects of the model will be described briefly (Andriessen, 2003).

The DGIn-model shows that effectiveness of a group can be defined in terms of three types of outcomes, namely individual outcomes, group outcomes, and organisational outcomes. The input factors in the model are the more or less static characteristics of groups. They form the start condition for a (new) group and are often 'given' by the organisation. However, the characteristics can and will change in the course of time and as a consequence of the activities (processes) of the group. These changes are symptoms of the fact that groups pass through various stages in their life (see also Forsyth, 1990). Often, a mature group has found certain stability in its characteristics, but this can be changed again on purpose or through unexpected events.

The following (groups of) input characteristics are distinguished in the DGIn model:

- **Goal/Task Characteristics**: what the group has to do;
- **Personal Characteristics**: the competencies, motives, and other characteristics of group members;
- **Formal Structure**: including formally defined roles and procedures;
- **Group Culture**: i.e. its norms, values, shared attitudes and knowledge;
- **Technology**: (communication) tools available for the group;
- **Physical setting**: the physical setting in which group members collaborate, it incorporates their distributedness;
- **Context**: i.e. a group and its processes are embedded in an **organisational setting**. Its characteristics are important conditions for successful functioning of groups. The organisation provides a.o. the goal(s), and resources for the group. But as important as conditional factors are also the general culture and structure (procedures, production processes etc.) of that environment.

The model distinguishes the following five basic categories of interaction (apart from individual task-performance):

- **Communication**: exchanging information, experiences and views (knowledge), sometimes through the use of communication tools.

Communication is the basis for the following co-operative activities:
- **Co-operation**: working together towards a common product;
- **Co-ordination:** adjusting the work of the group members;
- **Learning**: collecting, sharing and creating (information and) knowledge;
- **Social interaction**: social activities that support group functioning without being explicitly task oriented. These activities contribute to building trust and cohesiveness.

The outcomes discerned in the model are the following:
- **Organisational outcomes**: products related to the task performance, task effectiveness, and innovation;
- **Group related outcomes**: such as group rewards, group vitality, and group cohesion;
- **Individual outcomes:** such as insights, satisfaction, and salary.

Group interaction results in all kind of intended and unintended outcomes. Intended outcomes are related to the goals and tasks of the group. Because of developmental processes, this line of causation is, however, not as simple as suggested by this reasoning. For, the processes in the group change the (input) characteristics of the group in a continuous lifecycle, till the group is dissolved. This process is depicted by the arrow below the boxes in the model.

I will use the DGIn-model to structurally describe the groups under study here: dispersed knowledge groups. This implies that, if in these groups knowledge sharing is the main task, this group task overlaps with one of the group interaction processes of the DGIn-model: sharing knowledge. In addition, as the focus in this thesis lays on the ICT support of sharing knowledge, the other processes depicted in the DGIn-model gain less attention.

Where the DGIn-model seems to be useful to provide a description of the object of evaluation, its underlying and incorporated theories may be useful to specify barriers for groupware usage. The model for example shows that input factors should fit each other, otherwise the group will not successfully function as a group. Theories incorporated here denote for example that ‘Persons’ should have the capacity to perform the group ‘Task’. In one team discussed in Chapter 2, group members did not have time for the group task. One could consider this a specification of this capacity problem. Another notion can be derived when ‘input factors’ are combined with the processes denoted in the box ‘group processes’. A process such as knowledge sharing is more likely to occur in groups with an open knowledge sharing culture. A last example I would like to provide here is an implication of the three outcome boxes. These imply that individual goals are as important as group, or organisational goals, in order for the group to be successful. In Chapter 2 barriers were identified that can be considered a specification: group members were not interested in interaction with other group members. A possible explanation may be that they could not achieve individual goals by participating in the group. In the further development of the evaluation approach more notions incorporated in the model may be useful, this is addressed in Chapter 5 and further.

In this thesis especially the characteristics ‘Physical setting’, or dispersedness is relevant, as the evaluation approach focuses on dispersed knowledge groups. This characteristic is described in more detail in the next section.

3.3 Dispersed and virtual groups

With the proliferation of technology in the work environment, organisations are now able to form teams based on the required expertise and skills rather than individual member collocations (Solomon, 2001). This has resulted in the existence of many dispersed groups. Members of these groups often work at different locations which might even be distributed world-wide, they may thus work in different time zones. The same holds for knowledge intensive groups. In order to be able to share knowledge, these groups do not only rely on face-to-face meetings. Its members may be dispersed and use information technology to support them in their knowledge sharing processes.

When groups depend on ICT for their interaction processes they are referred to as virtual groups. However, the term ‘virtual’ is applied in many different ways. It is used to refer to relying on ICT (Bell & Kozlowksi, 2002; Jarvenpaa & Leidner, 1998) as is the case in the example above. However the term is also used to refer to being geographically distributed (Bell & Kozlowksi, 2002), to working in different time zones, and to being inter-cultural (Jarvenpaa & Leidner, 1998).

Martins, Gilson and Maynard (2004) have provided an overview of research on virtual teams. They start their paper with a discussion of the definitions used to denote virtual teams and state that there is considerable overlap in definitions and that there are small variations in the specifics. The majority of definitions is based on the notion that virtual teams rely on technology-mediated communication while crossing several different boundaries (e.g. Bell & Kozlowksi, 2002; Lipnack & Stamps, 1997; Lurey & Raisinghani, 2001). The most commonly noted boundaries are those of geography, time, and organisation, with the first two being mentioned in almost all definitions.

Traditionally virtual teams are contrasted with face-to-face teams, referred to as traditional or conventional teams. However, the distinction between these two types of teams is not black and white. Virtual teams may range on the extent to which each of the boundaries is crossed. Virtualness then becomes a dimension, or a team characteristic: a virtual team is a team that is more or less virtual. As a result Martins, Gilson & Maynard (2004) define virtual teams as “teams whose members use technology to varying degrees in working across locational, temporal, and relational boundaries to accomplish an interdependent task” (p. 808).

In this definition the *locational boundary* refers to any physical dispersion of team members, such as different geographic locations or different workplaces at the same geographic location. The location dimension can be assessed on the degree to which virtual team members are located in neighbouring offices within the same building, campus, country, etcetera (Palmer & Speier, 1998). The *temporal boundary* encompasses two elements: lifecycle and synchronicity. Where lifecycle captures the extent to which a team is temporary or ongoing, while synchronicity refers to the timing of member interaction on the group’s task. The distribution of virtual team members across temporal boundaries can occur due to member’s locations in different time zones and due to the use of asynchronous communication media (such as email) that limit the ability of team members to interact in ‘real-time’ (Bell & Kozlowksi, 2002). The *relational boundary* refers to the differences in relation networks of virtual team members, that is, their affiliations with other teams, departments, organisations and cultural sub-groups. Differences may result from the fact that team members are drawn from different organisations via outsourcing or through joint ventures among service providers who work across organisational boundaries (Maznevski & Chudoba, 2000; Townsend, DeMarie, & Hendrickson, 1998; Zigurs & Buckland, 1998).

Teams may choose from a broad array of technologies to supplement or replace face-to-face interaction and cross the above mentioned boundaries. The technologies differ in their extent of media richness as communication channels (Daft & Lengel, 1984) and in the extent to which they enable synchronous collaboration. Where media richness refers to the media’s capacity for sending rich information. (The concept of media richness is described in more detail in Section 3.5). Thus, whereas desk-top videoconferencing is relatively high in media richness and in synchronicity, e-mail is low on both. It is now stated that the extent to which a team uses these technologies affects its extent of virtualness as well (Griffith, et al. 2003).

Although being dispersed is a reason for team members to rely on ICT to interact, it does not imply that dispersed teams rely (more) on ICT. On the contrary, Bikson and Eveland (1990) for example found spatial distance to be negatively associated with electronic interaction. On average, people sent about 45% of their messages to others in their immediate physical vicinity. Bikson and Eveland (1990): “Borrowing Orr’s (1986) phrase, we seem to find electronic hallways, but they appear in the main to parallel the spatial ones" (p. 253). In this thesis E-MAGINE should enable dispersed groups to evaluate their current use of a groupware application with the support of a usability expert and decide on adjustments or alternatives. In other words the level of virtuality of these groups are not clear (yet), only the dispersedness of the group members is given.

In describing and studying teams each researcher has his own focus and as a consequence they may highlight other group variables, such as trust (Costa, Roe, & Taillieau, 2001) and cohesion (see e.g. Chang & Bordia, 2001). These two factors are especially relevant in virtual settings, as these are hard to positively affect when group members are at a distance (Jarvenpaa & Leidner, 1998). One of the reasons is that being at a distance more easily results in miscommunications. In fact trust and cohesion relate to barriers for groupware usage in dispersed (knowledge) groups. Apparently if trust or cohesion are not present these groups are unlikely to be successful, as a consequence it is unlikely that they will (successfully) use groupware. However, ICT may also be applied in order to build trust in virtual teams. Thomas and Bostrom (2008) provide examples, they explain that the relation between technology and trust in the team depends on the way the technology is adapted. Technology related adaptation processes are discussed in this thesis under Section 3.6.3.

A related idea is that communication partners have to build a common ground in other to be able to understand each other (Clark & Brennan, 1993): " …without assuming a vast amount of shared information or common ground – that is mutual knowledge, mutual beliefs and mutual assumptions" (p. 222) – coordination of the content and process of interaction cannot find place. Three types of information may be used to support these processes:

- non-verbal information
- object information
- context awareness

In general people prefer to have these three types of information available during the interaction process, because it reduces the uncertainty of the interaction setting. However, in many types of 'dispersed settings' (part of) these cues are lacking. This is one of the factors that interaction processes easily result miscommunications (see above). Steinfield, Jang and Pfaff (1999) expand the notion of awareness in order to be able to develop awareness support for collaboration and communication at a distance. In the development of this support they focus on features providing awareness support in the context of project teams. They define awareness as occurring "… when group members possess knowledge about the current status and actions of the various components (including people) in a collaborative system" (p. 83) and distinguish 5 types:

- activity awareness: knowledge about project related activities of group members, both during and between meetings
- availability awareness: knowing the physical availability of group members
- process awareness: knowing the state of affairs of the primary work process
- environment awareness: knowledge about outside events that may have implications for the group
- perspective awareness: knowing background information to make sense of other people's actions.

In groups were members do not know each other, and do not have the means to organise a face-to-face meeting, it is expected that social cues support the feeling of belonging to the group. It may thus contribute to cohesiveness and thus increase the motivation of group members to participate. For that reason, some researchers and developers have added awareness features to collaborative applications.

In Chapter 5 and further, lack of cohesion, trust and feeling of belonging, as possible barriers for the success of dispersed (knowledge) groups will be re-addressed. As will be the potential contribution of awareness features as discussed above.

Now that a structural description of dispersed knowledge groups is provided it is relevant to know how these groups contribute to knowledge processes in organisations. Therefore the following section first introduces knowledge management in general and subsequently it describes how dispersed groups may function as knowledge carriers in organisations.

3.4 Knowledge management

Knowledge Management (KM) is one of the most popular management concepts of the last decade. Textbox 3-1 provides a few of the numerous definitions that can be found in the literature. Definitions of KM partly overlap. Awad and Ghaziri (2004) identified several integral parts in definitions of KM. They state that all definitions refer to two or more of the following processes:
- Using accessible knowledge from outside sources
- Embedding and storing knowledge in business processes, products, and services
- Representing knowledge in databases and documents
- Promoting knowledge growth through the organisation's culture and incentives
- Transferring and sharing knowledge throughout the organisation
- Assessing the value of knowledge assets and impact on a regular basis

The need to support knowledge processes has always existed in organisations. However, its importance has certainly increased in the last few years. It was not until the 1990s that chief executives started talking about knowledge management (Hansen, Nohria, & Tierney, 1999). This interest is highly related to the increasing relevance of the so-called knowledge factor in organisations. Many books on management have focused on this increasing relevance (Davenport & Prusak, 1998; Huysman & de Wit, 2002). In addition, the rise of networked computers has enabled the codification, the storage, and the distribution of knowledge more easily and cheaply than before (Hansen et al., 1999; Hutchinson, 1999; Kimble, Hildreth, & Wright, 2001). However, managing knowledge is not a goal in itself, it supports achieving other goals that make the organisation more effective. For example, good KM strategies prevent reinventing the wheel at different places in the organisation; it makes the organisation more effective. Additionally, it contributes to the development of new knowledge and as such to innovation and competitive advantage for organisations (Newman, 1997).

- Knowledge management is a conscious strategy of getting the right knowledge to the right people at the right time; it is also helping people to share and to put information into action in ways that strive to improve organisational performance (O'Dell & Grayson, 1998)
- Knowledge management is accumulating knowledge assets and using them effectively to gain a competitive advantage (Brooking, 1996).
- Knowledge management is the process of gatherings a firm’s collective expertise wherever it resides – in databases, on paper, or in people’s heads – and distributing it to where it can help produce the biggest payoff (Hibbard, 1997, p. 46).
- Knowledge management is in our view the structured support and guidance of (conditions for) acquiring knowledge, exchanging knowledge and using knowledge to support business processes within an organisation (Huysman & de Wit, 2002, p. 2)
- Knowledge management is the name give to the set of systematic and disciplined actions that an organisation can take to obtain the greatest value from the knowledge available to it (Davenport & Prusak, 1998).
- Knowledge management is any process or practice of creating, acquiring, capturing, sharing and using knowledge, wherever its resides, to enhance learning and performance in organisations (Swan, Scarbrough, & Preson, 1999, p. 669)

Textbox 3-1 A few of the numerous definitions for Knowledge Management (KM)

Several authors have stressed the importance of balancing people, technology and work processes in managing knowledge. However, especially the role of technology has received attention in the literature. On the one hand, several examples have been described of KM strategies with an over-emphasis on technology (de Wit & Huysman, 2000; Dixon, 2000; Moffet, McAdam, & Parkinson, 2003; Swan et al., 1999). This over-emphasis is a result of a perspective on knowledge management as being synonymous with technology (Dixon,

2000; Huysman & de Wit, 2002). In this perspective, knowledge management systems are considered a successor of information management systems. As a consequence, several authors, including Swan, Scarbrough and Preston (1999) warn for knowledge management being the 'next fad to forget people'. On the other hand, examples can be found were KM strategies with a focus on people and quality planning programmes are hindered by inadequate enabling technologies (Moffet et al., 2003).
A substantial part of literature on knowledge management describes how technology best can be applied to support knowledge sharing. However, different views exist on how technology can be applied successfully. These differences often depend on how knowledge is defined. Therefore, the next section describes definitions of and perspectives on knowledge.

3.4.1 Definitions of knowledge

In most views knowledge is regarded as the next step, after 'data' and 'information' (e.g. Jashapara, 2004). Data can be defined as 'symbols that are not (yet) interpreted'. A list of numbers for example does not mean anything in itself. However, data can be analysed or interpreted into information, which is defined as 'data that has meaning'. Information is always linked to a specific situation, it is context specific and its validity is limited. The next step is from information to knowledge, the interpretation of information leads to knowledge, which can be defined as insights, experiences and procedures that give guidance to (individual and/or organisational) thinking, acting and communicating. Vice versa, knowledge is necessary to be able to apply or use information. As a consequence, knowledge is personal and applicable in different situations.

Although the distinction between data, information, and knowledge can be made on the basis of theory, the distinction is more complicated in practice. It may differ among persons whether something is considered as data, information, or knowledge. For example, some documents, containing text, drawings, or figures only have meaning for insiders; i.e. those who are involved in the context or are specialist on the topic concerned. Only they can interpret the content and work with it. As a result, the terms knowledge and information are often used inter-changeably in the literature (Kakabadse, Kakabadse, & Kouzmin, 2003). Therefore several authors, for instance Davenport and Prusak (1997), have proposed to consider these terms as if they form a continuum with information as an overlaying term. Others are very strict in the distinction between knowledge and information: knowledge can only be in 'people's heads' and as soon as it is made (or can be made) explicit (e.g. in (digital) documents) it is information. From that moment on the knowledge is consisted to be de-personalised.

Most of the categorisations of knowledge are denoted as opposites. A quite common distinction is the categorisation of knowledge in tacit and explicit knowledge, as is introduced by Polanyi in the 1950s, and elaborated on in the 1960s (Polanyi, 1958; 1966). In this distinction tacit knowledge is derived from experience, and embodies beliefs and values of the knower. It is in people's minds; it consists of mental models skills, behaviours and perspectives, and it is largely based on experiences. It is personal and contextual and therefore hard to formalise or communicate. As Horvath (1999) states: "People know more than they can tell. Personal knowledge is so thoroughly grounded in experience that it cannot be expressed in its fullness" (p. ix). Explicit knowledge is knowledge that is considered not personal. It can be expressed using a formal, systematic language using objects, words, and numbers. This type of knowledge can thus be shared via documents. In this distinction explicit knowledge seems to overlap with information. Again, although the distinction between data, information, and knowledge can be made based on theoretical grounds the line is not sharp. In this thesis, I will apply the distinction between tacit and explicit knowledge as described here. To be able to distinguish between knowledge and information I will describe them in relation (based on van der Spek & Spijkervet, 1997):

Knowing

- which information is needed (knowing what)
- how information must be processed (knowing how)
- why information is needed (knowing why)
- where information can be found to achieve a specific result (knowing where)
- when which information is needed (know when)

Nonaka and Takeuchi (1995) introduce four processes that describe the conversion from tacit to explicit knowledge and vice versa. In addition, these processes denote the conversion of tacit knowledge into (new) tacit knowledge and explicit knowledge into (new) explicit knowledge. The four different knowledge processes are the following (see also Table 3-1):

- **Socialisation** is the process of sharing tacit knowledge of individuals; skills and insights are learned by others through direct interaction and imitation.
- **Externalisation** requires the articulation of tacit knowledge into explicit knowledge.
- **Combination** involves the conversion of explicit knowledge into more complex sets of explicit knowledge such as a new method, theory, or model.
- **Internalisation** means the conversion of explicit into tacit knowledge of individuals; thus, into personal insights and skills.

As an example of the socialisation process, one can think of showing how something is done: a carpenter showing his pupil how a specific handling is performed. In an externalisation process such an action would be described on paper. Externalisation can also be done by explaining something using metaphors, models or concepts. Combination refers to combining different types of explicit knowledge into something new. In this way more complex or highly integrated knowledge can be developed. Internalisation may be done by reading instruction or following courses and by learning by doing.

Table 3-1 The four conversion processes of Nonaka & Takeuchi (1995)

To: From:	**Tacit knowledge**	**Explicit knowledge**
Tacit knowledge	Socialisation	Externalisation
Explicit knowledge	Internalisation	Combination

3.4.2 Different knowledge management strategies

The main distinction in KM strategies relates to the distinction between perspectives on knowledge management. When knowledge management is considered as a process, the focus is on facilitating using and sharing tacit knowledge. And when knowledge management is considered a technique the focus is on the facilitation of using and sharing explicit knowledge. Hansen et al. (1999) refer to the two approaches as the personalisation strategy and the codification strategy. These two approaches suggest a different use of computer systems. According to the personalised strategy, knowledge is closely tied to the person who developed it and is shared mainly through person-to-person contacts. Computer systems are applied to support connecting people: to let people find each other and support their interaction processes. In the codification strategy, knowledge is carefully captured, codified, and stored in databases, where it can be accessed and easily used by anyone in the company. This approach is much more focused on the use of computer systems, as they support storing and reusing knowledge.

Hansen et al. (1999) emphasise the importance of making a choice between the two strategies. All available resources should be directed to one of both strategies: To the codification strategy, which implies (i) a focus on the sharing of explicit knowledge, (ii) the standardisation of working processes and (iii) the application of ICT to facilitate the storage and retrieval of knowledge. Or, to the personalisation strategy, which implies (i) a focus on the sharing of implicit knowledge, (ii) the facilitation of meetings and (iii) applying ICT to connect people. ICT can support employees in finding who is who, who knows what, and when someone is available.

Others stress the importance of combining the two strategies, in order to gain the benefits of both strategies and get the best of both (e.g. de Bruijn & de Nerée tot Babberich, 2000). The argument is that organisations and their employees mostly use a combination of the two in sharing knowledge and organisations should match ICT with this practice. The research of de Bruijn and de Nerée tot Babberich (2000) is one of the studies that indicate that a conscious choice should be made in applying ICT to support KM. The available, or to be implemented, ICT facilities should fit the type of knowledge that needs to be shared and the applied knowledge sharing strategies. As observed in the case studies presented in the previous chapter; some groups did not use the groupware application as it did not ‘match’ their tasks. According to the respondents, the system only facilitated the sharing of documents, however they needed to share knowledge that is hard to formalise thus hard to make explicit in documents. In most organisations different types of groups exist, they may vary from groups working on standardised processes to groups collaborating to develop new products. These groups need to share different types of knowledge and information. The study of Kane and Alavi (2007) indicates that both can be true, it depends on the situation: in some situations a combination of mechanisms is superior while in other situations a limited application of technologies is preferable. I therefore expect the suggestion of de Bruijn and de Nerée tot Babberich to be the most useful for organisations, provide a combination of technologies for knowledge sharing support. For groups it might be useful to focus on one of both strategies. In each case, a conscious choice should be made.

3.4.3 Groups as knowledge carriers

In general, knowledge is shared on three levels in organisations: on individual level, on group and on organisation level. At each level, tacit knowledge, explicit knowledge, and a combination of both can be exchanged, within and between levels. This makes groups important elements in KM strategies. They support the transfer of individual knowledge to organisational knowledge. Individuals sharing knowledge may develop group knowledge; however, this knowledge has to be accepted by the organisation to become organisational knowledge. Only then the knowledge is available to be distributed to (other) individuals or groups. Both individuals and groups may store knowledge in explicit and digital organisational repositories or in the implicit norms, values, and culture of the organisation. For these reasons they have received a lot of attention. Consequently some organisations focus on groups as knowledge carriers (and creators) as a knowledge strategy (Inkpen and Dinur, 1998).

Groups can function as knowledge carriers and as such contribute to the dissemination of knowledge through the organisation. In addition, they can develop new knowledge, by combining the expertise of different group members. Some groups have both aims, whereas other groups focus merely on one of both. For example, the communities within Unilever had the assignment to share and develop new knowledge; whereas the communities within Delft Cluster mainly had the assignment to disseminate knowledge through the consortium (see Chapter 2). However, in both groups the three factors people, technology, and work processes have to be organised in such a way that knowledge effectively flows within the group and between the group and the organisation.

Referring to groups as knowledge carriers or knowledge creators in organisations relates to the search of knowledge intensive organisations, in which much tacit knowledge must be transferred, to personalised means to enable employees to share and create knowledge (Hansen et al., 1999). The groups focus on sharing tacit and implicit knowledge related to their organisational practice and as such they are often referred to as Communities of Practice (CoPs). As Wenger (2001) states: “initial efforts in knowledge sharing initiatives has focused on the support of information systems with disappointing results. CoPs provided a new approach, focused on the social structures that could best assume ownership for complex and dynamic knowledge with substantial tacit components” (p.3). Brown and Duguid (1991) state that organisations should focus much more on informal knowledge sharing and informal ways of working in order to be innovative. A study performed by Huysman and de Wit (2002) also presents clear evidence that a major success factor of effective KM and of innovation lies in knowledge-sharing CoPs.

But what is a CoP? Lave and Wenger (1991) were among the first to introduce and elaborate on CoPs. They focus on the fact that much learning is ‘situated learning’. i.e. people learn through social interaction, rather than by more traditional acknowledged instructional learning. Lave and Wenger describe a CoP as “… a set of relations among persons, activity, and world, over time and in relation with other tangential and overlapping CoPs” (p. 98). In these communities, newcomers learn from old-timers by being allowed to participate in certain tasks that relate to the practice of the community. Lave and Wenger (1991) have described various context-bound groups of workers, such as butchers and midwives, who share and develop knowledge around a certain practice, with apprenticeship as a central learning concept. Others, like Orr (1990) and Barley (1986) have analysed at great length the interactions of certain groups of professionals using in-depth (ethnographical) studies. Here social interaction for instance can be found in the numerous talks and even productive ‘gossip’ among repairmen. They continuously talked work during lunch or coffee breaks; they posed questions, raised problems, offered solutions, discussed changes in their work, etc. (Brown & Duguid, 2000; Orr, 1990). Their work extended the concept of a CoP, the apprenticeship concept is not central anymore; central is the day-today sharing of their practice by the group members which binds them (Soekijad, Huis in 't Veld, & Enserink, 2004).

As a result of the observation of the activities of CoPs, it became clear that groups are indeed important knowledge carriers in organisations. Therefore, the concept was developed as a tool or instrument in an organisational KM strategy (de Bruijn & de Nerée tot Babberich, 2000). CoPs were expected to form a framework by which both explicit and tacit knowledge can be shared. The framework was expected to support solving individual or common problems and the development of new knowledge. As such they can be found in several large companies such as Unilever, BP Amoco, Shell, and AtosOrigin

In addition to a description of dispersed knowledge groups and of how they may function as knowledge carriers in organisations a structural description of available technologies for these groups is needed. These technologies are commonly referred to as groupware, the next section focuses on defining groupware.

3.5 Defining groupware

Groupware functions as an umbrella term for technologies that support person-to-person collaboration (Coleman, 1995). It comprises applications such as group decision support systems (GDSS/DSS), desktop video and audio conferencing, email, newsgroups, group editing or writing systems, and workflow systems. A groupware technology may consist of one of these systems, but mostly several functionalities are combined in one system to support a group. In this thesis, I will therefore also use the term ‘collaborative platform’ for groupware applications. A collaborative platform more explicitly denotes that a groupware application may combine several groupware functionalities in one application.

The area in which groupware tools and their use are studied is called Computer Supported Co-operative Work (CSCW). A relatively young field of research; at the mid-1980s research activities in this field increased and conference series and literature appeared. CSCW refers to the field of study which examines the design, adoption, and use of groupware. Conditions that emerged in workplaces to encourage this included (a) computation technology inexpensive enough to be available to all members of some groups; (b) a technological infrastructure supporting communication and co-ordination, notably networks and associated software; (c) a widening familiarity with computers, yielding groups willing to try the software; (d) maturing single-user application domains that pushed developers to seek new ways to enhance and differentiate products (Grudin, 1994b). In the literature, the terms CSCW and groupware are often used interchangeably. In line with Grudin (1994a), I will rely on the terms CSCW and groupware or collaborative platforms to describe respectively the field of research and the technology.

In defining groupware and its focus, the overview presented by Grudin (1994b) is insightful. He states that in the software universe, groupware can be place somewhere between single-users applications and information systems supporting organisations. These software areas each emerged independently, as a consequence research and development has emerged independently as well. Thus the CSCW research field stands between the two research fields 'Management Information Systems (MIS)' and 'Computer Human Interaction (CHI)/Human Factors Society (HFS)'. (Human Computer Interaction (HCI) is also referred to as Computer Human Interaction (CHI).) Although the research fields have developed independently and still have their separate tracks at conferences, it is also tried to cross-fertilise insights. Chapter 4 for example will show how researchers try to transfer insights from evaluation methods for individual software applications to develop useful evaluation methods for groupware applications.

3.5.1 Types of groupware

Different types of groupware are often categorised based on the classification of Johansen (1988). In this classification the type of encounter, defined in a combination of the dimensions of time and place, structures the types of groupware. This combination results in a four-cell clustering with the classes 'same place-same time', 'different place-same time', 'different place-different time', and 'same place-different time' (See Table 3-2).

Table 3-2 A categorisation of groupware applications (based on Johansen, 1988)

	Same time: 'Synchronous'	**Different time: Asynchronous'**
Same Place: 'Collocated'	Voting, presentation support	Shared computers
Different place: 'Dispersed'	Videophones, chat	E-mail, workflow systems

Another classification for groupware is presented by Andriessen (2003). He uses the interaction processes presented in his DGIn-model (see section 3.2) combined with the categorisation of Johansen (1988) to structure groupware applications. However, the category 'different time–same place' of Johansen is left out, as applications in this category are very scarce. The combination results in the categorisation depicted in Table 3-3.

For the dispersed knowledge groups in this study especially the synchronous and asynchronous applications that support *dispersed* interaction processes are interesting. Applications in category C therefore are of minor relevance for this study. In addition, many groupware applications combine several functionalities in one platform, as explained above. In this study I am especially interested in these more complex groupware applications, as they should be able to support several interaction processes of dispersed groups. This makes their support (potentially) more complete. The groupware applications that were provided to the groups discussed in Chapter 2 are examples of such collaborative platforms. Modest applications such as telephone, e-mail, and fax were quite common for these groups to use. Group members applied especially the first two media to stay in contact with their group members. The collaborative platforms were more controversial and not used at all, or not to their full potential. E-MAGINE focuses on the evaluation of use of the last types of systems. The next section provides some factors that influence the adoption of groups to use these applications.

Table 3-3 Types of Collaboration technology (based on Andriessen, 2003)

	A **Different place/different time: Support between encounters**	**B** **Different place/same time: Support for electronic encounters**	**C** **Same place / same time: Support for face-to-face meetings**
Communication Systems	fax e-mail voice-mail video-mail	telephone video/audio-conferen-cing systems (multi-point) chat-systems	
Information sharing systems	document sharing systems computer conferencing	tele-consultation systems applications for searching remote information sources	presentation systems
Collaboration systems	co-editing systems, co-writing systems	shared whiteboard, CAD, word process or spread-sheet	group decision support systems
Coordination systems	synchronisers: group-calendar shared project planning shared workflow system	awareness/notification systems	command and control centre support systems
Social encounter systems		media spaces virtual spaces	

Another categorisation of groupware is the media richness perspective. It describes the media's capacity for sending rich information, i.e. several types of information (e.g. text, pictures, smell, noise) and immediate feedback – how well it conveys cues, and how many and in which ways the senses are involved. A related notion is social presence, it addresses how successfully media convey a sense of the participants being physically present, using face-to-face communication as the standard fro the assessment (Short, Williams, & Christie, 1976). Thus where media richness takes a media perspective, social presence takes the perspective of the participant(s). The theories both argue that media differ in the experienced nearness of the person one communicates with. Video conferencing is experienced as coming close to face-to-face situation, telephone communications comes next and electronic mail is experienced as quite limited. The concepts are applied in the identification of good matches between task and medium. A complex task is assumed to be better support by a rich medium, whereas information-lean media best support tasks such as simple information exchange. This categorisation is thus developed in order to provide insight into how media (software systems supporting interaction processes) may *match* interaction processes. As such it is an interesting categorisation for E-MAGINE. One of the barriers identified in Chapter 2 can be considered an example of this media-related mismatch. Group members explained that the ICT support provided was not suitable for the type of knowledge they share. The system only provided document sharing, this was not considered ‘rich’ enough. This implication will also be brought into the development of E-MAGINE.

3.6 Dilemmas and challenges in supporting groups using groupware

In the search for factors influencing the successful support of information technology two main research streams can be identified: One stream has a utilisation focus and the other stream focuses on the fit between the task and the technology provided: Task Technology Fit. This last approach can also be referred to as the contingency approach. Both approaches are illustrated in the next sections.

3.6.1 Technology acceptance models

Most of the utilisation research is based on theories of attitudes and behaviour. The underlying assumption is that aspects of the technology lead to user attitudes about systems. These user attitudes along with social norms and other situational factors lead to intentions to utilize these systems and ultimately to increased utilisation. Stated or unstated, the implication of these theories is that increased utilisation will lead to positive performance impacts (Goodhue & Thompson, 1995). In this research stream the Technology Acceptance Model of Davis (1993) is most frequently referred to. The model is explained in more detail in the following section.

The Technology Acceptance Model by Davis (Davis, 1993; Davis, Bagozzi, & Warshaw, 1989; Davis, 1989) assumes that users are likely to use a system when the system is perceived as useful and easy to use (see Figure 3-3). In this model Perceived Usefulness (PU) is defined as “the degree to which a person believes that using a particular system would enhance his or her job performance” and Perceived Ease of Use (PEOU) as “the degree to which the person believes that using a particular system would be free of effort” (Davis, 1989, p. 320). This effort consists of physical effort, mental effort and ease of learning using the system. The two concepts Perceived Usefulness and Perceived Ease of Use both influence the decision of (intended) users to use technological tools. The TAM model focuses on the adoption of technology in organisational settings, but can be applied in other settings as well.

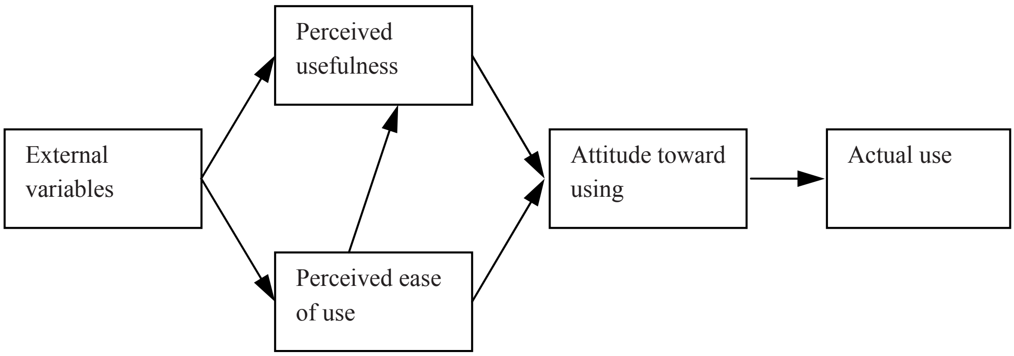


Figure 3-2 The Technology Acceptance Model (based on Davis, 1993)

The TAM model has inspired many researchers to develop new versions. These versions often focus on a further specification of the external factors that influence perceived usefulness and perceived ease of use. Or, new, relations between the presented concepts are studied. Some researchers apply the model in other domains. See for example the Technology Transition Model (TTM model) by Briggs and his colleagues (Briggs, Nunamaker, Jr., & Tobey, 2001), the TAM2 model by Venkatesh and Davis (2000) the presentation of an extension of the TAM model by Amoako-Gyampah and Salam (2004), and the extended TAM model on internet utilisation behaviour by Shih (2005). Legris, Ingham & Collerette (2003) conduct a review of several versions of TAM. They conclude that TAM is a useful model, but that the original model needed improvement. The authors state that TAM2 can be considered an improvement. The main difference between TAM2 and TAM is that the ‘External variables’ of TAM are specified in TAM2. Still the model hardly explains more than 40% of the variance in use. The authors add that the TAM(2) model needs to be integrated into a broader one which would include variables related to both human and social change processes, and to the adoption of the innovation model. The DGIn-model includes these dynamic aspects. The External Variables specified in TAM2 largely overlap with part of the variables specified in the DGIn-model. This leaves

'Perceived usefulness' and 'Perceived ease of use' as relevant concepts that are not modelled yet, but have to be reminded as affecting use.

3.6.2 Contingency perspective

Trying to find a match between a group and a groupware application reflects the contingency perspective. This perspective was formulated in reaction to the idea that there was 'one best way' to structure organisations (Mintzberg, 1979). Applied to technology systems the implication of this perspective is that information and communication applications should perfectly match the requirements of the situation, the user and its context, as a consequence there is no one best way.

There are different ways to achieve the objective of a perfect match: conform the ICT application to the group, conform the group to the application, or apply a process of joint optimisation. However, a problem with applying the contingency perspective is that although the concepts of 'match' or 'fit' are intuitively clear, it is very difficult to measure their quality (Venkatraman, 1989). What are attributes of a good fit? For the development of E-MAGINE this question should be answered, assuming that a good fit is a prerequisite for successful groupware support. In addition, the perspective focuses on a quality of fit between *task* and technology. Above it is described that effective and successful groups not only effectively execute their tasks, these groups have successful outcomes on two other levels as well. Can the concept of Fit be broadened from Task-Technology Fit to Group-Technoloy Fit? Finally,the notion of fit assumes more or less static concepts that have to fit together. The perspective as such leaves hardly room for change, it leaves no room for so-called adoption, adaptation or appropriation processes. Groups are dynamic entities. How useful is the concept of 'fit' then? The next sections provide more insight into adoption processes that may occur.

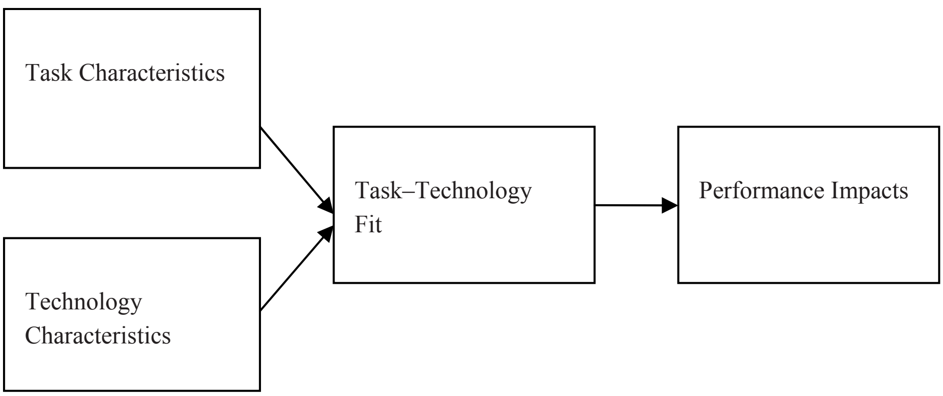


Figure 3-3 Theories of Fit (based on Goodhue, 1995)

3.6.3 Adaptation and appropriation processes

Experience shows that adaptation processes take place when a new system does not fit the users and context completely. The more a new system deviates from this match the more intensive and of longer duration this adaptation process is (Orlikowski & Robey, 1991). So people using the tool, make the tool 'their own', which can result in successful but also unsuccessful use of the application. Poole and DeSanctis (1990) refer to this process as adaptive structuration. It refers to the social process that intervenes between the provision of a specific group support technology and the outcomes of use of that technology. In their paper on this concept Hiltz, Dufner, Holmes, and Poole (1991) discern four modes of adaptation: (i) the group may use the system in a way consistent with the intentions of the designers (consistent with its spirit as Hiltz et al. state it); or, (ii) the group may use the system in a way consistent with its spirit, but change or circumvent the intended mode of use of specific features; or, (iii) the group may violate the spirit of the system, but retain its operations and functionalities, using them in unintended ways. In the worst case (iv) a group may alter both the spirit and the specific features of a system. The outcomes of the adaptation process are a.o. influenced by the attitude of the group members towards the system. Are they confident in their approach to a system, do they believe they can learn to use it and do they actively try to learn to do so? Or are they doubtful and do they lack confidence from the beginning? Another factor that influences the adaptation process is the level of consensus in the group. To what extent do the members of a group agree on how the tool should be incorporated? If they do not agree, they may spend more time on arguing about the technology than trying to accomplish their task. For the success of groupware tools this consensus is an important factor, for the success of most groupware applications therefore depends on a critical mass using it. As a consequence of appropriation processes finding place, supplying a group with a groupware tool can have very different consequences. However, a groupware application often can only support group processes if the whole group or community uses it. In case an Intranet application in an organisation is not up-to-date because only half of the users keeps it up-to-date, it is for the whole group not attractive anymore to use the information provided and put further effort in keeping it up-to-date. Therefore, Grudin (1994b) states that groupware requires more careful implementation (introduction) in the workplace. The implementation phase is at least as important as the design process; otherwise it is very well possible that adaptation takes place in a way that is not appropriate.

3.6.4 Tailorability versus uniformisation

The aspect of appropriation is not the only problem when holding on to the idea of finding a good match between group and groupware. Another dilemma with ICT is that although, on the one hand, the applications offered to a community should perfectly match its needs (which implies tailorisation); on the other hand, organisations should stimulate using uniform platforms and applications in order to make it possible to communicate and share applications between different locations and/or communities. Here, a dilemma becomes evident, the dilemma between tailorability and uniformisation. If a tool is extremely tailored to the group, it is possible that the group becomes isolated from its environment, making interaction with other groups, using ICT, not possible. Another possible effect is that the application does not fit with the other applications used by the members of the group; they can hardly integrate their group work with their other daily activities. Another problem is that tailorability to the group may not be a straightforward design criterion, as group members may have different requirements. For example as a consequence of the fact that group members are dispersed and thus may be working in a different physical working environments. Still, individual outcomes of using a tool have to be in balance if individuals are to be motivated to continue contributing to the group as is depicted by the DGIn-model.

3.7 Combining utilisation and fit theories

Goodhue and Thompson (1995) state that while each of the perspectives, utilisation and task-technology fit, provides insight into the impact of information technology on performance, each alone has some important limitations. First, utilisation is not always voluntary. For many users, utilisation is more a function of how jobs are designed than of the quality of usefulness of systems, or the attitudes of users towards using them. Second, there is little explicit recognition that more utilisation will not necessarily lead to higher performance. Utilisation of a poor system (i.e. one with low task-technology fit) will not improve performance. On the other hand, models focusing on fit alone do not have sufficient attention to the fact that systems must be utilized before they can deliver performance.

So, one could say that ‘use’ and ‘task-technology-fit’ are both input factors for performance (where several other factors affect the factors ‘use’ and ‘task-technology-fit’). Combining the utilisation and fit theories in our context implies that a groupware system should be used in order to be able to measure the success in terms of level of support provided by the application. And that factors affecting *use* (indirectly) affect *successful use* as well. Combining the utilisation and fit theories further implies that *frequent use* in itself is not ‘good enough’. The challenge for E-MAGINE is to come up with more insightful and qualitative evaluation metrics.

3.8 Recent developments

Since the execution of this research project developments in ICT have affected the object of evaluation, e.g. ‘dispersed knowledge groups that have groupware at their disposal’. Three main streams of ICT related changes can be discerned, these relate to: 1) infrastructure, 2) hardware and software and 3) the Web.

Infrastructure

Regarding the infrastructure, improved and cheaper bandwidth have "theoretically enabled real-time data transmission to pretty much any remote site around the globe" (Bayerl & Lauche, 2010, p. 140). In their study of dispersed team collaboration Bayerl and Lauche (2010) describe how this affects coordination in a distributed setting. They conclude that technological changes alter existing routines and role division in distributed teams. These two observations indicate that the organisation of distributed work depends on the available media capacities.

Hardware and software

With respect to hardware and software, four main trends are specified here, based on (Poppe, Rienks, & van Dijk, 2009) and Benford et al. (2005):

1. New sensing possibilities

New sensing possibilities of hardware systems allow for the design of more intuitive interfaces that go beyond traditional keyboard and mouse. Examples are automatic speech recognition, video tracking, light sensing, etcetera. This trend results in a shift from the traditional dialog-oriented way of interaction to more subtle and implicit interactions.

2. Shift in initiative

Traditional systems are responsive in nature, they react to input from the user. Nowadays, pro-active systems are more common. These systems provide suggestions to the user for the execution of programs or even execute programs without having received an explicit (user-)command to do so. Ju and Leifer (2008) illustrate this by presenting a framework with an 'initiative dimension'. Their framework combines direct manipulation on the one end with autonomy on the other. They claim that systems that enable both user and system initiative are more effective than traditional single initiative structures.

3. Diversifying physical interfaces

Currently interfaces range for immersive displays and active billboards, to wearable and embedded displays. This implies that current collaboration can easily go beyond the traditional desk-top environment as people can interact through multiple channels and across different locations.

4. Shift in application purpose

There is a trend to more purpose-designed and specialized applications in contrast to the general one-size fits all desktop PC. In addition, whereas the traditional systems are in general task-based, the new applications are more focussed on everyday life. In parallel is ‘user experience’ the new focus of human computer interaction, in contrast with the dominant task and usability paradigm. The support of task execution is no longer the main goal, but rather the interaction itself.

All four trends can be found in applications that focus on group support. This has resulted in applications that support group meetings using speech recognition for example (Post, Huis in 't Veld, & van den Boogaard, 2008) or games designed for more than one player, with a large shared touch screen as input device.

Web

A significant current development of the World Wide Web concerns the rapid growth of ‘Web 2.0 applications’. The main characteristics of Web 2.0 can be described as a ‘architecture of participation’ (O’Reilly, 2007). These characteristics include simplicity of usage, immediate feedback on user interface and structural level and the possibility to value each user’s contribution (Grudin, 2006; Kittur et al. 2007). Web 2.0 orchestrates available technology in a way that encourages users to participate actively as its architecture of participations helps to balance effort and benefit even in work-related settings. It is therefore also referred to as ‘the social web’ (Paroutis & Saleh, 2009). As a consequence, a growing numbers of users engage voluntarily in collaborative work using Web 2.0 applications (Prilla & Ritterskamp, 2010). As Web 2.0 applications are mainly used to interact and share content with others, this trend is particularly relevant to dispersed knowledge groups. Therefore, a more detailed description of the main and most typical Web 2.0 applications is presented here (based on Prilla and Ritterskamp, 2010) :

1. Wiki’s

Wikis are applications providing and organising user-generated content. They are organised in a democratic manner, meaning that – notwithstanding the possibility to restrict access to a closed group – everybody has equal rights to add, change, and link content in a wiki. One could think that different users adding and structuring content, without centralized control, would lead to chaos. However, Wikipedia, the best known example of a wiki, shows that its community is capable of organising its content properly. However, to achieve this result the people from the community using the Wiki should feel responsible for proper content and organization. Not in all communities members feel this responsibility.

2. Tagging

Tagging is to freely assign keywords to content. Again, at first sight this seems to end up in a chaos. However recent studies show that *tagging* sites often leads to rich and well-structured vocabularies (Golder and Huberman, 2006). As a consequence tagging can be applied very well to filter large amounts of information. This is especially helpful in large communities when it is hard for members to find useful knowledge and information (see Turoff & Hiltz, 2009 for an example of tagging within a large professional community). Prilla and Ritterskamp (2010) warn that the success of tagging is a result of *mass* collaboration. Therefore, it may not be applicable in single organisational settings as the number of users is usually not big enough.

3. Blogs

Blogs (or web-logs) are at the very heart of Web 2.0 and represent an archetype of user-generated content. In its simplest form, a blog is a webpage containing posts (i.e., short paragraphs of information on a particular topic) by a primary author and related comments by other users in chronological order. Today's blogging platforms offer good support to get a blog up and running within minutes, the processes of creating and commenting a post are effortless. Efimova (2009) has studied the use of blogs as means to share knowledge in organisations. Her study shows how knowledge workers apply blogging to stay informed and to get things done. It also shows how this way of working results into blurred practices between what is personal and what is professional. It indicates that there is growing need to know how to deal with transparency and fragmentation of one's work.

4. Social Networking Services

Social Networking Services (SNS) are platforms that provide opportunities to share information and get in touch with like-minded people in both professional and personal networks. Examples are Linkedin, Hyves and Facebook. From the perspective of collaboration support, social networking services may help to make use of network effects in organisations. They may be applied to establish connections between people who work on similar tasks, providing the opportunity for information exchange on a common problem domain. Steinfield et al (2009) show that internal social network services may indeed contribute to social capital in the organisation.

5. Feeds

Feeds provide information about updates and recent changes to resources like websites, blogs, and wikis as described above. Users can 'subscribe' to these resources and receive Feeds at a regularly basis, or when something new has occurred. Feeds are summarizing, text-based representations of these resources. Although the underlying protocols depend on client-side pull requests, most Feed readers are capable of providing a user experience similar to push mail, i.e., the user is kept up to date, without taking any (new) action. (This is in parallel with the 'shift in initiative' described above). From the perspective of collaboration support, feeds can contribute to a knowledge worker's awareness of collaborations he or she is involved in, e.g., if they are used to convey information about changes to a shared workspace.

As a consequence of these developments, new types of group interactions have emerged. See for example Wenger, White and Smith (2009) for a more specific overview of developments in technologies for community support. They describe that new technologies enable new modes of engagement. "The evolution of publishing and interaction tools enables both stronger individual voices, through self-expression tools like blogs, as well as stronger group manifestations, through collaboration tools like wikis." (p. 187) At the same time the authors stress that the successful use of these technologies, still depend on the dynamics, goals, practices etcetera, of the communities using them. For they continue saying that: "(…) the successful use of these capabilities for communities depends on the practices members develop around them." (p. 187) For that reason they present several linkages between (community) activities and tool features. In other words, they apply and prescribe a fit approach as well in order to successfully support these groups.

In chapter 10 I will discuss the potential implications of these developments for group support and for the applicability of E-MAGINE.

3.9 Conclusion

In this chapter dispersed knowledge groups and their role as knowledge carriers in organisations are discussed. It was found that groups are commonly described using input – process – output models. From these models the DGIn-model is identified as a suitable model to structurally describe the dispersed knowledge groups that are the focus in this study. The DGIn-model is chosen because the model is unique in describing groups and incorporating a technology factor. It is further unique in denoting the physical setting of group members as a relevant characteristic. The available ICT applications for these groups, referred to as groupware, are also introduced and described. From this overview it is concluded that especially collaborative platforms, providing a combination of functionalities and focusing on the facilitation of dispersed interaction are of interest for this study.

In the discussion of these different subjects several implications were specified that are relevant for the development of E-MAGINE. Firstly, the DGIn-model is not only useful to structurally describe dispersed knowledge groups, it also incorporates group dynamic theories and theories on (individual) technology use and technology acceptance. The relevance of these theories in this setting was illustrated by the barriers identified in Chapter 2.

Secondly, group characteristics such as (lack of) cohesion, trust and feeling of belonging, were identified as relevant factors for the success of dispersed (knowledge) groups. As was group members having a solid common ground and the potential contribution of awareness features to compensate for lack of communication and awareness cues in dispersed interaction settings. An overview of the factors identified in this chapter is provided in Chapter 5. Here a list is presented of success factors identified in Chapter 2 and 3.

Thirdly, more insight is gained into groups as knowledge carriers in organisations. To enable these groups to share knowledge in some cases the codification approach is applied, and in other the personalisation approach. But combinations of these two can also be found. Successful knowledge groups are characterised by their open knowledge sharing culture: members continuously pose questions, raise problems, offer solutions, discuss changes in their work, etcetera.

Fourthly, several categorisations of groupware systems are introduced. Here media richness seems to be a relevant concept, as sharing knowledge might require rich applications. Whereas sharing 'information' (or explicit) knowledge might very well be shared using less 'rich' applications. New case studies will be used to elaborate on this assumption.

The for last section discusses some theories on technology acceptance, technology use and some related challenges. From this overview it is concluded that 'use' and 'task-technology-fit' are both input factors for performance (where several other factors affect the factors 'use' and 'task-technology-fit'). As a consequence is *frequent use* in itself is not 'good enough' as an indicator of successful technology support: it does not necessarily relate to performance. The challenge for E-MAGINE is to come up with more insightful and qualitative evaluation metrics. Another challenge is to specify fit. In any case, fit needs to be extended, the tool should not only fit the task, but also the group and its context. This is an implication of several theories incorporated in the DGIn-model discussed above.

The chapter concludes with an overview of recent developments. In the concluding chapter this overview will be used to discuss implications of these recent developments for the applicability of E-MAGINE.

The next chapter will provide an overview of software evaluation methods.

4

Groupware Evaluation Approaches

4.1 Introduction

All evaluation processes have common features: these all have a purpose, and in all cases there is an object being evaluated and a process through which one or more attributes of this object are judged and are given a value (Karat, 1997). The same holds for E-MAGINE, the evaluation approach that is developed in this research project. The *purpose* of this evaluation approach is introduced in Chapter 1. The *object* of evaluation, groupware applications provided to dispersed knowledge groups, is studied in Chapter 2 and further specified in Chapter 3. In the current chapter the focus is on the *process* of evaluation: what evaluation steps should be taken in order to answer the evaluation question of E-MAGINE.

In this chapter a review of software evaluation methods is presented, in order to support identification or development of a suitable evaluation process for E-MAGINE. After an introduction into the first software evaluation methods developed in the tradition of Human Computer Interaction (HCI), the chapter continues with four evolutions in software evaluation. Insight into these evolutions provides an understanding of the diversity of existing evaluation approaches. This diversity is a result of a shift in the purpose and focus of software evaluation. Knowledge of and insight into this diversity enables a well-founded choice for a suitable evaluation approach of E-MAGINE. If applicable, sections conclude with suggestions and implications for the development of E-MAGINE.

4.2 Developments in the tradition of software evaluation

Software evaluation has its roots in the research tradition of HCI, a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them. In this tradition researchers aim to develop scientifically valid methods that could measure aspects of interaction processes between human and computer. The discipline emerged with the rise of computer usage in the 1960s, although the term 'HCI' was only adopted in the 1980s. The introduction of micro-computers in the 1980s resulted in a rise of usage by non-specialist users of all types: administrative staff, business clerks, sales persons, managers, and scientists. Their job was not primarily geared to the computing medium itself, but they used it as a tool in their everyday work. They used the computer to support them in a large range of tasks, and they often experienced problems using it. This resulted in the interest into issues like user need analysis, interaction design, information presentation, input and output devices, as well as evaluation techniques and methodologies. Researchers and practitioners with various technical and non-technical backgrounds started to address these issues and developed more insight into this interdisciplinary field of research (Arnold, 1998; Bannon, 1991).

In the HCI tradition software evaluation methods focused especially on gauging the usability of a software product. The usability of a product is referred to as the capability of a product to be used easily. It is one of six main software quality characteristics presented in ISO-standard 9126. The others being functionality, reliability, (infrastructural) efficiency, maintainability, and portability. In this ISO-standard usability is defined as '*a set of attributes of software which bear on the effort needed for use and on the individual assessment of such use by a stated or implied set of users'* (ISO IEC 9126, 1991). This definition makes it clear that usability is not a general characteristic of software, it is a characteristic that can only be valued in relation to its intended users. Preece et al. (1994) add two specifications, defining software evaluation as being '*concerned with gathering data about the usability of a design or product by a <u>specified</u> group of users for a <u>particular</u> activity within a <u>specified</u> environment or work context.'* (p. 602). This implies that in an evaluation process the application is assessed in relation to its context-of-use, including the users, the tasks or activities and the environment or work context. In other words, its context-of-use provides the criteria the software product has to meet.

Usability as a term is rather a conceptual entity: although it addresses valuable aspects concerning software products, it does not present a method how to utilise these attributes. Nielsen (1993) made an attempt to make usability more tangible by identifying five usability attributes: ease of learning, efficiency of use, memorability, error handling, and satisfaction. The explanation of these terms can be found below.

<u>Ease of learning</u>

The system should be easy to learn so that the user can rapidly start working with the system. There is, for example, a big difference between user interfaces that are intuitive to use, because the interface is tuned to the terminology of the user, and user interfaces that are 'generic' and for which the user always has to make a translation between the terms of the user interface and his own terminology.

<u>Efficiency of use</u>

The system should be efficient to use, so that a high level of productivity is possible. Examples of measures that can increase the efficiency of use are storage of previous decisions, automatic filling of fields for the user, and following a workflow that is close to the user's workflow. Ease of learning and efficiency of use can be conflicting. In order to make a service system easy to learn, extra help can be given to the user, a feature an advanced user might not like because it impedes efficient use of the system. Some systems offer the possibility to choose between a 'novice' mode and an 'expert' mode, where the latter mode is much faster than the novice mode, as it does not provide all kinds of explanatory information and inbetween steps.

Memorability

The system should be easy to remember, so that the casual user is able to return to the system after some period without having to learn everything all over again. Memorability is different from ease of learning in the sense that there is a difference between first-time use and using the system again after a while.

Errors

The system should have a low error rate, which means that users make few errors when using it. If they do make errors they should be able to correct them with ease. Furthermore, 'catastrophic' errors, such as deleting all files on the system at once, should be impossible. (See also Lewis & Norman, 1986 on errors and error prevention.) Rolling back to a previous state of the system (the undo function in many programs) should always be possible. A user should be advised when an action cannot be undone.

Satisfaction

The system should be pleasant to use, so that users are subjectively satisfied when using it; they should like it.

The criteria of Nielsen are used as evaluation criteria in many different usability evaluation methods. Usability can be assessed in many different ways though; therefore the main methods are listed in the next section.

4.3 Existing evaluation methods

This overview of existing usability evaluation methods is inspired by the overview of Äborg, Sandblad, Gulliksen, and Lif (2003). They use a mixture of these methods to develop their own evaluation method, ADA. A similar approach might be useful in this thesis. The methods are categorized into usability testing methods and usability inspection methods. The first category of evaluation methods involves users actively co-operating in the evaluation process, the second category can be performed by evaluators alone.

4.3.1 Usability testing methods

Performance measurement

Performance measurement is a traditional usability testing method with the aim of measuring whether or not a usability goal has been reached. User performance is mainly measured in laboratories with single users or groups of users performing a pre-defined set of tasks while data on errors and time are collected. Several usability problems will be identified with this method and comparison of different design solutions is possible, as the data is quantitative. However, there is seldom enough time, money or laboratory expertise available to use this kind of method (Nielsen, 1993).

Questionnaires

Questionnaires are useful for measuring user satisfaction, but are less so for other usability issues (Nielsen, 1993). Since questionnaires can be distributed to many users this is often an inexpensive survey method. However, the difficulties in constructing good questionnaires and the time required to analyse the result are often neglected when deciding on the method. Another problem is that questionnaire studies often have low response rates. Examples of frequently applied questionnaires are MUMMS (Measuring Usability for Multi-Media Software) and SUMI (Software Usability Measurement Inventory). The first was developed by Kirakowski (1997) and the latter by Kirakowski and Corbett (1993).

Thinking aloud

This is a useful method in which the users verbalise their thoughts while using the application. In this manner the usability expert gains an immediate understanding of major usability problems with the user interface. The method is inexpensive, but has as drawback that it is not very natural for users to think out loud and to verbalise their decision process. Expert users execute part of their work automatically, which makes it even harder to verbalise decision processes. Thinking aloud may even influence the users' performance.

Pluralistic walkthrough

For this evaluation method, users, developers, and usability experts meet and discuss usability problems that are associated with the dialogue elements in different scenario steps. Pluralistic walkthrough is effective for evaluating the learnability of a user interface, but it is not for evaluation of interfaces in daily use, since the users have difficulties predicting their skilled behaviour.

4.3.2 Usability inspection methods

Cognitive walkthrough

Cognitive walkthrough is a method in which an evaluator examines each action in a solution path and tries to tell a credible story describing why the expected user would choose a certain action. It is based on assumptions about the users' background, knowledge and goals, and on understanding the problem solving process that enables them to guess the correct action. The method is not as applicable when inspecting interfaces for skilled users because of the complexity in predicting their behaviour.

Heuristic evaluation

In heuristic evaluation the evaluator uses sets of heuristics (i.e., guidelines) to assess an interface for usability bugs, usually related to how individuals see and perform a task. It is easy to learn and inexpensive to use. A drawback is that evaluators using this method seldom manage to identify domain-specific usability problems. The main reason for this is the evaluator's limited knowledge of and insight into the details of the context-of-use.

User observation

In user observation an evaluator observes how a single person uses an application, performing tasks within a semi-controlled setting.

Field studies

Evaluators study people interacting within their everyday (working) environment. These observations can provide the context that is missing from observational techniques. These techniques are complex and expensive in terms of time, logistics and analyses. Evaluators require experience and a considerable amount of time to conduct the evaluation. The number of people that must be observed at each site is high, which can make this task overwhelming.

A large group of the first usability evaluation methods focused on single-user applications that were in the last stage of their development. The methods consisted mostly of lab experiments performed by usability experts analyzing all kinds of interaction aspects. Most of the effort spent on evaluation focused on assessing how good (or bad) a product was and focused fairly little on improving the design (Karat, 1997). Several evolutions have taken place since the development of the first usability evaluation methods. The first evolution concerns the moment of evaluation in a software product's design process. Currently evaluation methods are used to evaluate end products as well as early designs and prototypes. These evaluations provide input for the design process. In this manner they increase the quality of the software product. The second evolution concerns the focus of evaluation. With the rise of groupware applications this focus had to be widened. The methods had to be able to evaluate not only single-user applications, but also groupware applications. With this development, evaluation questions became more complex, as is explained in the relevant section. In order to be able to handle this complexity, the focus of evaluation widened from the interaction between the user and the system to an inclusion of the context in which the system is used. This development is the third evolution described in this chapter. The fourth evolution is closely related to this wider focus of evaluation methods and shows another way to handle the more complex evaluation questions: As the user was acknowledged to be the expert on the context in which the system is (to be) used, more and more participative evaluation methods were developed. The four trends are described in more detail in the next sections. It will become clear from these descriptions that the four trends are closely interrelated.

4.4 From end-product evaluation to an iteration with design activities

Evaluation methods were applied in the last stage of a software design process in order to investigate whether the software product met the requirements set by the designers. Instead of a one-moment activity, evaluation methods have evolved into an activity that can be applied at all stages of the design process. Evaluation methods are currently applied as tools for information gathering during the entire design process (Gediga, Hamborg, & Düntsch, 2002; Karat, 1997). This has resulted in an iterative design process: the outcomes of the evaluation activities further guide the design. The design and evaluation processes are intertwined and cannot strictly be separated anymore. This integration of the design and evaluation processes enables early changes in the design or prototype. This is less costly in terms of time and money than changing an almost finished product, which may not even be possible anymore. The earlier in the design process a system is evaluated, the greater the flexibility for changes in the design against minor costs (van den Anker, 2003).

This new role of evaluation in a design process has resulted in the development of different types of evaluation. The distinction between summative and formative evaluations is classic. Summative evaluations take place after the product has been developed, because they are concerned with making judgements about the finished item. In contrast, formative evaluation methods support the formation of a product that will meet its requirements. Evaluation activities of this type mesh closely with the design and guide the design by providing feedback. However, Andriessen (2003) approaches this issue from a slightly different angle. In his view, summative evaluation is in fact at the same time formative in that it provides feedback for the next release of the software product. He therefore proposes the following categorisation of evaluation activities: anticipating evaluation (before the design starts); early evaluation (during the early design process); and operational evaluation of (socio-technical) systems in use. As anticipating evaluation may find place even before a prototype exist, this approach may appear a bit curious. What is there to be evaluated when no design product exists? It can be very informative however, to evaluate the 'would-be scenario' with an intended system before any design process is even started. See for example Van den Anker and Lichtveld's (2000) presentation of an evaluation based on scenarios of the new situation.

In practice the distinction between the three stages of evaluation presented by Andriessen (2003) is not always clear. They are more like values on a gliding scale on which design and evaluation activities are intertwined. However, the distinction is useful to specify the type of evaluation process E-MAGINE should apply: it aims to support dispersed knowledge groups in assessing the usefulness of the groupware application they are currently provided with. As a result E-MAGINE should consist of an operational evaluation approach.

4.5 From evaluating single-user systems to evaluating groupware

The second development is a consequence of the increase in complexity of software systems: the development of multi-user or groupware applications. This resulted, for instance, in new kinds of interactions: not only human-computer interactions became common, but also human-computer-human interactions. Evaluation methods had to evolve in parallel; they not only had to be suitable for the evaluation of single-user applications but of groupware applications as well.

In the Introduction of this thesis (Chapter 1) it is stated that the importance of developing groupware evaluation methods is widely recognised (Antunes & Costa, 2003; Baker, Greenberg, & Gutwin, 2001; Grudin, 1994b; Knuttila, Steves, & Allen, 2000; Pinelle & Gutwin, 2000; Ramage, 1996; Scholtz, Damianos, Greenberg, & Kozierok, 1999; Twidale et al., 1994). Only by structurally evaluating groupware applications can we learn how to improve their quality. E-MAGINE will enable groups to evaluate their current use of a groupware application and decide on adjustments or alternatives. These adjustments may be very specific for the group or groupware application at hand. However, these recommendations will be based on general principles of implementing and using groupware. By specifying these principles this thesis contributes to this field of research and supports the improvement of groupware applications in general.

In the development of groupware evaluation methods it is wise to incorporate the insights of the evaluation of single-user systems. In the evaluation of groupware applications however, there are numerous more problems to deal with. There are several reasons why evaluation of groupware applications is complex. “In principle, evaluation should be a significant check of a system’s capacity to deliver what is required of it” (Twidale et al., 1994, p. 441). However, the important role of the (social) context in which groupware applications are used makes it impossible to evaluate an application in isolation. One important aspect for example is that group interaction processes affect how the system is used, whereas at the same time the system influences these group processes (Grudin, 1994b). The system’s use may have an impact on how work processes are organised and on how people cooperate. In other words, the social structures are both a condition and a consequence of social action, where social action refers to the collaborative use of the groupware application (Giddens, 1984; DeSanctis & Poole, 1994).

Evaluation methods of single-user systems totally neglected the importance of coordination and cooperation between work processes that is necessary in many work situations (Bannon, 1991). However, there are more challenges that have to be met when translating the evaluation insights of single-user systems to the evaluation of groupware. Preece et al. (1994, p. 602), for example, present four major considerations in designing an evaluation process:

- The characteristics of the users who take part in the evaluation; for example, experience, age, gender, psychological, and physical characteristics.
- The types of activities or predicted activities that the users will perform. These may range from rigidly specified tasks, which are defined and controlled by an evaluator, to activities decided on by the users.
- The environment of the study, which may range from a controlled laboratory situation to a natural work setting.
- The nature of the application under evaluation, which may be anything from a series of sketches to a working software prototype or a fully developed product.

Each of these four evaluation aspects becomes more complicated when applied to groupware applications. From evaluating single user applications we learn that it is important to find ‘representative users’. But what do ‘representative groups’ look like? A practical complicating factor in the evaluation process is that many more respondents are needed to collect data (Baker et al., 2001). Another problem is how to distinguish effects of ‘human-human interaction’ from ‘human-computer interaction’? How can social or group effects be separated from effects related to the system interface? Furthermore, group goals and individual user goals are not always the same; in fact they may often conflict, as described in Chapter 3. Which goals should a groupware application meet? Further, in the implementation and use of groupware applications many more political, cultural, and organisational issues are at stake than in a single-user system. Time is an important factor here, as group interactions evolve over days or weeks (Twidale et al., 1994). As a consequence one-moment evaluations such as lab experiments are not very useful. In one-moment evaluation the effect of social processes on the adoption and use of groupware cannot be measured.

Hence, evaluation of groupware applications implies that contextual factors a) become more important for the success of the application and b) become more complex compared to a single-user application. As a result the focus of evaluation approaches has widened: a development that is given attention in the next section as well. E-MAGINE should also be able to handle contextual factors in the evaluation of a groupware application. More than that, it should be able to handle the complexity of contextual factors that influence the success of a groupware application. Section 4.6 and 4.7 describe evaluation strategies that have been developed in order to be able handle the complexity of contextual factors influencing the success of a groupware application.

4.6 From usability evaluation to socio-technical evaluation

The third trend concerns the focus of evaluation. In the first instance software evaluation methods focused on interaction aspects of an application, i.e., the system's ease of use for individual users and tasks. They focused on a thorough analysis of task support and interaction support of the system. Evaluation methods included assessment of the extent a user was able to recall how to perform a task on the system (memorability criterion of Nielsen, 1993) or to what extent the design of the interface supports easy navigation through its different functionalities. It was argued, however, that the focus on the interaction that takes place between the user and the computer overlooks the relationship of the computer to the day-to-day work practices of the users (Crabtree, 2003). The methods do not take into account that users might be interrupted while performing these tasks, or might be unwilling to use a system for political reasons. These are factors which are even more relevant for the success of groupware applications, therefore this trend and the previous one are highly interrelated. As a consequence, a highly usable system is not necessarily a successful system. If a system is usable but does not support users in accomplishing their tasks in daily practice it is not useful for them. Thus by focusing on *usability* aspects, the system's *usefulness* for a particular task and situation may be overlooked. Analytic attention to computer use is still warranted; however, it should be extended to address use in relation to work practice (to the socio-technical context of use) rather than only human-computer interaction which is too narrow a focus (Twidale et al., 1994).

The insight that software that meets all defined quality characteristics (including usability) will not necessarily be perceived as a high quality product when the software is actually applied in real life has led to the definition of a new ISO-norm: Quality in Use (Bevan, 1999). The norm is defined as: *the capability of a system to enable specified users to achieve specified goals with effectiveness, productivity, safety, and satisfaction in specified contexts of use* (ISO IEC DTR 9126-4, 2001). The norm underlines the relevance of a system's usefulness and its fit to the context-of-use in order to be a highly qualitative product. The norm does not neglect the software quality characteristics: they can even form a prerequisite for a system to be successful. In other words, Quality in Use is the combined effect of the six categories of software quality when the product is in use. It is measured in terms of the result of using the software, rather than properties of the software itself (Bevan, 1999, p. 5). It stresses the importance of a more subjective view of the quality of the system. After all, in the success of the system the user's opinion of its qualities can be, and is very likely to be, decisive. A relation with the fourth trend in software evaluation can be identified here: this trend is presented in the next section and describes the increasing role of the user in software evaluation approaches.

With the introduction of the new concept 'Quality in Use' the definition of usability was slightly changed, being: the capability of the software product to be understood, learned, used and attractive to the user, when used under specified conditions. The phrase 'under specified conditions' (equivalent to the context of use) was added to clarify that a product has no intrinsic usability, only a capability to be used in a particular context. This insight was not completely new. Usability was already related to the context-of-use in the introduction of Section 4.2. However, this new definition has broader implications: the context-of-use of the application not only provides the criteria the application has to meet, the result of usage of the application in this context is a decisive criterion for its quality. For the same reasons the other software quality characteristics were also redefined in terms of 'the capability of the software' and 'when used under specified conditions' in the revision of ISO/IEC 9126 (ISO IEC FCD 9126-1, 1998). Textbox 4-1 provides an overview of the new definitions of all six quality characteristics.

I. Functionality: the capability of the software to provide functions which meet stated and implied needs when the software is used under specified conditions.
II. Reliability: the capability of the software to maintain its level of performance when used under specified conditions.
III. Usability: the capability of the software product to be understood, learned, used and attractive to the user, when used under specified conditions.
IV. Efficiency: the capability of the software to provide the required performance, relative to the amount of resources used, under stated conditions.
V. Maintainability: the capability of the software to be modified. Modifications may include corrections, improvements or adaptation of the software to changes in environment, and in requirements and functional specifications
VI. Portability: the capability of the software to be transferred from one environment to another.

Textbox 4-1 Definitions of software quality characteristics (ISO/IEC FCD 9126-1 definitions**)**

It seems attractive to apply the Quality in Use norm to the E-MAGINE evaluation approach. The purpose of evaluation of E-MAGINE is to establish the usefulness of an application in practice. The Quality in Use provides criteria to measure this usefulness and provides directions for measuring a system's success in practice: it focuses on the user's opinion of the result of using the software. Software quality characteristics are considered a prerequisite for successful support, but the user's assessment of the result of using the software is considered decisive for its usefulness. In my opinion the Quality in Use norm, including these two notions, should therefore function as input for E-MAGINE. Consequently, the six software quality characteristics should be assessed in the evaluation approach. Additionally, users should be involved in the process of evaluation. As Gediga, Hamborg & Düntsch would describe it, E-MAGINE should consist of an opinion-based evaluation method (Gediga et al., 2002).

The importance of the match of the system to its context-of-use was also identified in Chapter 3, where it was referred to as the Contingency Perspective. This perspective implies that groups will successfully apply and use groupware if the groupware application matches their characteristics. As was stated in Chapter 3 the Contingency Perspective appears to be a relevant notion for the development of E-MAGINE. In this chapter it became clear that, generally, software evaluation methods have adopted this perspective, stressing the relevance of the context-of-use in the assessment of the quality of an application. This is in line with the Contingency Perspective and the socio-technical approach introduced in Chapter 1.

Socio-technical evaluation methods aim at evaluating 'the big picture' in order to provide feedback on all aspects of this total picture. The development of these types of evaluation methods demands a further integration of research disciplines. As the object of evaluation extends, expertise is needed not only of HCI but also of research areas such as communication theory, group interaction analysis, and organisational change theory (Andriessen, Koorn, & Arnold, 1998). A number of theories related to these research areas were addressed in Chapter 3. Communication theory, and especially theory on mediated communication, focuses on the question of to what extent the use of the medium hinders or supports people's interaction and information exchange. This research area includes the media-match theories depicted in Chapter 3. Group interaction analysis supports knowledge on the context that needs to be evaluated. New systems have to match into this context. These interaction processes have also been addressed in Chapter 3. Finally, organisation change theory stresses the fact that the more a new situation deviates from the existing one, the more energy has to be invested in the change programme (Andriessen, 2003). This discipline shows that the usefulness and success of a tele-informatic system not only depends on the characteristics of both the system and its direct context (users, tasks), but also on the manner in which the system is introduced in the organisation. Their joint optimisation can be achieved by a careful introduction of the system. Jenkins, Stanton, Salmon and Walker (2011) also provide an example of the complexity of evaluating a socio-technical system.

Andriessen, Koorn and Arnold (1998) present the MEGATAQ evaluation as an approach that can deal with the enlargement of the evaluation object. They provide an evaluation framework from which relevant elements can be selected. They also provide the MARC (MEGATAQ Assessment Reference Checklist) instrument which supports selection of relevant evaluation instruments. Their assumption is that evaluation of systems developed for e.g. organisational settings demand for other evaluation activities than systems developed for e.g. educational settings. The approach thus intends to support the evaluation of a broad range of software applications and starts with a very generic framework. E-MAGINE on the other hand focuses on the evaluation of a specific setting from the start: groupware provided for dispersed (knowledge). The approaches have in common that in potential many aspects may be relevant for evaluation. A modular evaluation framework from which relevant elements can be selected is a practical solution in these settings. As a consequence the set-up of MEGATAQ may be a suitable example for E-MAGINE.

As was stated above, the norm of Quality in Use stresses the importance of a more subjective view of the quality of the system. This implies that the user needs to be consulted about his experiences when using the system. This implication is related to the fourth trend in software evaluation, where the role of the user has shifted from an 'object of evaluation' to an 'actor in the evaluation process'.

4.7 From expert evaluation to participative evaluation

The fourth evolution in software evaluation concerns the manner in which evaluations are executed. Evaluation methods used to be executed by experts, as were the design activities. Currently, however, approaches in which users are involved are more popular than expert evaluations. In these approaches experts alone do not decide on the quality of the system. The experts incorporate reactions and opinions of current users and potential users into the final system. In this situation users are not simply passive objects under study. As Bannon (1991) describes it users are, or can become, active agents.

User involvement can be characterised as being somewhere on the continuum from informative, through consultative to participative (Damodaran, 1996). The essential distinction between these three main types is how active users' roles are, whether they influence decisions for example. Kujala (2008) explains that participatory design is sometimes used interchangeably with user involvement, but actually is located at the participatory end of Damodaran's continuum. The varied approaches to user involvement may serve different goals.

In parallel with the recognition of the importance of the context, it was learned that real improvements to a system could only be accomplished by involving users in the processes of design and evaluation (Holtzblatt & Beyer, 1996). After all, the users are the real experts on their task and context. Expert evaluation assumes that the evaluation expert speaks for the user in an adequate fashion; in other words, the evaluation expert is expected to be an expert on the user context as well. As software systems are used in very different contexts, this is an unlikely situation. It is more likely that the users themselves can deliver reliable detailed information about the system's context of use. As a result the consultation of users has become more and more popular and it has further influenced the development of iterative design. In some approaches users even actively participate and directly influence design choices. Researchers found that studying users from the 'outside' is not enough; users needed to be involved in the design process itself (Bannon, 1991; Crabtree, 2003).

Human factors experts still have an important role in participative design processes, although this role is slightly different and requires different skills. This is a consequence of the fact that users cannot fully understand all the possibilities offered by ICT. They need input in order to be able to imagine what the future might be like, using the system-to-be-developed (Kuutti, 1996). This input can be provided by a technology expert, for example. The expert and user may be able to construct the future situation together, using scenarios for example. The role of the design or evaluation expert is transformed to that of a facilitator of this process. In addition, he supports the identification of system requirements based on the outcomes of evaluation (van den Anker, 2003).

For a groupware tool to be successful it is important that its potential users accept it and are willing to use it. Involving users as active participants in the design process contributes to the achievement of two objectives. It does not only increase integration of the system with its context of use, it also increases user support for system implementation. This support is especially important for groupware applications, since success of the system often depends on a substantial number of users using it (Grudin, 1994b). For example, the success of a group calendar depends to a large extent on the number of employees involved that keep it up-to-date. The more calendars are up-to-date, the more useful the system may be. In Chapter 3, this phenomenon is referred to as critical mass. Consequently, if the system is designed with a high user involvement, it should both make the system closer to the way people work (hence increase its fit to its context of use) and be more likely that its intended users are willing to use it. Here a parallel is made for the evaluation of the groupware application. If the system is evaluated with a high user involvement it is more likely that the users support the evaluation outcomes and thus support the resulting adaptations.

Intended end-users are not the only actors who can help establish the requirements for the system. When a groupware application is to be implemented in an organisation, a large community of organisation members will be affected one way or the other. Many employees will have to adapt their ways of working to the new system. As a result, relevant stakeholders not only include the end-users, but also representatives from management or maintenance. These stakeholders may even have different requirements than the potential end-users. In such cases the different interests have to be identified and the priority of requirements has to be decided upon, preferably by consensus. Users should be involved in these decision making processes; user involvement should be designed as a participative process. In this process the evaluation expert may also have the role of facilitator, which can be challenging, for, end-users and managers may have quite different interests (Howcrofft & Wilson, 2003, p. 20).

In conclusion, it is important that E-MAGINE involves users and other stakeholders of the groupware application in its evaluation process. There are four arguments that support this conclusion. The first argument was identified in the previous section: the norm of Quality in Use prescribes the relevance of the subjective opinion on the usefulness of the groupware application in practice. In this section three other arguments were identified. Firstly, the detailed knowledge of users on the system's context-of-use is important for extending the fit of the application to this context of use. Secondly, it is necessary to involve different stakeholders of the application to identify contradicting requirements and prioritise these, preferably by consensus. Thirdly, participative evaluation may contribute to compliance for the evaluation outcomes. User involvement may be applied in different ways in the evaluation approach: the first goal may be achieved by applying informative or consultative user involvement, the second and third goal however demands active user participation.

4.8 Conclusions and design requirements

E-MAGINE is an evaluation method that should support dispersed knowledge groups in assessing the usefulness of their groupware application in sharing knowledge. In this chapter a literature review of software evaluation methods is presented, in order to further specify its design requirements and to identify an applicable evaluation process for E-MAGINE.

In section 4.4, it became clear that E-MAGINE, with its focus on the evaluation of applications in use, falls in the category of operational evaluation approaches.

In section 4.5, it was concluded that contextual factors are relevant for the success of a groupware application. A similar conclusion was derived based on the case studies presented in Chapter 2 and the literature discussed in Chapter 3. The relevance of these contextual factors is confirmed in section 4.6. Section 4.6 also provides directions to evaluate these contextual factors: First the concept of Quality in Use is identified, this concept provides manners in which a widened and more complex object of evaluation can be evaluated. Quality in Use prescribes how software evaluation methods can be extended by not only evaluating the software, but also the fit of the software to its context of use. Adopting the Quality in Use concept implies adopting the assumption that software quality characteristics are a prerequisite for successful support. And, that the result of using the software as assessed by the user is decisive for its quality and success. Software evaluation methods should therefore 1) estimate the extent to which the software quality characteristics are met and 2) consult the user about the quality of the application in use.

A second notion discussed in section 4.6 was the notion of fit. The acknowledgement of the relevance of fit is in line with the Contingency Perspective and socio-technical approaches. This notion implies that E-MAGINE should (also) be able to evaluate the fit of the groupware application to its context of use. An implication that was derived at in Chapter 3 as well. A third finding in this section is the potential practicality of a modular evaluation approach.

Finally, in section 4.7, four arguments for involving users and other stakeholders in the evaluation process are identified. The last two of these four arguments can only be achieved by user participation (in contrast to informative or consultative manners of user involvement), I will therefore select this approach of user involvement as requirement for E-MAGINE.

This results in a new list of design requirements for E-MAGINE presented in Textbox 4-2. Design requirement 1 and 2 did not change (see the concluding section of Chapter 2 for the old list of design requirements). Former design requirement 3 is specified into the new design requirements 3 to 5. Lastly, former design requirement 4, is now design requirement 6. In this new list design requirements 1 to 3 specify the *focus* (object) of evaluation and requirement 4-6 provide directions for the *process* of evaluation.

The design requirements cannot be met using the evaluation methods presented at the beginning of this chapter. Most approaches have too narrow a focus: they focus on tasks such as entering a single command or pressing the right mouse-button. Approaches that do involve context such as user observation or field studies are usually less than cost-effective. One of the problems of observing groups is that this requires many subjects: the logistics of finding them and scheduling theses sessions can be difficult. Groups also vary greatly in composition and in how its members interact, which makes observations difficult to analyse and generalize when compared to single user observations. Additionally, the groups in this thesis are not even co-located, which makes observation of group activities even more complex.

One type of research method to deal with these problems is the ethnographic approach. In ethnographic methods interviews and observations are combined to gain a detailed understanding of the intended user, its task, and context. Ethnographic experts might help distil issues that influence the successful use of a application (Crabtree, 2003). However, these approaches are very labour intensive, and as a result do not meet the requirement of a cost-effective evaluation approach.

E-MAGINE should:

1) Concentrate on the support of dispersed knowledge groups (*object* of evaluation);
2) Concentrate on groupware in use, e.g. apply operational evaluation (*object* of evaluation);
3) Evaluate the fit between application and context (*object* of evaluation)
   To evaluate the fit between application and context the evaluation approach should evaluate (1) the application, (2) the group and its context, and (3) the fit between these two.
4) Apply the concept of Quality in Use (*object and process* of evaluation);
   The concept of Quality in Use implies that the method should (1) estimate the extent to which software quality characteristics are met by the collaborative application (see Textbox 4-1) and (2) consult the user on the quality of the collaborative application in use.
5) Apply participative evaluation (*process* of evaluation);
   Participative evaluation is applied in order to (1) gain insight into details of the context of use; (2) be able to identify potential contradicting requirements by consulting different stakeholders and (3) create compliance for the evaluation outcomes.
6) Be practical (cost-effective) (*process* of evaluation).

Textbox 4-2 Design requirements for E-MAGINE

In all, no evaluation approaches have been identified that are suitable for the assessment of the support of a groupware application for sharing knowledge in a dispersed group. Perhaps a combination of evaluation methods can lead to a suitable approach. This idea will be elaborated on in the next chapter.

5

Development of an Evaluation Framework

5.1 Introduction

The framework for the evaluation approach E-MAGINE will be developed in this chapter. Framework in this context actually refers to two types of frameworks underlying the evaluation method. First, a framework for the *process* of evaluation will be build: the main evaluation steps of E-MAGINE will be specified. Second, a framework for the criteria that indicate success of the *object* of evaluation will be specified. The evaluation method is designed in line with the design requirements identified in the previous chapters. The chapter concludes with a presentation of the research strategy for the subsequent development steps.

5.2 Framework of the E-MAGINE evaluation approach

The main design requirements of E-MAGINE seem to be contradicting: It should evaluate a large range of factors (design requirement 3), but at the same time the methodology should be practical and cost-effective (design requirement 6). E-MAGINE should further concentrate on the evaluation of groupware in use (design requirement 2), but in some cases the application is not used at all, as illustrated in Chapter 2. In those cases intensive evaluation activities are not useful.

In Chapter 4, section 4.6, a possible solution to cope with these issues has been identified: A modular approach combined with an instrument that supports the selection of relevant modules. I will apply this set-up for E-MAGINE as well, it will be developed as a modular two-phase approach. The 'selection instrument' applied in the first phase will not only be used to select relevant modules for the second phase of evaluation, but also to assess whether the groupware application is used or not, by whom, and to what extent. Such a two-phase approach has the benefit of avoiding the application of time intensive evaluation instruments in case reasons for non-use of non-successful use are not related to the focus of these instruments. It further has the potential of fulfilling both design requirement 3 and design requirement 6.

Below I will describe the two phases of evaluation in more detail.

5.2.1 First Phase of evaluation

An evaluation process should always start with a kind of introductional meeting to discuss and select the goal(s) of evaluation and its main conditions. Such a meeting is therefore applied as a first step of the E-MAGINE evaluation process. The main step of the first phase of evaluation however should be a kind of scan. For, if the First Phase of evaluation has to direct the further evaluation process then it also should consist of a kind of instrument that scans all potential relevant factors. In Chapter 6 the development of such an instrument is presented, it will be referred to as the First Scan. The purpose of applying the First Scan is to generate a first and rough profile of the group and its context as well as of the (use of the) groupware application. This rough profile will be referred to as First Level Profile. The First Level Profile should include an overview of the presence of conditions for successful groupware use (which will later be referred to as Success Factors). These conditions might relate to the group and its context, or to the application, or to the match between these two (in line with design requirement 3). In case conditions are, or seem to be, absent, this gives an occasion for more detailed evaluation activities in the second phase of E-MAGINE.

5.2.2 Second Phase of evaluation

In principle all kinds of group or technology factors might be studied in a Second Phase. In my study I focus particularly on knowledge sharing in dispersed groups (design requirement 1). This implies that in this study the main instrument in the Second Phase of evaluation has to be an instrument that assesses the quality of knowledge sharing support. It will be called Knowledge Sharing Support Inventory (KSSI, see Chapter 8). It will be developed as a general instrument which can be adapted to the situation in which it is applied. This allows for adaptations such as leaving out irrelevant questions, and specifying the features of the groupware application. The First Level Profile resulting from the First Phase of evaluation is used to direct these adaptations.

In case the First Phase of evaluation indicates that a groupware application is not or hardly used, it makes no sense to apply the KSSI, as the KSSI focuses on the opinion of the user of the result of using the software (in line with design requirement 4). It may be interesting to apply other evaluation instruments instead. One option is to study in more detail the issues that were indicated as possible impediments for (effectively) using the groupware application. Many aspects may be selected for further evaluation, such as usability issues, but also such issues as social cohesion and trust among group members. Calibrated instruments exist for certain purposes such as usability testing and trust. In Chapter 4, for example, SUMI is mentioned as a possible usability evaluation instrument (Kirakowski, 1997). And Jarvenpaa and Leidner (1998) apply a modified version of the Schoorman et al. scale (in Mayer & Davis, 1999) to measure the level of trust in distributed teams. Anyway the focus of the Second Phase is determined by the outcomes of the First Phase of evaluation.

After the KSSI or other evaluation instruments are applied, a Final Profile of the group and its context and of the application can be generated. The Final Profile completes the First Level Profile with the results of the Second Phase of evaluation. If the KSSI is applied the

Final Profile shows the level of knowledge sharing support of the application. However, the Final Profile does not contain concrete suggestions for improvements. In addition, the impediments for successful support are not prioritised at this stage. Whether adjustments should be applied and what they should entail depends on several aspects, including the priorities in this setting, the available budget, the possibility to switch to other groupware applications, etcetera. Therefore, a final evaluation step is needed in order to generate a plan of action.

A plan of action can be achieved through the use of a focus group as suggested by Äborg, Sandblad, Gulliksen, and Lif (2003) and Doherty, King, and Al-Mushayt (2003). Äborg et al. (2003) suggest a group meeting in order to verify results and generate compliance for the outcomes of the evaluation. Doherty et al. (2003) use focus groups to explore whether any statistically significant associations identified during the quantitative analysis were indicative of underlying relationships. The focus groups were also used to uncover deeper insights into the nature and implications of the relationships and to identify any circumstances under which the relationship might not be true. A focus group also fulfils design requirements 5 where it is suggested to apply participative evaluation (design requirement 5). Therefore, E-MAGINE is developed to include such a focus group as the last step in the evaluation process.

The concept of focus groups has been developed in the context of market research (Duggan, 2003). Focus groups are heterogeneous groups, whose members represent a variety of customer profiles, who provide feedback on perceptions, attitudes, and ideas on the topic of interest. For E-MAGINE this heterogeneity is also very useful and in line with its design requirements. The focus group will consist of not only end-users, but also other stakeholders of the application, this enables creating compliance for the evaluation outcomes. The meeting will be applied for the verification of results and the development of a plan of action for improving the situation. In addition, a focus group seems to be useful to identify possible contradicting requirements and prioritise these. The session should be prepared on the basis of the Final Profile. Doherty et al. (2003) prepared a draft interview guide for their focus groups. Such a guide may be useful for E-MAGINE as well and will be developed in Chapter 8.

The fit of the application to the group (design requirement 3) is measured in two manners in this set-up of the evaluation approach. In the First Phase and partly in the Second Phase of evaluation it is *the evaluator* who determines whether there is a fit. In the Second Phase of evaluation, the *users* of the application and *other stakeholders* are consulted on their perception of fit of the groupware application to its context of use.

5.2.3 A schematic overview of the evaluation process

When E-MAGINE is developed as described above it results in an evaluation process as presented in Figure 5-1. It shows that E-MAGINE consists of two phases of three steps each. The evaluation process starts with an introductory meeting, a meeting between the client and the evaluator (step 1). The goals of the evaluation process are set and agreements are made on how to proceed. It is important to combine the evaluator's specialist knowledge with the contextual knowledge of someone from the organisation in order to generate effective recommendations (Block, 2000). Therefore the approach aims to involve a group leader or facilitator from the beginning of the evaluation. In the next step (step 2) the First Scan is applied. This Scan results in a First Level Profile of the group and the application (step 3). The issues that were indicated as possible hindrances for successful use of the groupware application are suggested for assessment in Phase 2 of the process. Although the KSSI is the main evaluation instrument of E-MAGINE, in this phase many aspects may be selected for further evaluation (step 4). Step 5 provides a Final Profile of the group and its application based on the test results of the applied evaluation instruments. The final step (step 6) involves feedback from the evaluator to the group in order to generate and prioritise suggestions for improvements (see also Huis in 't Veld, Andriessen, & Verburg, 2003).

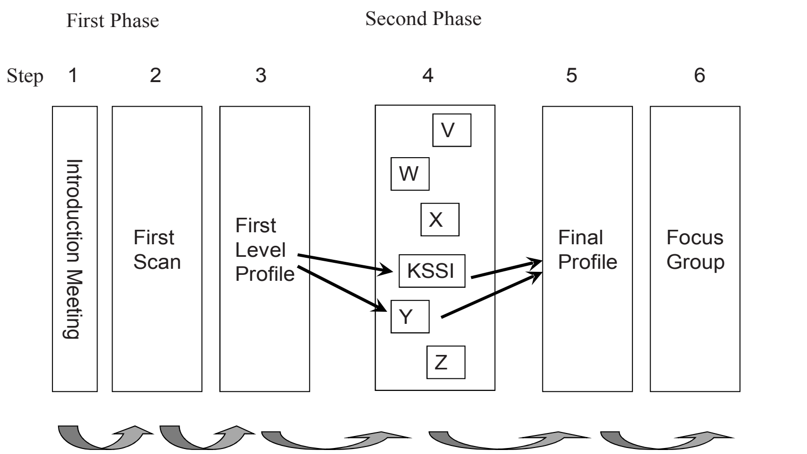


Figure 5-1 The E-MAGINE evaluation process

5.3 Methodical requirements

Every methodology and instrument should meet general methodical requirements, the requirements of reliability, validity and acceptability. E-MAGINE should meet these requirements as well. Reliability is the extent to which an instrument is able to produce accurate data, and the same data when measured at different times, or by different users (assuming that the phenomena being measured have not changed). An instrument is said to be valid if it measures what it is supposed to measure. Validity concerns the 'truth of measurement' and in evaluating the validity of a method "we should evaluate whether the methods actually measures what we think it should measure" (Doyle, 2003, p. 274). An acceptable method implies that the method should be perceived as relevant and fair by respondents (see for example Stanton & Young, 1999).

The three methodical criteria hold for the complete evaluation approach E-MAGINE, as well as for its two main instruments which are developed in this thesis, the First Scan and the KSSI. Fulfilling these three methodical requirements will be thought of in the further development of the method. Testing the reliability of E-MAGINE and its instruments is however hard in this stage of its development. Two possible options will not be applied here as they are beyond the scope of the research: 1) application of the evaluation approach by (an)other researcher(s) and 2) applying the approach twice. However, the First Scan will be applied twice in the same setting (see Chapter 7). To test the validity of this method it is possible to present the outcomes of the method (and its instruments) and ask respondents whether these outcomes are in line with what they expected. Where this is possible this will be done. Acceptability can be verified by asking respondents cooperating in this study what they think of the approach and its instruments. This will also be done, whenever possible. In Chapter 10, the concluding chapter of this thesis, it will be discussed whether E-MAGINE meets these methodical requirements.

5.4 Further development of E-MAGINE

Now a first framework for the process of E-MAGINE is developed the next step is the development of its main instruments: The First Scan and the Knowledge Sharing Support Inventory. As is explained in section 5.2.1 the First Scan should generate an overview of conditions for successful groupware use present in the setting. These conditions can be considered criteria for success. In Textbox 2-1 (Chapter 2) an overview is provided of barriers for groupware usage in general and more specifically for successful groupware support for knowledge sharing. For most of these barriers it holds that 'the opposite' can be considered conditions for successful groupware usage. I will refer to these conditions as Success Factors. Rewriting these barriers into Success Factors results in the list presented in Textbox 5-1. This list will be used as a starting point for the development of the two instruments.

In Chapter 6 a number of new case studies will be presented that are used to generate new input for the evaluation method in general and the First Scan and KSSI specifically. The new case studies will be applied in order to identify more Success Factors and to validate the Factors identified so far. For the development of the KSSI it is relevant to identify important knowledge sharing activities and the groupware functionalities that may support them. Before presenting the case studies a framework is developed for the Success Factors.

5.4.1 A framework for Success Factors

The First Scan will be applied to identify the presence (or absence) of Success Factors in the setting under evaluation. For the development of the Scan a categorisation of Success Factors is useful. Such a framework not only structures Success Factors identified so far in this thesis, but can also support the identification of new Factors.

In Chapter 2 a first categorisation was derived based on case studies, here three groups of barriers for successful groupware usage were identified: (1) Barriers related to technology; (2) Barriers related to the tool-task fit and (3) Barriers related to the group and its context. In the further development of the evaluation approach it appeared that the application not only should fit the task (tool-task fit), but that it should fit the context-of-use (including the task). Thus, the second category 'tool-task fit' should be extended to a category 'tool-context of use fit'. Actually, this is specified in design requirement 3: to evaluate the fit between application and context the evaluation approach should evaluate (1) the application, (2) the group and its context, and (3) the fit between these two. A categorisation of Success Factors in line with these findings is rational.

In addition to the DGIn-model (presented in Chapter 3) Andriessen (2007) also presents a categorisation of success factors for socio-technical settings. He specifies 7 main requirements for the design and evaluation of these settings. Out categorisation partly overlaps with these main requirements. A comparison between the two categorisations seems useful in order to validate and refine ours. First, the requirements presented by Andriessen are summarised here:

1) Technical efficacy

Tools should have the basic technical quality properties, such as functionality, reliability (robustness), portability, maintainability, and (infrastructural) efficiency.

2) Context match: Matching the users

Systems have to be easy to use and attractive (= usable).

3) Context match: Matching the task

Systems need to have the functionalities that are needed for the task. Groupware tools do not necessarily have to support all tasks of the group, but designers should be aware of the following issues:

1) Group members have not only co-operative tasks, but also individual tasks.
2) Groups can have multiple tasks and work methods, synchronously and over time; they may redefine their tasks and methods as a result of experiences and external influences.

4) Context match: Matching the social and physical setting

Systems should match group structure, composition, and culture. They should be compatible with the physical setting and open to interaction with the environment.

5) Interaction process support

Systems should support the intended processes adequately and not hinder other processes. The processes are: individual and co-operative task performance, communication, sharing information and knowledge (learning), co-ordination, and social interaction.

6) Outcome support

Outcome support indicates the degree to which use of the tool contributes to intended outcomes, does not hinder other outcomes, and contributes to the development of new practices. This includes the criteria related to task outcomes (products), individual user outcomes, group outcomes and organisational outcomes.

7) Adequate introduction, adaptation and group development (short: I, A, D)

Tools and groups should be adaptable to each other and to the environment. Tools should be tailorable, e.g. adaptable to suit a special need or purpose, and open to appropriation. Groups should be reflective and open to team building.

The Contingency Perspective plays an important role for the requirements presented by Andriessen. In addition they underline the importance of adaptation processes. The importance of a match between application and context becomes evident in requirements 2, 3 and 4, but also the requirements 5, 6 and 7 can only be achieved when a match between application and context is guaranteed.

When the first categorisation developed in this thesis is compared with the categorisation presented by Andriessen (2007) four main differences can be noticed. Firstly, his 7 groups of requirements exclude a category that comprises only group and contextual factors. Secondly, ‘match to context’ is specified into 3 categories, namely ‘matching the users’, 'matching the task' and 'matching the context'. Thirdly, Andriessen makes a distinction between task support and interaction or outcome support. Fourthly, some of the factors that are specified under 'match to context' in the first categorisation, can be considered examples of Andriessens category 'Adequate introduction, adaptation and group development'. In all, the categories of Andriessen provide a further specification of relevant contextual factors, but exclude a category that comprises only group and contextual factors. It seems therefore useful to merge the two categorisations and apply the new structure as a basis for the further development of E-MAGINE and its main categories.

To merge the two categorisations the following changes are made to the categorisation presented by Andriessen (2007). Firstly, I add one category to this list: Groupness. In chapter 3, groupness is defined as a dimension affected by (1) interdependency of goal and task performance; (2) duration of the interaction; (3) intensity of interaction; (4) continuity of membership; (4) formality of membership and (5) number of people involved. However, some other aspects contributing to groupness were identified in Chapter 2. It became clear that groups may not use a groupware application when the supported group does not function as a group, for example, if group members do not feel affiliated to the group, or if they perceive the group to be nonexistent. It appeared that a collection of individuals who are not motivated to interact with other individuals is not 'enough of a group' to be successfully supported with a groupware application (at least in this context where it concerns dispersed knowledge groups in an organisational setting). In these settings, groupness is very low: no interaction finds place, nor face-to-face, nor mediated. And, although a list of group members can be generated (several individuals have subscribed themselves to the application) these individuals do not recognise themselves as a group member. Apparently, groupness is more than the more or less objective attributes that define the concept, it also relates to more subjective, social psychological aspects such as motivation, cohesion and feeling of affiliation. Actually, these two groups of attributes relate as cause and effect. Levels of the five attributes dimensions affect the levels of aspects such as motivation and cohesion. I therefore extend the concept of groupness to include not only the descriptive aspects related to the factors defined above, but also the social psychological concepts, such as motivation.

Secondly, for the category 'Technical Efficacy' it holds that the characteristics indicated by Andriessen are in line with the software quality characteristics defined by ISO/IEC 9126 (see Chapter 4), except for one. Andriessen specifies the usability criterion as a matching requirement, arguing that it depends too heavily on the context-of-use to specify it as a purely technical criterion. However, as usability experts are able to give a (rough) indication of the usability quality of a software system without involving the user (e.g. by applying usability inspection methods such as heuristic usability evaluation as proposed by

Nielsen and Molich (1990) in my opinion it can be applied as a technical quality property. Therefore I will add it to the list of requirements contributing to Technical Efficacy. More detailed usability issues, for which consultation of the user is necessary, fall into 'Context Match – Matching the user'.

The last adjustment to the list of requirements is a simplification of the list by making a division in 5 main categories of requirements. See Table 5-1 for an overview of the final categories.

Table 5-1 Categorisation of Success Factors in 5 sets

1) Groupness	
2) Technical Efficacy	
3) Context Match:	3a. Context Match – Matching the Users
	3b. Context Match – Matching the Task
	3c. Context Match – Matching the Setting
4) Group Support:	4a. Group Support – Support of Processes
	4b. Group Support – Support of Outcome
5) Adequate Introduction, Adaptation and Development	

Now that a categorisation of Success Factors is developed the Factors identified in Chapter 2 can be re-listed. The resulting list is shown in Textbox 5-1. Factors identified in literature (Chapter 3) are also added to the list. The new case studies in the next chapter will be used to further complete this list.

From the list in Textbox 2-1 the three general factors are applied as general notions in this thesis, not as specific Success Factors. The first general finding 'Full dependency on ICT is no guarantee for full use of available applications and features' is an inspiration for developing E-MAGINE. What are (other) reasons for groups to use groupware? The second finding 'Teams tend to stick to initially established patterns of interaction and technology use' is expected to relate to Success Factors in the category 'Adequate Introduction, Adaptation and Development'. Just supplying a group with a specific groupware application does not necessarily lead to successful support. The last finding 'A groupware application may support interaction between members and central storage of knowledge' is confirmed in the Chapter 3. It will be used to distinct between different types of groupware support.

5.4.2 First steps in developing the KSSI

The Knowledge Sharing Support Inventory (KSSI) is the instrument that should evaluate the extent of knowledge sharing support by a groupware application. Findings that inform this evaluation question are relevant for the development of this instrument. In Chapter 2 several observations were made in relation to the support of knowledge sharing. These are relisted in Textbox 2-1 and below:

- A groupware application may support interaction between members and central storage of knowledge.
- Some knowledge sharing tasks, such as 'sharing experiences', are perceived as unsuitable for ICT facilitation.
- A groupware application seems more likely to be successful as central storage of knowledge (information or experiences) if active structuring and filtering activities are applied.

These observations will be used as input for the KSSI. In addition, the case studies that will be presented in the next chapter are used to add new relevant observations to this list.

The Second Phase of the evaluation process focuses on the opinion of the user about the result of using the software. As a consequence, the KSSI will have this focus as well. Therefore it is interesting to gain more knowledge of the aspects that influence the opinions of users about the usefulness of a groupware application for sharing knowledge. The case studies in the next chapter are also used to identify these aspects. Naturally, these aspects will also be input for the KSSI.

5.5 Conclusions

An evaluation framework for E-MAGINE was developed in this chapter on the basis of the design requirements identified in the previous chapters. The framework consists of two phases to fulfil its design requirements. A main evaluation instrument is specified for each phase: the First Scan and the KSSI, respectively. Further, methodological requirements for the evaluation method were specified. Lastly, a categorisation for Success Factors was derived. New case studies described in Chapter 6 will provide input for the further development of E-MAGINE in general as well as for these two instruments specifically. The two evaluation instruments will be developed in Chapters 7 and 8.

Groupness

- Group members motivated to participate in the group. Motivating factors are:
  - group members interested in interaction with other group members (Ch. 2).
- A cohesive group
  - Group members not being largely dispersed (Ch. 3).
- Group members having a solid common ground (Ch. 3).
- The group operating in an open knowledge sharing culture (Ch. 3).
- High interdependency in goal and task performance of group members (Ch. 3).
- Long period of interaction between group members (Ch. 3).
- Frequent interaction between group members (Ch. 3).
- High continuity of membership (Ch. 3).
- High formality of membership (Ch. 3).
- Small number of people involved (Ch. 3).

Technical Efficacy

- Groupware applications are compatible to infrastructure applied by group members (Ch. 2).
- Sufficient infrastructure is available (Ch. 2).
- The availability of awareness features (Ch. 3).

Context Match – Matching the Users

- Users require a collaborative application that is easy to use (user-friendly) (Ch. 2).
- Users require easy access to the collaborative application (Ch. 2).
- Subgroups (may) require a collaborative application that specifically supports these subgroups (Ch. 2).
- Users require a collaborative application that they perceive as useful (Ch. 2).
- Users using the same application for the different groups they are member of. (Otherwise they may perceive the different applications as being competitive.) (Ch. 2).

Context Match – Matching the Task

- Matching the task implies that there is *added value* in using the application to perform a task (Ch. 2).
- Matching the task implies the support of tasks which users consider suitable for ICT mediation (see also support of processes) (Ch. 2).

Textbox 5-1 Success Factors identified in Chapters 2 and 3, restructured according to the framework presented in the current chapter.

Group support – Support of Processes

- Matching processes implies the support of processes which users consider suitable to for ICT mediation (Ch. 2).

  Knowledge sharing is supported if:
  - a groupware application supports interactions between members and/or central storage of knowledge (Ch. 2);
  - active structuring and filtering activities are applied (especially relevant when the application functions as central storage of knowledge) (Ch. 2);
  - knowledge sharing processes are supported which users perceive as suitable for ICT mediation (Ch. 2).
- The application supports the building of trust, the building of a common ground and a sense of belonging to the group (Ch. 3)

Group Support– Support of Outcomes

In Chapter 2 and 3 no specific factors were identified concerning Support of Outcomes.

Adequate Introduction, Adaptation and Development

- A successful adoption process includes groupware usage pushed by the organisation
- (Ch. 2).
- A successful introduction of the collaborative application entails time to learn to work with it (Ch. 2).
- A successful adoption process of the application entails the need for interaction experienced by the group members, even when this implies the change of existing communication structures (Ch. 2).

Textbox 5-1 (continued) Success Factors identified in Chapter 2 and 3, restructured according to the framework presented in the current chapter

Research Phase II:

Filling in the details

6

Case studies for fine-tuning E-MAGINE

6.1 Introduction

The case studies described in this chapter are used as input for the two instruments of the E-MAGINE evaluation approach: The First Scan and the KSSI. In the case studies any factors that facilitate or inhibit usage of a groupware application are specified and used as input for the First Scan. In addition, tool features are identified that successfully support knowledge sharing activities. In this way the cases generate the questions that constitute the First Scan. They further function as input for the KSSI instrument, which can be applied in the Second Phase of the evaluation approach.

In this phase of the development of E-MAGINE three organisations were willing to cooperate[2]. However, in one of these organisations the groups did not apply groupware, so I selected the other two organisations for fine-tuning E-MAGINE. The selected groups all meet the three selection criteria: the groups are dispersed, knowledge-intensive and function in an organisational setting. However, here as in Chapter 2, the groups are very diverse. The groups under study differ on two interesting aspects, the phase the groups are in and their organisational setting. The first case study, at Habiforum, concentrates on starting communities in an inter-organisational setting. The second study, at AtosOrigin, focuses on two different types of groups functioning within the same intra-organisational setting. This diversity will support the development of an evaluation approach applicable in a large range of settings.

6.1.1 Research activities

In both cases interviews and observations of the groups were applied in order to determine the relevant concepts. Data generated in this manner was completed with documentation of the organisations involved as 'sources of evidence' (Yin, 2003). However, the research activities that have been applied were not exactly the same for two reasons. Firstly, the diversity of the groups required different approaches. Some groups organised meetings that could be visited and observed, other groups had no meetings during the period of research. Secondly, access to the groups was not the same in the two organisations. As a result, some groups could be studied in-depth, whereas only scarce information could be collected from other groups. In all, the research approach and number and types of communities studied within each company varied according to the types of communities within the companies, the availability of the groups and individuals, and organisational and management requirements. The detailed research activities are described separately for the two case

[2] Access to the organisations and groups was generated in the context of the CommShare research project.

organisations.

Interviews and observations were used in the case studies to identify issues that contribute to the five groups of Success Factors presented in Chapter 5 (see Table 5-1 and its copy in Table 6-1 below).

Table 6-1 Categorisation of Success Factors in 5 sets

1) Groupness;	
2) Technical Efficacy;	
3) Context Match:	3a. Context Match – Matching the Users;
	3b. Context Match – Matching the Task;
	3c. Context Match – Matching the Setting;
4) Group Support:	4a. Group Support – Support of Processes;
	4b. Group Support – Support of Outcomes;
5) Adequate Introduction, Adaptation and Development.	

Which characteristics of the group or the application contribute to groupness or technical efficacy? What characteristics of the context lead to requirements for the application so that the application matches the users, the task and the group setting? And what support is needed from the application in order to match the processes and outcomes of the group? Answers to these questions support the construction of evaluation instruments for assessing the fit between the group and the application. Finally, the cases should reveal what aspects contribute to adequate introduction, adaptation and development processes. The case studies are presented using similar structures. Their description starts with the context in which the communities are functioning. Subsequently the research approach in that specific context is given. Depending on the context, access was generated to one or more communities. A description of these communities follows, as well as the collaborative application provided to these communities and its functionalities. The section ends with observations of this application with respect to its usage level and knowledge sharing support. The case description concludes with implications for E-MAGINE. Factors that function as motivators to use the collaborative application to share knowledge in the dispersed group are identified as Success Factors in the cases (in line with the definition of a Success Factor). For each case the Success Factors identified are presented in a summarising textbox.

6.2 Habiforum

6.2.1 Context

In the Netherlands land space is scarce; over 16 million people need space to live, work, travel, and recreate. It is therefore important to make cost-effective and sustainable use of this space. For this reason the state financed the network organisation Habiforum, a consortium of public and private parties. Habiforum aims to develop, assemble and make available knowledge about multiple space use. These activities should result in new concepts and new ways of working that contribute to space in the Netherlands being used more cost effectively and in a more sustainable manner.

To achieve this goal Habiforum developed several initiatives, one of which is founding Communities of Practice. In these communities knowledge in this area of expertise should be shared so that innovations can take place. In order to set up these communities the consortium contracts different institutions and consultancy companies to work together and start up a community. Approximately ten CoPs were initiated at the time of this research project.

Approximately four institutes or companies were contracted per community in the first phase. Representatives of these groups of four formed the so-called core-teams. A core-team is responsible for finding experts in the field, bringing them together, starting up the community, and subsequently coordinating and facilitating its activities. The resulting communities consisted of members from different organisations that were located dispersed over the Netherlands.

Habiforum intended to establish communities that eventually would be able to act independently, without their core-team and even without Habiforum as a supporting consortium. Until then Habiforum would provide the core-teams with financial resources and facilitate the exchange of experiences between these core-teams. Moreover Habiforum set up a web portal providing information about the consortium and about multiple space use in general. This web portal also provided speciliased websites including workspaces for every community within Habiforum.

6.2.2 Research approach

In the context of this research project the communities within Habiforum were especially interesting because they had to start from scratch. How would they develop? What was the idea behind developing a supporting web portal? What strategy for developing this platform would be applied and why? Would the communities appreciate and successfully use the web portal provided by Habiforum? The answers to these questions provide more insight into what factors facilitate or inhibit success of a collaborative platform.

I studied the communities with a colleague researcher and we decided to apply participative observation as a research strategy. In that manner we could gain in-depth insight into this community. We were invited to become members of one of the core-teams, the MultiSpace community core-team (a fictional name). I took up the role of web editor for this community in order to be closely involved with the development of the web portal. More information about this role is provided in the 'groupware application' section. Participative observation thus enabled gaining in-depth insight into the group as well as in the application that would be developed. At the same time, provided the network organisation most of the conditions for the community, making it harder to directly affect community processes. Lastly, if I would interfere by bringing in suggestions for features for the tool for example, I could easily identify these interventions and monitor their effects.

As members of the core-team we were also members of another community founded by Habiforum: the Overall community (a fictional name). This community was initiated to support the core-teams. In the Overall community issues concerning all of the communities in Habiforum were discussed. Meetings of the Overall community focused on exchanging experiences in the process of starting up and facilitating a Community of Practice. At these meetings we met members of other core-teams and gained some insight into other communities in Habiforum as well.

Participating in the core-team of MultiSpace consisted of attending both the meetings of the core-team and the total community. We held interviews with members of the core-team and with members of the community during these meetings. In these interviews I focused on the members' expectations with respect to the website and their reasons for using or not using the site. These expectations were also explored through a questionnaire during the first meeting of the community, which investigated expectations with respect to the community in general and to the ICT facilitation in particular. We also had four extensive interviews with respondents outside of the MultiSpace community. One interview was held with a facilitator of another CoP and one with a web editor of another CoP. Two further interviews were held with the consultants whose assignment it was to facilitate the communities with a collaborative platform. An overview of the interviews is provided in Appendix II.

6.2.3 Community MultiSpace

Task

MultiSpace was an inter-organisational community that focused on (existing) small-scale industrial estates in urban areas. The poor quality of the existing industrial architecture and town planning was their starting point; for MultiSpace frustration about unsuccessful efforts to improve the existing practice was their motivator for action. MultiSpace wanted to investigate why changing the practice of industrial estate planning proves to be so difficult, and its founders wanted to find ways to change this. The 'formal' kick-off meeting of the community of practice MultiSpace was mid-September 2001. The community existed until their last meeting in February 2003.

Members and setting

The core-team of MultiSpace united five persons from four different companies and institutions active in this field: three consultants, an architect and a researcher. It focused on developing a community in multiple space use in industrial estates. To find members for the community the core-team relied on their networks of clients and colleagues, all situated in the Netherlands. Local authorities were mainly represented in the community, but also real estate developers and researchers. The community members were interested in developing industrial estates in a sustainable way, they joined the community to become inspired or solve problems in achieving this aim. Most of these members owned a specific estate that had to be developed from scratch, or redesigned and (partly) rebuilt. The institutions had to pay a fee to become a member, for which they received free access to all activities for at least two of their employees. In addition, membership included free access to the closed part of community's website. All activities were organised by the core-team including the community meetings.

Activities

The community, and especially the core-team, tried to stimulate discussions in which members openly share their knowledge and tell about their cases. In other words, members were expected to share their ideas and experiences in (re)building and (re)designing their own industrial estate(s) following the principals of multiple space use. According to the core-team sharing the details of these cases and relating experiences was the only way the community could develop useful and innovative ideas. However, the core-team was aware of the impediments for openly sharing knowledge. Firstly, for most of the community members the concept of a Community of Practice was new and it was not completely clear what they could expect from it. Secondly, most members did not know any of the other members, except the core-team member who had invited them to join. Thirdly, some members had potentially conflicting interests, like the local authorities and the real estate developers. Such a situation usually results in both parties playing their cards close to the chest. At the same time the community members were expected to share and present their case in the community, including the problems they had encountered or the possible mistakes they had made. The core-team and community members tried to solve this issue in several ways. In one meeting for example, one member asked for confirmation from all members to maintain confidentiality because they might discuss some sensitive information. Members explicitly made agreements on this issue, and this happened again at a later meeting. The core-team further focused on organising informal meetings in which they were open about their own ideas and experiences too.

An especially interesting event in this respect was the so-called Pressure Cooker: a 24-hour event, from 6 pm. to 6 pm. the next day. The Pressure Cooker turned out to be a good set-up for combining social activities with an intensive brainstorm session that lasted a whole day. During the brainstorm session the participants split up into two or three groups and each group focused on one of the cases brought in by one of the community members. Participants were very enthusiastic about this formula, as they had the possibility to exchange experiences in an informal way and go into one specific problem in-depth during the brainstorm sessions. As this set-up was successful the core-team extended this process by combining the Pressure Cookers with tours to the specific industrial estates.

Completion

Habiforum stopped supporting this community after two years. As a consequence, the core-team decided to conclude its activities. Though the community members paid a fee, the core-team saw no way to continue the community without losing money on it. The team organised a final community meeting in February 2003. The core-team members presented the innovative concepts which they had distilled from the several cases. These concepts were discussed with members of the community and some experts in the field. After the meeting the most inspiring ideas were collected and described in a final document. This final document was presented to Habiforum as the final outcome of the community.

6.2.4 Groupware application

Goal of facilitation

Habiforum not only supported its communities with funding, the consortium also provided websites. Each community website was part of the Habiforum web portal. The website was intended to facilitate communication and information sharing outside the meetings of the CoPs. As community members worked dispersed and for different organisation, Habiforum wanted to provide them with an inter-organisational platform through which they could easily stay in touch and exchange information. The web portal further provided information about the Habiforum consortium, activities initiated by Habiforum, and multiple space use in general. MultiSpace had its own website and work space on this platform, as did the other communities. Details on the website of MultiSpace are presented after the development of the portal is described in the next section.

Development of the software

The development of the community website was a long-lasting process. Habiforum was a recently initiated consortium and it had to start from scratch for developing an ICT infrastructure, including a web portal and relating websites. The consortium assigned an ICT supplier to develop the infrastructure. The supplier developed the software and organised instruction sessions the users. In these instruction sessions users received information on how the software could be used to generate and update websites. As the communities were intended users, each community was also invited to send a representative to these instruction workshops. These representatives would become web editors and would be responsible for the content of the community website.

The instruction sessions were held in April 2001 and were useful for showing how the software could be used and implemented. However, after the instruction sessions it was still not completely clear how to support the communities with the software. It was unclear to Habiforum how to co-ordinate the several subdivisions of their web portal, and it was unclear to the web editors how they could use the websites to support their community. In addition, it appeared that the software lacked features supporting discussions or other interactions between members. The structure of the platform appeared relatively rigid and was mainly suitable for presenting information.

Involvement of consultants

Habiforum decided to hire consultants who would further facilitate the process of developing the community websites. The consultants started with interviewing the communities' web editors. At that moment the communities still were in a start-up phase, the core-teams were searching for the most suitable way of developing a community, but none of the communities were active yet. As a result it was difficult for the web editors to be specific in their requirements for the website. The consultants developed a new framework for the web portal based on the interviews and on information from Habiforum. This framework formed the basis for the websites of all the communities. Each community could fill this structure with its own content.

Again the web editors were invited to join a one-day workshop for instructions. The consultants initiated and organised this workshop, which was held in November 2001. Not only the web editors were invited but the community leaders as well. During the workshop the structure of the framework was explained. In the new set-up the web portal provided open and closed working spaces for the communities. Each community had one open and one closed space, in which further subdivisions were possible. The open space was intended to inform visitors of the web portal about the specific community. The closed space was intended for the community members only. Although the software system appeared relatively rigid, the consultants managed to provide discussion folders for the community members. New functionality was added, which made the platform more applicable for supporting interactions between members. At the same time the new framework had some restricting implications for the web editor, who could not fill the website himself, but had to forward text to the so-called superuser working at Habiforum in order to have it published on the website. The same held for personal information of the community members. It was possible however to insert documents into the provided folders.

During the workshop some time was spent on explaining the roles related to the web portal. A person from Habiforum would have the supervision over all the content. This superuser was also responsible for organising the accounts for the web portal's closed working spaces. This meant that web editors could only provide accounts for their community members through this superuser. The web editors together with the community leaders were responsible for the content of their websites. In the workshop the community leaders were motivated to activate their members in using the website. One consultants gave a presentation on the potential added value of the web portal for the community and how this added value could be achieved.

Presentation to community members

The next step was promoting the website to the community members. So, the consultants visited community meetings, where they introduced the website. The community website was introduced and attendants were informed about how they could use the site at their advantage. Such a presentation was also provided at a community meeting of MultiSpace. In MultiSpace this particular meeting was the first meeting for many community members. They were introduced to MultiSpace, the concept of a Community of Practice, the activities the core-team had in mind and the website.

In MultiSpace the core-team also had internal discussions about how to use the website to support their community. According to the MultiSpace core-team their website had two facilitating goals. Firstly, it had the function of promoting MultiSpace by providing information about the mission and goal of the community. Hopefully it would attract new members. Secondly, it had the goal of facilitating its members in discussions and interaction. For this facilitation function it provided two separate folders, one accessible to every community member and another folder only accessible to core-team members. This resulted in three levels of access to the website: the first level was accessible to every visitor with mainly information on the mission and goal of the community MultiSpace. The second level was accessible to community members only. Here documents such as the agenda of the community meeting, reports, and photos of meetings could be found. The third level was created for collaboration between core-team members only. This work space was intended to support their preparations for community meetings, reports to Habiforum, etcetera.

Functionalities

Every community had its own work space on the web portal. This space could be used to present information on the members and the topic of the community, to store and share documents, and to start discussions. The first page of the community site showed a description of the community and a list of its members. The name of each member was click-able, revealing personal data such as contact information. The website also provided the option to enter the closed working space. The list with members was provided again here. Members who did not want their information to be provided to every visitor could choose to only present their personal data in this closed working space. Furthermore, four document folders were provided for the community: a folder for the core-team, a folder with documents of cases, a folder with a list of coming events, and a folder with a list of past events. This last folder also provided access to documents related to these events. In addition, there was a so-called theme folder. This folder was accessible from every community site and thus accessible to everyone who was belonged to a community. The folder was suitable for discussions on themes in the area of multiple space use that were interesting for everyone regardless of their specific community.

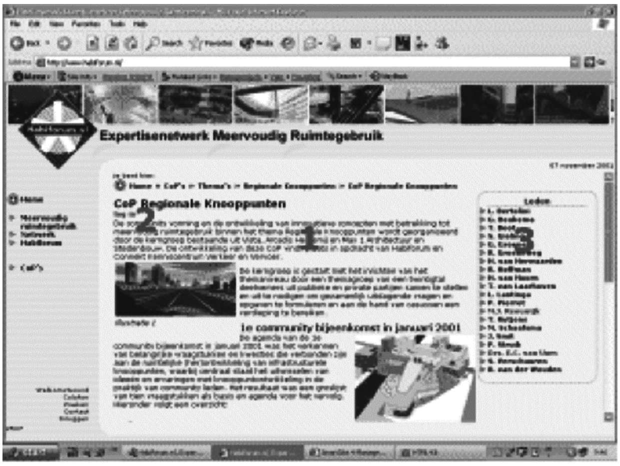


Figure 6-1 Open work space of a Habiforum community

Figure 6-1 shows the public work space of one of the communities in Habiforum. Numbers are used to refer to interesting features of the site. The text under (1) provides information on the community, such as its goals and working area. ‘Sign in’ at (2) is the link to the closed work space of the community it allows members to access the shared workspace using their login name and password. (3) denotes a box with a listing of the community members, each name links to more detailed personal data.

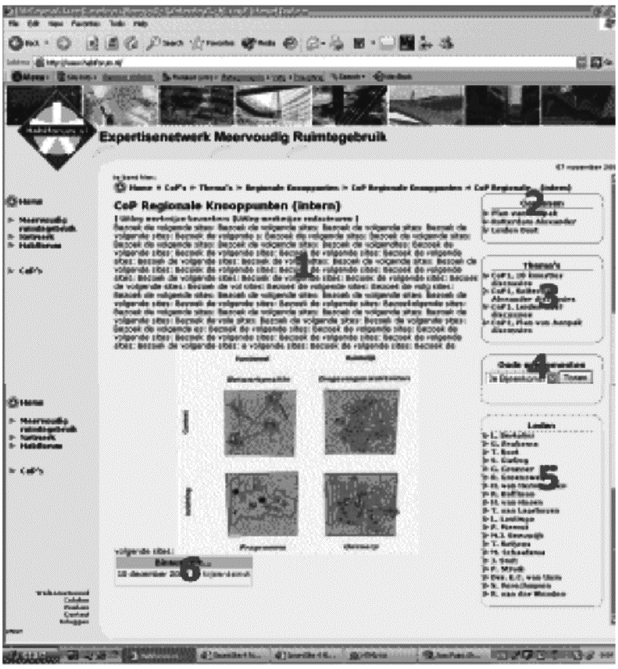


Figure 6-2 Closed work space of a Habiforum community

Figure 6-2 represents the closed work space of this community. Again numbers are used to refer to interesting features of the website. (1) refers to information on the community which is relevant for its members. (2) represents a folder with documents that can be viewed and downloaded. The box under (3) provides the links to the discussion themes. Number (4) gives an overview of past and coming events in the community. The box with number (5) provides the list of community members. And the last feature, (6), lists the community agenda.

6.2.5 Usage of the web portal

Habiforum had several goals in providing the communities with a web portal. Firstly, they wanted to show visitors to their web portal what activities were initiated by Habiforum. Founding the Communities of Practice was one of them. Secondly, they wanted to provide the community members with an inter-organisational platform through which they could stay in touch and exchange information with ease. Thirdly, they wanted to support discussions between members of different communities.

I interviewed one of the consultants to find out about the actual usage level of the community platforms. He had been involved in the process of developing the web portal and he had information on the usage level of all web sites. It was unknown how many 'visitors' had accessed each community website however; access rates were available only for the web portal as a whole. It was therefore impossible to find out how successful the websites were in promoting the communities. However, their success might also be derived from response. The information on the MultiSpace website did not lead to any new members, nor to questions to Habiforum or MultiSpace for more details. On the other hand, community members of MultiSpace sometimes used the Habiforum web portal rather than the MultiSpace website to find more information on the organisation that had provided funding for their activities. The respondent could tell however how many documents had been uploaded, how frequently the website was updated and what discussions were taking place in the closed working spaces of the communities. As the web editor of MultiSpace I had knowledge on this community's closed working space. I had filled it with descriptions of cases, meeting reports and photos of community meetings. I had updated the website whenever new information became available and after each community meeting. However, only some documents and photos were downloaded and the discussion folders were not used at all. Still, MultiSpace appeared to be the most active community online. Hardly any activity took place on the other community websites. Only one other community website was extensively filled with documents. These documents were hardly downloaded however. On this site too, the web editor was the only active person. Few documents were shared on the site and no discussions were initiated within the communities, let alone between communities. It can therefore be concluded that Habiforum's goal two and three were not achieved.

6.2.6 Observations, interpretations and resulting Factors

Based on several interviews and by reflecting on my role as the web editor I could identify inhibitions for usage of the collaborative platform. From these inhibitions, (absent) Success Factors can be distilled. These are presented below according to the structure I arrived at in Chapter 5. Some Factors were derived from the MultiSpace community, from these inhibitions I dispose of more details. Other Factors were derived based on information from other communities. Each section concludes with an implication for E-MAGINE, which will result in either a Success Factor that is relevant to assess in E-MAGINE: in the First Scan or in the KSSI.

Groupness

a) Group goal versus individual goal

The (formal) goal of the community was to develop innovative and useful concepts for the development and improvement of industrial estates. This was stated in the assignment of Habiforum. This goal, however, particularly motivated members of the core-team. One of their reasons to accept the assignment of Habiforum was that this goal was in line with their own goal. Most of the other members of the community were interested in that goal too; however, they were especially interested in finding solutions for their own industrial estate. Members of the core-team were aware of the gap between their main purpose and the main purpose of the community members, but they found a way to bridge this difference. They realised that community members wanted to discuss issues that related to their own industrial estate, or similar problems that might help to solve their own problems, they therefore concentrated the meetings on discussing real cases, as they are concrete and easy to focus on. From these discussions the core-team then distilled the more abstract concepts. In this way, the core activity of this community became discussing cases. Developing innovative concepts became the core activity of the core-team. Members of the core-team thus functioned as a mediator in developing innovative concepts, achieving the goal Habiforum had set. Although the purposes differed on the individual, group and organisational level, a way of working was developed that motivated group members to contribute to the group.

> *"It is my personal experience so far that Habiforum/CoP MultiSpace plays an important role in this. In this way I can absorb interesting knowledge and experience here and subsequently present it within the municipal organisation. Moreover the discussions stimulate my creativity in my contributions to concrete planning development processes and tackling hindrances and bottlenecks." (HF-SI-Community member Multispace)*

From another community it became clear that it was hard to involve members structurally in the first place. The community leader explained that members frequently failed to show at community meetings, not because they did not want to participate, but because visiting community meetings was not part of their primary business responsibility. Community members considered the meetings interesting and nice, but business related meetings like negotiations with clients always had priority. In addition, the community leader had many members working at high levels in organisations and thus having far reaching responsibilities. As a result it was hard to plan a meeting. And if a meeting was planned many might not show up due to unexpectedly circumstances.

> *"No, that's why. You know in advance, that is the experience you get, you need to have sufficient volume. Only half will show up. And why? It is not that they don't want to, but even at the last minute they will call and say 'Well, I need to go abroad all of a sudden', 'I'm in the States right now' or 'my diary doesn't allow it' or 'I need to be in some negotiation or other'. They cancel just like that. And why? It is not primary. It is not something they are held accountable for by their own boss, whether or not they participate in the COP. [...] It is just a thing on the side. It's like a conference that you can't go to, nobody minds."(HF3)*

Implication: Here an observation from the literature is confirmed: the group task (goal) needs to be relevant for the individual group members, in order to let them be motivated to participate.

Success Factor: A group task (goal) which is relevant for the individual members.

Technical Efficacy

No remarks were made about the platform's technical efficacy or related issues. Many community members had never looked at the site at all.

Context Match – Matching the Users

a) Vague boundaries, and vague roles

In MultiSpace institutions rather than individuals were members of the community. These institutions could send two of their employees to each of the activities. Theoretically it would be possible to send a different representative to every community meeting, but the same individuals usually appeared. However, it often happened that more employees of an institute attended a specific meeting when the estate of that specific institution was the subject of the meeting. And these individuals were all interested in receiving login credentials for the website. So new accounts had to be generated after every community meeting. This led to a long list of accounts of which it was not completely clear who were the active members who frequently visited community meetings, and who had attended a community meeting only once. The core-team had the overview, but community members said in interviews that they did not know exactly who was a member and who was not, often they only knew members of the core-team. Community members liked the diversity in participants, as they all had a different role and contribution to the community. However, they could not identify these roles on the community website, here only three types of roles were distinguished, the role of visitor, the role of community member, and the role of core-team member.

Implication: Communities that consist of members representing different group roles seem to profit from groupware support that matches these different roles. In addition, the application might provide information on these roles and what function these roles have in the community. It might also provide information on who has which role.

Success Factor: Different group roles require a collaborative application that supports these roles and supports awareness of these roles.

b) Generating accounts

A web editor could not generate and dissolve accounts himself; he needed support from Habiforum. So, although the number of accounts was rapidly changing, it took several steps before one could gain access to the website of the community. First, a new member had to contact the web editor, subsequently the web editor had to contact the superuser at Habiforum, who would send the login credentials to the web editor. The web editor had to forward these credentials to the member. All in all, this process was complicated and time-consuming, and hindering easy access to the closed work space of the community websites.

Implication: The process for gaining access presented here might not be a problem for a steady group whose members are selected or invited to participate at the beginning of the group life cycle. Providing these members with login credentials can be done in one action, and these access rights do not change as long as the group exists. However, in this example of changing group membership this procedure functioned as an impediment for using the closed workspace.

Success Factor: Rapidly changing memberships require simple procedures for creating accounts.

c) Access

One impediment for using the platform was that practitioners working for local authorities often lacked access to the internet from their own desk. They had to use a ‘shared’ workstation provided by their local authority. This involved practical hindrances such as having to leave their desk and waiting for their turn.

The leader of the Nodes community gave another practical reason why his members did not use the platform: members of his community hardly ever used computers at all. Most of them were directors of large organisations and they spent most of their working time in meetings or in transit. Their e-mail was usually handled by their secretaries, and these directors had no interest in other computer mediated communication. This community leader said that everyone had received logins for the site, but he did not expect anyone to have accessed it yet.

> *"At least half those people are computer illiterate. The directors don't even see their PCs on a daily basis. That's the start. Half don't even have a PC or they have a secretary who checks emails and they hardly work with PCs themselves. Let alone chatting and debating […]. We provided login names of course. But I'd be surprised if anyone logged in." (HF3)*

Implication: From this example I infer that easy access to the collaborative application supports use of the collaborative application. This means easy access to a workstation from which the application can be accessed and easy access during daily activities.

Success Factor: Easy access to the collaborative application.
Subfactors:
- access to the application from their own workstation
- regularly using tools from which the application can be accessed (e.g. desktop computers)

d) Willingness to share information
Besides facilitating interaction between team members, the web portal was also intended to promote each community by presenting information about its objective and members. This issue came up in the discussion with one of the community leaders. He had published the community objective, but admitted this information could be improved. However, he could not provide personal information of his community members as they did not want to have their personal data openly published on the internet.

> *"They have also decided collectively – I have just asked them in detail – that they don't want to put their identities, literally their email addresses, freely accessible on the net. If anyone wants to contact me he should make an effort. Then they have to take a hurdle and what I don't want is that anyone who appears on the net can mail me." (HF3)*

One of the purposes of Habiforum was to use the website to communicate information about the communities active in Habiforum and about its members. However, community members were not interested in this purpose, more than that, they were against it. In this example, group members were expected to need a certain support of the application that they did not want at all. The facilitating organisation had identified this need based on general principles of facilitating communities: it is important for communities that members get to know each other, for which providing information on who is who on the website is a generic recommendation (Preece, 2000).

Implication: Here a contradiction between the purpose of facilitation of the supporting organisation and the aims and wishes of community members can be identified. Their aims and the supporting features of the collaborative platform should match, in order to motivate community members to use the groupware application.

Success Factor: A collaborative application that (as much as possible) supports the specific aims or demands of the group members. (Instead of fulfilling 'general demands'.)

Context Match – Matching the Task

a) Necessity of collaborative platform

For each community and each community member active in the context of Habiforum, it holds that there was no strong necessity to use the community website. Each community had face-to-face meetings in which knowledge and information could be exchanged. In that way, both goals could be achieved, i.e., developing innovative concepts and supporting practitioners in applying multiple space use. MultiSpace was evaluated by respectively Habiforum, its core-team, and its members as being successful in achieving both aims, without using the collaborative application. In other words, the community did not depend on the site to be successful. The website therefore had to provide something extra, an added value to its users, in order to be used. It appears that the website and facilitators involved did not succeed in showing this added value. Communities in Habiforum hardly used the websites.

Implication: It is always important to provide a collaborative application that is useful to support the group task. However, in case the group does not depend on the collaborative application in achieving its goals, extra attention must be given to providing and showing its usefulness; using the application should provide a clear added value over not using the application.

Success Factor: Matching the task implies that an application is not only useful in supporting task execution but also provides an **added value** over other, existing, ways of working (including using other applications).
Subfactor: The group depends on the application in achieving its goals.

b) Focusing on face-to-face meetings

In Multispace meetings were organised in such a way that each meeting consisted of two cases that were presented and extensively studied, after which participants tried to identify the most crucial issues and solutions to solve them. When the meeting was closed, the cases were closed too. This means that the discussions about these cases were wrapped up and the problem owners would 'take the outcomes home'. New cases would be presented in the next meeting. Such a structure does not invite group members to discuss cases in between meetings. In fact, this set-up implied that there was not much 'new' to tell and share between the meetings. Even if there happened something new the core-team also used e-mail to inform its community members. One reason for this was that group members did not visit the platform frequently. As a consequence group members do not need to look at the platform to stay up to date. These ways of working reinforce each other.

> *"And here [in MultiSpace] it is so because it can take two months before there's something new, and if there's something new it is questionable if it is interesting to you, and everything is also sent in the post. I think if you really want to use something like that then you want people to visit it a few times a week. [...] I think that's not necessary because the intervals are too big. But if you have news more often because you do things more often or if you have something to say more often, then it could work. That's what I mean, the intervals are too big here for such a page to work well. Then it doesn't hold the attention." (HF-SI-Community Member Multispace)*

Whereas a common goal may function as a binding factor, the goal of developing innovative concepts mainly bound members of the core-team. The goal of supporting the development of industrial estates in an innovative way bound members of the community. Because of its set-up and its focus on face-to-face meetings, this last binding factor was especially present at meetings. Both goals could not keep the community members constantly focused in between meetings.

Implication: If the goals of the community can be met by cyclic activity and in face-to-face meetings, interaction support by ICT might not be useful. This finding confirms the Success Factor identified in the previous section. This Factor needs special attention if the group does not depend on the collaborative application to achieve its goals. The observation here seems to be a specification. Not only is the group independent of the application in order to achieve its goals, it also seems that application support is unsuitable in a setting in which the task is executed in a 'cyclic manner', i.e., face-to-face meetings alternated with quiet periods. This is added as another specification of the previous Success Factor, which leads to a more informative Subfactor:

Success Factor: Matching the task implies that an application is not only useful in supporting task execution but also provides **an added value** over other (existing) ways of working.

Subfactor: The group depends on the application in achieving its goals (e.g., the goals of the group cannot be met by cyclic activity in face-to-face meetings).

c) No activities between meetings
In the MultiSpace community the meetings focused on developing innovative concepts. That was the reason for the core-team to organise less standard meetings like the Pressure Cooker and tours to industrial estates. Community members were taken from their daily work context on purpose. It was assumed that this foreign setting would inspire the development of innovative ideas.

> *"But about the way of working in the Pressure Cooker, yeah I kind of like that, also the fact that you just, that you are really secluded, you are doing things differently than sitting down together for an afternoon and talking about it." (HF-SI-Community member MultiSpace)*

However, it may also have resulted into a gap between the members' daily work routine and participation in the community. A related discussion was held on one of the MetaCoP meetings. To create an innovative setting it can be very helpful to organise intensive meetings far from the daily setting of group members. However, a balance needs to be found in this respect, for extending this idea too far may result in innovations and ideas that are not applicable in practice. It may also result in a community that is invisible from the moment its members have returned to their daily work setting. At least some of the community members explained that they distinguished participating in the community from work that directly related to their organisation. Activities related to MultiSpace were postponed until a new community meeting as much as possible. For example, background documents sent with the invitation for a meeting were usually read at the meeting itself.

In addition, the core-team focused on sharing experiences in designing and (re)building industrial estates. As these experiences were mostly very context-specific they needed a long introduction and thorough explanation of the situation. Face-to-face meetings provide means to take this time, and easily clarify things that are unclear. These processes are much more complex through ICT. Thus, as the community focused so much on brainstorming and exchanging experiences, the ICT medium was unattractive for the support of these main tasks.

However, the platform was sometimes used to share documents. All case descriptions and photos of meetings were available on the platform. Some core-team members and some community members downloaded these documents.

> *"There are photos for instance of last year's Pressure Cooker, if anyone comes across them he could look at them, but this way it becomes more of an archive. One day you might accidentally have a need or a use for those photos." (HF-SI-Community member MultiSpace)*

Implication: In the previous setting it was identified that face-to-face meetings may be (perceived as) more suitable in supporting the group task (or main processes) than ICT. Instead, ICT might be suitable for the facilitation of supporting tasks, such as archiving group documents. The groupware application then, should match these relevant other tasks. Actually, this observation results in a need to identify the main task and possible potential (supporting) tasks of the group: the main task may not be as suitable for facilitation as other tasks or processes. However, even if face-to-face meetings may be more suitable in supporting the main group task than ICT, it is possible that other relating or supporting tasks or processes are better suited to be facilitated with ICT. In that case the application still provides an added value.
Success Factor: Matching the task implies that an application is not only useful in supporting task execution but also provides **an added value** over other (existing) ways of working.
Subfactor: The application is useful in supporting subtasks or subprocesses.

d) Privacy/Security

One needed a private e-mail account to receive an account to access the website. It appeared however that most of the community members did not have such an account. The local authorities they worked for provided their employees with one general account such as 'info@name_of_local_authority.nl'. It was therefore not possible to supply these members with a private account. This may have been an extra impediment for using the account.

Another privacy related issue concerned the core-team folder. The core-team were hired by Habiforum to initiate and facilitate the MuliSpace community. They had made agreements on process reports, including financial specifications. In the preparation of these documents it was possible to share first versions on the collaborative platform. However, the platform was provided by the client (Habiforum) and the core-team was unwilling to share first versions of their reports with the organisation that had given them the assignment. So although once they had expressed the intention to use a shared folder for all the documents related to the core-team, this folder was never used.

Implication: This observation shows that privacy and security are necessary for collaborative applications. At the same time however, they may function as impediments for using the application. Therefore I conclude that privacy/security should be guaranteed only if necessary.

Success Factor: Matching the task may entail providing a collaborative application that guarantees privacy and security (but, only if needed as access rules may hinder easy access).

Context Match – Matching the Setting

Flexible support

Every community within Habiforum was initiated by contracting a core-team. These core-teams were free to develop their own strategies for initiating their communities. This construction resulted in very diverse communities. MultiSpace for example had rapidly changing memberships, whereas the members of the Nodes remained for a longer time. MultiSpace facilitated practitioners, whereas Nodes invited people who had high responsibilities in organisations (directors etc.). However, all communities were provided with the same basic, rigid, framework for their support. The main principle of matching the setting cannot be achieved in this way. I noticed these differences also during courses provided for the web editors: every web editor had different demands for his community.

Implication: If one platform has to support several groups that differ in many respects (type of member, structure, culture), the platform should be adaptable and able to meet different requirements. One of the challenges identified in Chapter 3 is encountered: the organisation may choose a standardised application in order to facilitate interaction between groups, but if these groups differ in many respects, it is hard to compensate the gap between the application and the requirements of the different groups.

Success Factor: Groups that differ in many respects (type of member, structure and culture) and are supported by the same application require a flexible application that is able to fulfil different requirements.

Group Support – Support of Processes

The collaborative platform hardly supported any interaction processes in the setting of MultiSpace. No Factors other than those mentioned under the previous headings were identified that hindered support of the processes.

Knowledge sharing

One complaint about the usefulness of the application for sharing knowledge and information was that the site did not provide sufficient content.

Implication: Although this observation is related to the application, or more precisely, to the use of the application, technical quality aspects are not in any way related to low support of the application in this example. Here, the quality or quantity of the content is a Success Factor. The Factor is indicated as a Success Factor related to knowledge sharing.

Success Factor: Knowledge sharing is supported if there is sufficient and relevant content.

Group support – Support of Outcomes

The three types of group outcomes that are distinguished in the DGIn-model are not supported by the application. One purpose of Habiforum was achieved: the application provided information on communities that were initiated by the organisation. However, no Factors were identified concerning Support of Outcomes.

Adequate Introduction, Adaptation and Development

a) Adequate introduction process

The collaborative platform was introduced to the community members by one of the consultants that facilitated its implementation. However, this was the first community meeting for many members. They were unfamiliar with the phenomenon of 'Community of Practice' and did not know what to expect from it. As they still had to develop a vision of what it would mean to be a member of the group, the use of a website appeared even more abstract.

With hindsight, the community leader said that they should have let the community members play with the platform at that moment. A presentation about the platform and what it can do is very passive; people cannot easily internalise knowledge about using it. He had experienced a 'moment of trying out the platform together' in another group (outside the Habiforum context), and in his opinion this was one of the main Success Factors in that group for using the application. It contributed in getting to know each other and taking away barriers for using the platform.

Implication: This example provides the insight that explicit attention to the introduction of the application supports users in starting to use the application.

Success Factor: A successful adaptation process entails a careful introduction of the collaborative application to the group for example by providing hands-on experience in a group meeting.

b) Different goals supporting organisation and group facilitator
Having discussions between meetings within communities and between communities was not the goal of the core-team of the MultiSpace though, it was the goal of Habiforum. Habiforum had even provided discussion folders with overlapping topics that could be accessed by members of different communities. The institute hoped cross-fertilisation would be achieved in this manner. As the core-team did not consider using the platform as one of their goals, they did not put in much effort motivating its members to use the platform. A more extreme situation existed in another community, where the community leader was of the opinion that the group, its culture, and its members did not fit an interactive website. He further admitted that he did not like the web portal much. He did not like closed work spaces where you need passwords to gain access, interesting information might be hidden this way. Secondly, in his opinion information provided on the web portal was scarce. As a result the community leader did not bother to facilitate this group in using ICT at all.

> *"The conditions - the composition of the group, the nature of the group, the culture of the group – aren't right for an interactive [site]." (HF3)*
>
> *"Yes. I am not quite sure how it goes, it's outside my scope. But in my opinion […] very many documents are hidden. I don't like closed sites where you need to log in and with hurdles. That is not my thing. Better open it up with everything in plain view."(HF3)*

Implication: It seems that a motivating group leader or facilitator can be a strong reason for (starting to use) using ICT.

Success Factor: A successful adoption process entails a facilitator or group leader who motivates use of the collaborative application.

c) Need to interact versus existing communication structures
The website could be used to ask questions and discuss issues related to multiple space use, using the discussion forum. However, most of the community members were clients of one of the core-team members. This relationship was often the reason to invite them to the community in the first place. If community members had questions on multiple space use they usually asked the core-team member, and this behaviour continued throughout the existence of the community.

In addition, the community members did not know one another very well. As the community did not meet very frequently (once in 2-3 months) this situation did not improve much throughout the existence of the group. This may have contributed to the fact that there was no contact between meetings, for people are less likely to ask questions if they do not know one another.

Implication: From Multispace it appears that communication structures may already exist, depending on how group members relate to one another. The mere availability of an interactive platform is not enough to change these practices. Changing the communication structure requires effort and attention and a need for interaction experienced by the group members. This finding confirms an impediment identified in Chapter 2; Groups tend to stick to initially established patterns of interaction and technology use. I will translate this finding into a Success Factor in the category Adequate Introduction, Adaptation and Development.

Success Factor: A successful adoption process of the application entails the need for interaction experienced by the group members, even when this implies the change of existing communication structures.

6.3 Summary of Success Factors identified in Habiforum

So far, several Factors are presented that are likely to have influenced the low usage level of the collaborative platform provided to the different communities. The Factors are listed in Textbox 6-1. As a web editor I could closely follow the process of developing the collaborative platform. I can testify that a lot of effort was put into developing this platform and meeting the demands of the different communities. The consultants interviewed the web editors, organised meetings with web editors and community leaders, and tried to incorporate the requirements provided at these meetings. In addition, they used literature on communities and ICT facilitation of communities to determine requirements for the website. Still the application was not used.

It should be noted that in developing the collaborative platform the consultants were not allowed to select the software, they had to use Habiforum's Intranet software. In an interview with one consultant who had collaborated in developing the site, he stated that a disadvantage of this software was its rigidness. He could not implement all the features he had wanted. Further leaders and web editors were not sure about what they needed for their community as the communities were new in this setting. On the other hand, the communities that evolved in this setting did not precisely match general characteristics of communities. As a result, not all general recommendations for facilitating communities with ICT were suitable.

In my opinion a main, generic mismatch between group and application in Habiforum was a result of the rigid structure of the software as well as the unpredictable developments in communities, and the diversity of communities that evolved. The rigidness of the software was an additional handicap as it was hard to identify requirements beforehand for two reasons: Firstly, it was hard for community members to identify requirements for the application, as they did not know yet what the community would be like. Secondly, it was hard to determine requirements on general principles for communities as it was not clear yet to what extent differences between 'communities in general' and the communities in Habiforum might generate different needs. Before the communities were started, it was unclear what type of members would join, what their work settings were, and how they could be motivated to participate in community activities. In addition, the main processes of the several communities were unclear: the rhythm of meetings, their main activities, etcetera. As the purposes of individual members, of the group and of the organisation could be met without using the platform, members did not experience the need to overcome this general mismatch.

On the next page: **Textbox 6-1** Factors that are likely to facilitate the use of collaboration technologies for knowledge sharing identified in the Habiforum case study

Groupness

- Group members motivated to participate in the group. Group member motivating factors are:
    - a group task which is relevant for the individual members.

Technical Efficacy

No remarks were made concerning technical efficacy.

Context Match – Matching the Users

- Different group roles require a collaborative application that supports these roles and supports awareness of these roles.
- Rapidly changing memberships require simple procedures for creating accounts.
- Users require easy access to the collaborative application.
    - group members having access to the application from their own workstation
    - group members regularly using tools from which the application can be accessed (e.g. desktop computers);
    - Group members having specific aims or demands towards the application require a collaborative application that supports these aims or meets these demands as much as possible.

Context Match – Matching the Task

- Matching the task implies that an application is not only useful in supporting task execution but also provides an **added value** over not using the application.
    - the group depends on the application in achieving its goals (e.g., the goals of the group cannot be met by cyclic activity in face-to-face meetings).
    - the application is useful in supporting subtasks or processes.
- Matching the task may entail a collaborative application that guarantees privacy and security. However this is only done if required, as access rules may hinder easy access.

Context Match – Matching the Setting

- Groups that differ in many respects (type of member, structure and culture) and are supported by the same application require a flexible application that is able to fulfil different requirements.

Group Support – Support of Processes

Knowledge sharing is supported if:

- there is sufficient and relevant content.

Group Support– Support of Outcomes

No factors were identified concerning Support of Outcomes.

Adequate Introduction, Adaptation and Development

- A successful adoption process entails careful introduction of the collaborative application to the group for example by hands-on experience in a group meeting.
- A successful adoption process entails a facilitator or group leader who motivates use of the collaborative application.
- A successful adaptation process of the application entails the need for interaction experienced by the group members, even when this implies the change of existing communication structures.

6.4 AtosOrigin

6.4.1 Context

AtosOrigin is a large international organisation that provides ICT services, including consultancy, implementation and system integration, outsourcing, knowledge management, and maintenance services. At the time of this study, these services were provided world-wide, with a total of 28,000 staff; six thousand staff were based in the Netherlands on various geographical locations. As part of their services, AtosOrigin sells ideas and concepts based on knowledge management and communities which they themselves use; this company therefore is a most interesting case study.

AtosOrigin was formed in November 2000 by a merger of Atos, a French firm, and Origin, a Dutch company. Although it was a fairly new company at the time of the research, both partners in the merger had considerable experience in the field. The formal chain of command and formal processes were undergoing changes following the merger. Origin had a history of communities, and the majority of the communities within AtosOrigin had been developed by Origin prior to the merger.

6.4.2 Research approach

Selection

I studied the communities in this organisation together with a colleague researcher. The first interview was conducted with the manager of one of the Business Units within AtosOrigin. From this interview it became clear that different types of groups existed within AtosOrigin. It further became clear that although general characteristics of the different groups could be determined, there were no clear and strict distinctions between the different types of groups. This implied that there was not a fixed rule on what types of groups were provided with an ICT application and which groups were not. In the following interviews we therefore opted to gain information on all types of groups. We searched for respondents who could inform us about all these different groups. We also looked for people who could provide background information of the developments of these different types of groups and the applications facilitating them. They had to be active knowledge managers or had to have been working for the organisation for a long period of time.

Research activities

For the CommShare project all types of communities were relevant, so my colleague and I decided to split up in order to gain information on more communities. I was involved in eleven interviews that focused on gaining insight into reasons for people to collaborate and to share knowledge using a collaborative application. A list of respondents is provided in Appendix II. In the interviews several groups were discussed and we always asked whether we could visit the group meetings. Only some of these groups had meetings at the time of research. We were able to attend meetings of 4 different groups. At these meetings we observed the group's activities and talked to the group members. In the observations we focused on how knowledge (and information) was shared and what type of knowledge was shared.

Analysis

The interviews were analysed using the concepts defined in Chapter 5. However, these concepts were not used to structure the interviews. Open, non-directive questions were used in the interviews in order to increase the chance of finding new Factors that influence tool use and the support of knowledge sharing.

6.4.3 Communities

Several types of communities exist within AtosOrigin of which are the Expertise Groups, the Performer groups and the Networks of Professionals (NoPs) are the main types. Expertise groups are mostly related to one office and are organised locally. NoPS and Perfomer Groups are either related to one business unit, consisting of several offices or dispersed nationally. A few examples can be found of Performer Groups that are internationally. But there are more differences, mostly due to AtosOrigin's history. Firstly, in some departments all three groups are active and accessible to employees, in other departments, only one or two of these three types exist. Secondly, in some departments membership of one or more groups may be compulsory, whereas in other departments it is not. Thirdly, the first type of group meets in face-to-face meetings only, whereas the other two groups only interact through ICT. For the development of E-MAGINE, I focused on these last two types, the Performer groups and the NoPs.

Employees of AtosOrigin may be members of one (or more) Performer Groups and of one (or more) NoPs. Access to Performer Groups depends on the employees' role in the organisation, whereas NoPs have free access. Sometimes subjects in Performer Groups overlap with or relate to subjects that are discussed in NoPs. In such cases colleagues may meet (virtually) in a Performer Group as well as in a NoP. In addition, some NoPs have emerged from Expertise Groups: in some cases members of the Expertise Groups decided to continue their discussions using the NoP platform in addition to their face-to-face meetings. In those cases the relating NoP group often grows larger than the original number of group members of the Expertise Group. The size of these groups is limited as members that visit the meetings are mostly active in the same region or working for the same department. NoPs on the contrary are open to everyone within AtosOrigin, which increases the potential size of the group. The Performer and NoP groups, the two types of groups in AtosOrigin that are provided with ICT, are described in more detail in the following sections.

Performer Groups

A Performer group within AtosOrigin has the aim of improving business processes in terms of either efficiency, quality or reliability. This is usually achieved by the development of new ICT products or processes. Performer groups concentrate on knowledge sharing rather than knowledge creation and are centred on company objectives. They are called Performer groups because the software used to support the process of knowledge sharing (mostly sharing documents, including project outlines or business processes) is called Performer. The database is central, and interaction is usually limited to uploading and downloading knowledge and information.

Performer groups cannot be established without management support, and employees wishing to join a Performer group must formally request membership through the group Moderator. Membership is granted if the topic of the Performer Group relates to the employee's role within the company. Non-members have browsing rights of all Performer Groups, but cannot download or upload information. Employees who make requests for information contained in the Performer Group may be granted access, though they will still not become formal members, as they do not produce anything that will be entered into the shared Performer database. Group members are encouraged to submit to the shared database but are not obligated to do so. Anyone who is a member of a Performer Group can add information to the shared database, although the moderator has the final decision on whether items added to the database should be altered or removed. Moderators also have their own community in order to learn from one another.

Network of Professionals

A Network of Professionals (NoP) is a group formed around a specific topic relating to the expertise of the company and the work being performed there. These types of groups are not related to core business processes or structural document sharing. The topics discussed should however be of potential or indirect relevance to the organisation. The groups are discussion groups where individuals contribute their thoughts and ideas on their specific topic. The main goal of NoPs is to create new knowledge through discussion and the exchange of ideas. Depending on the group, these discussions take place face-to-face as well as on the NoP platform, or on the platform only.

Networks of Professionals require at least a quorum of five members in order to be granted the status of a NoP and be given company backing and support. Starting a community is fairly easy and is dependent on the applicability of the topic for the organisation and the required minimum membership. NoPs are dissolved when the topic is no longer relevant or when group membership dwindles to less than five. The NoP based on the millennium bug, for example, was dissolved early in the year 2000 as it was no longer relevant. At the time of research AtosOrigin had 50 Networks of Professionals. There are no rules relating to the functioning of NoPs and no rules of membership. If someone wishes to join a NoP he is free to do so, and individuals may be a member of more than one such group.

The success of NoPs is measured by the number of interactions and stored discussion items that take place between members of the community. There are no direct business related goals or objectives associated with NoPs in terms of measures of success. The ICT application that facilitate NoPs automatically record the number of interactions and management checks this periodically.

6.4.4 Groupware application

Two separate facilitating platforms were implemented within AtosOrigin to facilitate knowledge sharing: Performer and NoP. These two platforms were the result of different needs in the organisation.

Development of the application

Performer
The Performer platform was developed as a result of the need for central storage of documents that were relevant for a group of people.

> *"The knowledge repository [Performer] emerged from a demand for central storage of documents that were used by a number of people" (AO12)*

The Performer platform was developed to fulfil the need to standardise processes and documents related to these processes. People working on the same business processes stored the documents related to this process themselves, but thought it would be better to centralise this storage. Central storage of documents would not only enable them to standardise these documents but also to keep an overview of the most recent versions.

NoP platform.
The NoP platform on the other hand was developed to create an easy manner of asking a large group of people questions.

> *"Another line of thinking was the possibility to ask your questions to a certain group of people, possibly virtual [...] an advantage is that you reach a large group of people using an easy medium" (AO12)*

<u>*Functionalities*</u>

Perfomer platform

The Performer platform focuses on the facilitation of sharing standardised, explicit knowledge. The Performer database, situated on the company intranet, provides information on core business processes. The information is structured in a matrix consisting of the phases of a business process on the x-axis and the roles of employees on the y-axis. The matrix cells help employees to find documents related to their role in each phase of the process. The matrix and underlying database form the basis of Performer.

NoP platform

The NoP platform focuses on facilitating interaction and discussion between group members. Main elements of this platform are the list of group members and the discussion page. Other elements are a library to which group members could add information and a page on which they could provide personal data, such as working experience.

6.4.5 Usage of Performer and NoP

Most differences between the Performer and NoP platforms and its relating groups, relate to the fact that the Performer tool is highly institutionalised and that its usage is highly formalised. The content of Performer is related to specific business of the organisation. Only members can contribute information to the Performer matrix and their contribution is always reviewed by the moderator. The NoPs also have moderators, however, these groups are less strict, as is the use of the NoP platforms. It is easier to initiate a NoP group and a relating NoP platform: start-up costs and effort are lower. And, NoP topics are free to choose as long they relate to the business goals of AtosOrigin.

6.4.6 Observations, interpretations and resulting Factors

From the groups studied in the context of AtosOrigin several Success Factors could be identified: they are presented in the following sections. As was the case with Habiforum, each section concludes with an implication providing input for a Success Factor that can be assessed in the First Scan or in the KSSI.

<u>*Groupness*</u>

Several aspects influenced the motivation of employees to actively participate in the groups of AtosOrigin. These Factors will be added to the motivating Factors identified thus far.

a) Importance of the facilitator/group leader

Several respondents mentioned the important role of the facilitator or group leader for the success of a group. Ideally the facilitator inspires the group members, keeps track of where the group is headed and stimulates its members to participate. As in Unilever, several examples could be found of decreased activity levels because the facilitator had left.

> *"This has also to do with enthusiasm, especially of the leader of such a group." (AO11)*
>
> *"Groups that depend on meetings, fail or succeed by the actions of a leader." (AO12)*
>
> *"There always has to be someone who keeps the people on their toes and creates enthusiasm." (AO16)*

Implication: Several groups could be identified within AtosOrigin that were successful because of the presence of an active and inspiring group leader or facilitator. This motivated group members to participate.

Success Factor: An active and inspiring group leader or facilitator.

b) Facilitation in time

All group leaders felt that attendance rates could be improved. Poor attendance was mainly attributed to the fact that meetings took place after working hours and in the employees' time. This attribution was based on the fact that decrease of attendance rates had started since management had decided that group members had to meet in their free time. This will especially hold for communities, as participation in task groups or project groups is mostly central to the user's job.

Success Factor: The possibility to allocate hours spent on the group and meet in work time (Community Factor).

c) Individual rewards

Several respondents in AtosOrigin argued that people could be motivated to share their knowledge by defining participation in NoPs or Performer as an issue in performance interviews. This Factor will also hold especially for communities, for the same reason as described above.

Success Factor: Group participation as rating factor in performance interviews (Community Factor).

d) Other support from the organisation
Although some respondents were interested in inviting overseas group members or experts to their meetings, the organisation did not support travel expenses for this kind of meeting. Some respondents considered this a missed chance for the group. The impact of a higher frequency of group meetings on usage of the collaborative platform is unclear. Literature described in Chapter 3 indicates that use of ICT tends to increase when people know and trust one another. Increasing the number of face-to-face meetings means they get to know one another and builds trust. On the other hand, the group will not depend on ICT alone any more to achieve its goals. Still this organisational supports gives group members the feeling that they matter, that their group matters and that the work they do in this group is relevant to the organisation. This is considered a motivating Factor.

Success Factor: Financial support of the group (e.g., providing travel budget).

e) Motivating experts
Most of the NoPs as well as Performer Groups consist of junior and senior members. Respondents admitted that it sometimes is hard to motivate expert members to join meetings or contribute to the group otherwise. These experts are not really learning from such a network, they are merely present to be learned from. Some departments have solved this issue by making membership of a group compulsory. Still, the intrinsic motivation of expert members to participate might be low. For them there is a disparity in work and benefit. They perceive their group membership as if they only 'bring their knowledge to the group' and receive nothing in return. It is therefore important to identify the constellation of experts and juniors in the group. A mixed group needs special attention with respect to the motivation of members. In groups with experts and juniors it appears difficult to motivate experts to participate. The Success Factor I derive here is a balance in effort for and benefit from being a member of the group.

Success Factor: A balance in effort for and benefit from being a member of the group (which is more likely in groups with homogeneity in expertise).

f) Social events
Most of the meetings organised by the communities at AtosOrigin had a social element. Most meetings included dinner with pizza, for example. This had practical reasons too. People met in their own time at the end of a working day. In addition, most AtosOrigin employees worked at the customer's company so they could not meet during the day.

During dinner group members could chat informally and exchange experiences. The more formal part of the meeting started after dinner. This set-up created a relaxed atmosphere during the meetings. It motivated people to join the meetings and mingle with other group members. The meetings increased the cohesion of the groups, and as was argued in Chapter 3 cohesion is an important Success Factor for groups, it contributes to the level of groupness.

Implication: Cohesion is identified in the literature study in Chapter 3 as a Factor that has a positive effect on groupness. It is further known that social activities increase group cohesion, these social events are thus formulated as a subfactor of cohesive groups.

Success Factor: A cohesive group.
Subfactor: Social events in the group.

Technical Efficacy

No remarks were made concerning technical efficacy. However, several respondents indicated that the NoP platform was more accessible as a result of the fact that the (start-up) costs of the application were lower compared to Performer. The same held for the time it took before the tool was implemented, this was shorter for NoP compared to Performer. I will specify cost here as a Success Factor related to Technical Efficacy.

Success Factor: Low costs (including start-up and implementation costs)

Context Match – Matching the Users

Granting access

Respondents did not agree on who should be granted access to the available tools. Because everyone within AtosOrigin has access to the NoP platform, this discussion relates to the Performer tool. In the case of Performer only those who received permission from the moderator had access. Employees who had a role in the business process were automatically involved. Other employees needed to request access and validate this request with arguments.

> *"You first need to register with the moderators, only then can you download, that is not user-friendly. "(AO12)*

Implication: Although from this case it is unclear whether the strict access rules hindered use of the knowledge sharing application, the different opinions in this respect pinpoint to the fact that it is important to carefully define who is granted access and who is not. A mismatch is a missed chance for making the application a success.

Success Factor: Matching the users involves a match between the individual interest in access to the collaborative application and the technical as well as practical procedure for gaining access.

Context Match – Matching the Task

a) Relevance of group task for daily practice

As a result of the different purposes of the tools, employees might spend their time on the Performer platform as part of their job and neglect the NoP platform for the same reason. After all, the Performer platform supports sharing knowledge related to business processes and can hardly be neglected in these processes. Documents that are needed as input for these processes can be found on the Performer platform. Performer may even be the only space were they are available. The NoP platform supports sharing knowledge that is not directly related to business processes. As a result employees may neglect NoPs and the NoP collaborative platform without any serious consequences. Time spent on NoPs might even be experienced as wasted. The NoP platform is not directly related to business processes and thus not integrated in daily activities. The NoPs appeal more to individual interests and sometimes require participation in one's spare time.

Implication: It goes without saying that a tool is less likely to be used if the task for which it is provided is not central to the user's job. This finding can be considered a specification of a Success Factor identified in the Habiforum case: Matching the task implies that an application is not only useful in supporting task execution but also provides an added value over other, existing ways of working. If the task for which the application is provided is central to the user's job, or part of a work process he must contribute to, it is more likely that using the application provides added value for the user.

Success Factor: An application should not only be useful in supporting task execution but should also provide an added value over other, existing ways of working.
Subfactor: The task for which an application is provided is central to the user's job or is part of a work process.

b) Competing applications

The interviews confirmed that it is not only important to provide useful support of an application, but also that the added value of a tool should be made clear. This may be added valued compared to other tools or to not using the tool. It turned out that though the platforms Performer and NoP have different aims, they often became substitutes for each other. The different purpose of the platforms was unclear to a number of employees. As a consequence they did not know where to find or place knowledge and information. Sometimes they just disregarded one platform and focused on using the other one. The difference between the platforms was unclear and so was their added value. This resulted in competing platforms.

> *"If there are other tools as well on which you post your documents, and if those tools are used more, then you post your documents there because you're not gonna do it twice." (AO11)*

> *"People can be members of Performer Warehouse but also of a number of NoPs. That's confusing, because where can I find what I am looking for? If you make clear what one thing is for and what the other is for, then they need not be in competition with each other." (AO12)*

However, some employees used the two tools complementary:

> *"There is an order in the utilisation of tools. The primary source for knowledge is your network to find and gather knowledge. That happens over the phone and the e-mail, or if you come across someone in person. People start to cast the net a little wider only in a later stage, for instance through a NoP forum. I have noticed that they will search Performer only in a third stage, and often only after having heard that something might be available in Performer." (AO12)*

Implication: Here, again a specification of the above mentioned Success Factor identified in the Habiforum case can be derived. It appears that the added value of an application cannot be estimated by looking at the application in isolation, as its added value largely depends on other available tools.

Secondly, this finding provides input for how success of an application may be defined. Although a high frequency of use might be a good indicator for successful use of a tool, the reverse is not always the case: low frequency use is not necessarily an indicator for low success. A tool might be useful as an ultimate option. Performer sometimes fulfilled this goal in AtosOrigin. In other words, the first step in the evaluation process should entail a specification of how the end- user or client perceives successful use of the application. Is frequency of use an important criterion or are other criteria relevant? This is added as an instruction to the First Step of the Evaluation Approach (see Appendix VII).

Success Factor: An application should not only be useful in supporting task execution but should also provide an added value over other, existing ways of working.
Subfactor: the application is the only application available that provides task support.

Context Match – Matching the Setting

Easy access hindered by security issues

Although employees of AtosOrigin often worked at the customers' company, neither the Performer platform nor the NoP platform provided remote access. Respondents reported that this was a major hindrance for using either of the tools. Security is the main reason for this highly unworkable situation; the tools were behind the 'firewall' of the organisation.

> *"Well, to be honest, there are people, who forget to do it [storing documents]. I don't think they are not willing to, but if they're at the customer's side and they don't have access to the Performer then they forget to store it." (AO2)*

> *"I also have Internet as a search engine and it is often quicker, because I obviously can't access Performer when I am at a customer's, but I can get onto the Internet and then I tend to look if I can find information on the product on the Internet." (AO17)*

> *"The idea [of NoP] is very good, only I think our organisation can't handle it well, because people work on various assignments all the time and they are often at the client's so they can't connect with [the NoP] with enough regularity, because they just have no access." (AO17)*

Implication: The interviews in AtosOrigin confirm that it is important to provide easy access to the potential users of a groupware tool. Without this easy access people forget to store their knowledge and they cannot access the knowledge stored by their colleagues. In the Habiforum case a Success Factor related to this finding was identified in the category Context-Match – Matching the Users. However, the same notion is relevant for the setting. I will therefore also formulate a Success Factor in this category. It implies that the application may have to meet the requirement of providing remote access, depending on the settings in which group members work.

Success Factor: Group members who regularly work outside the company building require remote access.

From another anecdote it became clear that it is not only highly dispersed groups that are likely to depend more on ICT and as result are likely to use ICT to interact. Some employees at AtosOrigin work for the same customer and share their offices, at the customer's place, on a daily basis. These small groups of which members share their daily context used a collaborative platform as well; using ICT becomes one of their many ways to interact.

Implication: The implication is the notion that dispersedness is not univocal in its effect on tool use. Therefore a Success Factor cannot be distilled.

Group Support – Support of Processes

a) The Support of sharing knowledge

The absence of one specific feature was often referred to as hindering active knowledge sharing, the 'what's new' feature or the 'e-mail alert'. At the moment of study people could not see at a glance what was new on the NoP platform, if anything. This constituted a problem when someone used the tool to ask a question of his group members. They might not even know that a question was asked. As a result no one reacted and the question remained unanswered. In the end no one used the tool to ask questions anymore. Therefore this feature was eventually implemented into the NoP platform.

> *"Sometimes fellow group members don't even know that there is a question posted on the platform, and then nobody reacts." (AO11)*

> *"It [the NoP platform] has been extended with an e-mail alert system."(AO12)*

Implication: The feature of showing updates and changes is considered an increase in the quality of the application.

Success Factor: Knowledge sharing is supported if updates and changes of the content (since last visit, or since 'date') are provided.

However, another reason for a low response rate to questions was the fact that only a few group members were actively using the application.

> *"[...] I myself also used it a few times to ask questions that were on my mind, but there is hardly any response, because so few people visit that you can't really expect to get reactions from people [...] within a reasonable timeframe." (AO17)*

Implication: In line with the content-related requirement identified in the Habiforum case study, technical quality aspects are not in any way related to low support of the application. The reason is the low number of active group members. The Factor is indicated as a Success Factor related to knowledge sharing in this socio-technical setting.

Success Factor: Knowledge sharing is supported if sufficient group members actively use the application for sharing knowledge.

Other requirements mentioned were related to the structure and the content of the application. Several respondents mentioned the relevance of a clear arrangement of the content. However, it was added that this content structure should also be flexible so that it can evolve together with the group. Others stressed one specific quality characteristic of the content: it should be up-to date. These issues are added to the list of Success Factors.

Success Factor: Knowledge sharing is supported if a clear and flexible structure is provided for the content.

Success Factor: Knowledge sharing is supported if the content is up-to-date.

Final issues that were mentioned by respondents refer to the process of knowledge sharing, and not to the quality of support of the application. Some groups were dispersed over different business units and group members could be nationally dispersed. This decreased the chance that group members met occasionally. Consequently, some group members did not know one another, or not so well. Respondents mentioned that this could be a reason for not contacting one another, or not trusting one another's information. They said that they mostly preferred to consult someone they know.

> *"I have noticed you don't easily share information if you don't know one another." (AO11)*

People are more likely to share knowledge if they know one another. In addition, they are more likely to trust knowledge and information from someone they know. These two aspects are included as Successful Factors in the category of knowledge sharing in the list of findings. An information system may contribute to both Success factors: To the first one by providing a list of members and their expertise, for example. To the second one by including information on who has contributed what to the application.

Success Factor: Knowledge sharing is supported if the application supports 'getting to know your group members'. (People are more likely to share knowledge if they know one another.)

Success Factor: Knowledge sharing is supported if the application shows who added what information. (People are more likely to trust information or knowledge from someone they know.)

Group Support – Support of Outcomes

At AtosOrigin it was not exactly clear whether or how the application contributed to outcomes of the groups. As with all Knowledge Management investments, it is hard to specify return on investment. However, some remarks were made on the success of the collaborative application. Some facilitators stated that the success of a tool depends on the usage level. However, at AtosOrigin knowledge sharing tools sometimes are considered 'useful as a last option' (See 'Matching the task'). In the Inventory Meeting the criterion for successful use is addressed now, it seems to be useful to address it in the Focus Group as well. In that manner, different perspectives on successful use might be revealed. This instruction is added to the Focus Group Instructions (see Appendix VII).

Adequate Introduction, Adaptation and Development

To avoid confusion of the two platforms, it was decided that the applications needed a proper introduction and explanation to new employees. As this was a recent policy, it was not yet clear whether this introduction paid off. However, respondents expected this policy solve this problem at least partly.

Implication: Just as at Habiforum, respondents expected that a clear introduction to the collaborative application would increase its usage. As new employees also gained access to these communities, the introduction should focus on new employees.

Success Factor: New group members who join the group require an introduction to the collaborative application.

6.5 Summary of Success Factors identified in AtosOrigin

In this case study several Factors could be identified that facilitated or hindered the collaborative applications in AtosOrigin being useful as a knowledge sharing application. The complete list is provided in Textbox 6-2. In this organisation the usage level of the applications was higher than in the Habiforum groups. As a consequence more Factors were identified that relate to the Support of Knowledge Sharing, whereas in Habiforum more Factors were identified that facilitate or inhibit use of the application. The Factors related to the Support of Knowledge Sharing are mainly used as input for the Knowledge Sharing Support Inventory (KSSI), developed in chapter 8.

One interesting finding was the fact that two collaborative applications can be perceived as being competitive, even if their purpose of facilitation is different. This finding is elaborated on in Chapter 8 were the KSSI is developed. Another interesting finding was the influence of non-technical aspects on the perceived quality of support of the collaborative application for knowledge sharing. Respondents complained the application was not supportive enough because there were not 'sufficient group members that actively use the application for sharing knowledge'. A valid answer, but not an answer that directly relates to the qualities of the application. Similar Success Factors were identified in Habiforum, in that study the Factors related to the quality and amount of content in the application. These Success Factors were identified by asking questions on the quality of support of the collaborative application. Thus, by asking an evaluation question in line with the concept of Quality in Use. The Quality in Use concept prescribes that the user should be consulted on the quality of the collaborative application in use. However, it appears that users do not make a distinction between technical and other aspects, such as the content, in their evaluation of the quality of support of the application. This finding is relevant for the further development of the evaluation as it affects the usefulness of the Quality in Use concept in applying it as design requirement for the development of E-MAGINE.

On the next page: **Textbox 6-2** Success Factors that are likely to facilitate the use of collaboration technologies for knowledge sharing (identified in the AtosOrigin case study)

<u>Groupness</u>

- Group members motivated to participate in the group. Motivating factors are:
  - an active and inspiring group leader or facilitator;
  - the possibility to allocate hours and meet in work time (community factor);
  - group participation as rating factor in performance interviews (community factor);
  - financial support of the group (e.g. providing travel budget) (community factor);
  - a balance in effort for and benefit from being a member of the group (which is more likely in groups with homogeneity in expertise)
- A cohesive group
  - social events in the group.

<u>Technical Efficacy</u>

- Low costs(including start-up and implementation costs)

<u>Context Match – Matching the Users</u>

- Matching the users involves a match between the individual interest in access to the collaborative application and the technical as well as practical procedure for gaining access.

<u>Context Match – Matching the Task</u>

- Matching the task implies that an application is not only useful in supporting task execution but also provides an **added value** over other, existing ways of working.
  - an application that supports a task that is central to the user's job or part of a work process;
  - the application is the only application available that provides task support.

<u>Context Match – Matching the Setting</u>

- Group members that regularly work outside the company buildings require remote access.

<u>Group Support – Support of Processes</u>

Knowledge sharing is supported if:

  - updates and changes are provided (since 'last visit', or since 'date');
  - sufficient group members actively use the application for sharing knowledge;
  - a clear and flexible structure is provided for the content;
  - content is up-to-date;
  - the application supports getting to know your group members (People are more likely to share knowledge if they know each other.);
  - the application shows who added what information (People are more likely to trust one another's information or knowledge if they know who added it.).

<u>Group Support – Support of Outcomes</u>

No factors were identified concerning Support of Outcomes.

<u>Introduction, Adaptation and Development</u>

- New group members who join the group require an introduction to the collaborative application.

6.6 Reflection and Conclusions

Two case studies are presented in this chapter. In the case studies Success Factors that facilitate or inhibit usage of a groupware application are specified as input for the First Scan. In addition tool features that successfully support knowledge sharing activities are identified as an input for the KSSI.

The first case appeared to be an example of groupware that was in limited use by the group. In this case study the interviews focused on reasons for not using the application. As a result many factors were identified that potentially contributed to this low usage rate. These Factors will be used as input for the First Scan. In the second organisation, AtosOrigin, the groupware applications were used to share knowledge. Still, Factors that functioned as barriers for groupware usage could be identified. In addition Factors could be identified that affect using the application to share knowledge. As a consequence, the second case study provides input for both the First Scan and the KSSI.

An interesting finding in both cases was that users apparently do not make a distinction between technical aspects and other aspects, such as available content in the application, in their evaluation of the application. When they were asked whether the application supported them in sharing knowledge they frequently referred to non-technical aspects to explain whether or not the application suited them. Examples of their answers are: ‘sufficient group members actively use the application for sharing knowledge, so, yes the application supports me’ and ‘there is not sufficient and relevant content, so it does not support me’. Apparently, not only technical requirements have to be met for a collaborative application to be perceived as useful to support knowledge sharing. One leading principle for E-MAGINE is Quality in Use, this implies that the quality of the application is estimated by the users. However, from these cases it appears that asking users not always informs the quality of the application. In Chapter 8 implications of this finding for the development of the KSSI are presented.

The Success Factors identified in this chapter are added to the Factors identified in the previous chapters of this thesis. Similar Factors that were identified in different contexts (in two cases for example) are merged into one Factor on this list. In Appendix III an overview of all Success Factors is provided. In this overview it can be seen that the different categories in the list are more or less equally filled, except for the category Support of Processes and the category Support of Outcomes. In the first category mainly information on the sub-category: Support of Knowledge Sharing is identified, information on the support of the other interaction processes is low. This result can be explained with the focus of this research project, which is on knowledge sharing. In the second category, Support of

Outcomes, no factors were identified. Respondents could however indicate what relevant outcomes were for their groups. These outcomes may be used to formulate items in one of the two evaluation instruments First Scan or KSSI.

As the model is built on extensive literature and findings are for the greater part evenly divided over the categories, it seems reasonable that the activities in this research project so far have resulted in an identification of the main Success Factors. The complete list of Success Factors is used as input for the development of the First Scan and the KSSI, the main instrument of E-MAGINE.

7

Development of the First Scan

7.1 Introduction

In the previous chapters the framework for E-MAGINE was established and Success Factors were identified. The current and subsequent chapter will proceed with the next step in the development of E-MAGINE: the specification of two evaluation steps of the evaluation approach into actual evaluation instruments. In the current chapter the development of the First Scan is presented and Chapter 8 is dedicated to the development of the Knowledge Sharing Support Inventory (KSSI). The Success Factors that have been identified so far will function as input for these instruments.

This chapter first summarises the goals of the First Scan, which were defined in Chapter 5. Subsequently the design requirements for the First Scan are listed in section 7.2.2. In section 7.2.3 a suitable type of instrument for the First Scan is identified. This is followed by the specification of the items that need to be addressed in the evaluation instrument. The chapter continues with the application of the First Scan in a dispersed knowledge group. This first application is used to test its reliability and validity and to improve the instrument. The chapter concludes with adaptations of the First Scan and with lessons learned.

7.2 Developing the First Scan

7.2.1 Goal of the First Scan

The main inspiration for the application of a First Scan in the E-MAGINE evaluation approach was the conclusion in Chapter 2 that factors exist in daily work practice that hinder the use of a groupware application and therefore hinder its success. It was concluded that these factors need to be assessed before further extensive evaluation activities are applied at the level of knowledge sharing support of the groupware application. As a result, the main purposes of the First Scan are to 1) identify whether the groupware application is used, what functionalities of the application are used, to what extent, and by whom and 2) assess Factors that facilitate the use of the groupware application. In addition, the First Scan will be used to 3) describe the context-of-use of the groupware application and 4) direct the evaluation process in the Second Phase of E-Magine.

Based on the results of the First Scan, the evaluator develops a First Level Profile describing the group and the application. This First Level Profile has to provide a clear guide for decisions on what intstruyments should be applied in the Second Phase of the evaluation process.

7.2.2 Requirements for the First Scan

At this stage of development the First Scan is not meant to be developed as an instrument with items that are thoroughly developed, tested and validated. A first version of the evaluation approach, including first versions of the First Scan and KSSI, is more realistic. However, the instrument is based on constructs that are systematically developed and partly tested and validated in previous research (Andriessen, 2003). This is a good basis for an instrument that functions as a diagnostic tool: it "…does not […] enable a quantitative assessment […]. It provides a means of identifying problem areas, of extracting information on problems, difficulties, weaknesses, areas for improvement, and so on." (Ravden & Johnson, 1989, p.17). To be able to function as a diagnostic tool a structured assessment is necessary, it prevents that relevant issues will be overlooked. I will use the DGIn-model, described in Chapter 3, to structure the Scan. The Scan results in a First Level Profile, describing the group and the application. This Profile should reveal the weaknesses in the setting under evaluation; these weaknesses are the focus of the next evaluation step.

For the application of E-MAGINE it is also necessary to indicate how these findings inform the next evaluation step. A useful approach might be to specify the weaknesses in the setting into what I will call 'evaluation issues'. These issues then are input for the next step in E-MAGINE. Whether and how this works will be explored in Chapter 9, where the entire evaluation approach is applied.

In Chapter 5 methodological requirements for the evaluation method were specified. These criteria hold as much for the First Scan as for E-MAGINE. In all, the methodical criteria for the First Scan are: 1) be reliable, 2) be valid and 3) be acceptable (and face-valid). A first insight of the reliability of the First Scan is gained by applying it twice in the same setting (see Section 7.4). A thorough analysis in order te achieve high (item) validity, is beyond the scope of this project. Its acceptability is also tested by applying the scan in a realistic setting (Section 7.4).

7.2.3 Type of instrument

For the First Scan several types of instruments are potentially suitable: interview (unstructured, semi-structured and structured), questionnaire, checklist, observations and other. Checklists are very common in product and software evaluation. Such lists provide a predefined list of issues which an assessor can check in order to evaluate a product (design). A great advantage of checklists is that they provide structure and are practical to use. For this reason several authors recommend checklists as a practical and cost-effective manner to evaluate usability issues in a product evaluation (Stanton & Young, 1999).

Checklists are further recommended as an initial guide in the process of evaluation. Both recommendations support application of the First Scan as a checklist.

For the evaluation of some products the checklist can be applied by an expert just by observing the product. Sometimes more insight is needed and can only be gained by discussion with the owner, user or developer of the product. This way of working seems more likely for the application of the First Scan as checklist as well. It can be assumed that several issues are so complex that an in-depth discussion is required with someone who has inside knowledge of the group. As a result interaction with at least one group member or group facilitator is necessary in order to be able to address these issues.

Consequently the First Scan consists of a checklist that can be applied in an interview. In this manner, the First Scan sets the agenda, which ensures that all relevant aspects are covered. The lay-out of the questions on a data sheet ensures that the responses are easy to fill out. This is done by presenting easy to tick answer categories using a Likert scale from 1-5. These Likert scales are commonly used for measuring usability (Tullis & Albert, 2009).

Filling in the questionnaire in an 'interview setting', e.g. in an interactive setting where both the evaluator and the respondent are involved, has two advantages: It enables a further investigation of certain aspects if the evaluator thinks that is appropriate. And the evaluator may inform the respondent if things are not clear. The questionnaire will therefore be accompanied by the specification of the Success Factors as presented in this Chapter. This provides insight into the (underlying) Success Factors that need to be assessed. In addition explanation is provided with the E-MAGINE instructions (see Appendix VII). This manual explains the purpose of the First Scan.

As the First Scan should quickly address many issues it is applied with one key respondent, e.g. a group facilitator or group leader. In the Second Phase the contribution of group members is more focused and dedicated to areas that were identified as weaknesses in the collaborative setting.

7.2.4 Structure of instrument

The next step in the development of the First Scan is a conversion of each Success Factor into specific items that can be assessed in the First Scan. Section 7.3 addresses the specification of these items. In addition the items should be listed in an order that makes sense to the respondent. As the evaluation approach is introduced as a groupware evaluation approach, questions on the collaborative application are put in front, after a few general group related questions. The DGIn-model is used as a structuring device. First, some general aspects of the group are addressed (input factors of the model). Subsequently, it addresses characteristics of the collaborative application and other available applications (the tool aspect of the input factors in the model). The First Scan continues with aspects related to the group processes and concludes with group outcomes.

7.3 Specification of the items

In this section I will specify the Success Factors that resulted from the research steps executed so far into items for the First Scan. Assessment of these items is needed in order to identify which Success Factors are present in the context being evaluated. This assessment contributes to two purposes of the First Scan, purpose 2) assess the Factors that facilitate the use of the groupware application and 3) direct the evaluation process in the Second Phase of E-MAGINE.

First the definition of a Success Factor is rephrased: Success Factors are motivators to use a groupware application to share knowledge in a dispersed group. An example is: 'There is easy access to the collaborative application.' This Factor contributes to the requirement of 'Context Match – Matching the User'. Some Success Factors are related to either the group and its context (group functioning) or to the application (technical efficacy). Other Success Factors denote a relation between the group and the application. Presence of both types of Success Factors increases the likeness of successful groupware support for knowledge sharing. Each of the Success Factors falls in one of the 5 categories presented in Chapter 5 (See Table 5-1). This categorization is used to structure all Success Factors identified in this study (see also Appendix III).

Some of the Success Factors identified in the previous research activities are more applicable for communities, whereas other Success Factors are more applicable for teams. The First Scan will be developed to be applicable for both types of groups, but these more specific Factors will be marked in such a way that it is clear in which context they should be addressed.

In the subsequent sections the argumentation for the specification of each Success Factor into one or more items is presented. Information on Success Factors can generally be gained by addressing characteristics of the group or of the application. Information on Success Factors relating to a Match between application and context will in general relate to a minimum of two items: an assessment of a characteristic of the group or the context and an assessment of the characteristics of the application.

<u>*First group of requirements: Groupness*</u>

A collection of individuals is more likely to use a facilitating collaborative platform if it meets factors that contribute to a high level of groupness. This section lists Factors that contribute to groupness. The first six factors are derived from definition of Groupness presented in Chapter 3, the subsequent factors have been identified in the cases.

Success Factor G-I: High interdependency in goal and task performance of group members.
To be able to derive the presence of this groupness factor the group task should be assessed.
- What is the task of the group?

Success Factor G-II: Long period of interaction between group members
This factor implies the assessment of aspects of the lifecycle of the group.
- How long has the group been in operation (approximately)?
- How many months is the group planned to last from now?

Success Factor G-III: Frequent interaction between group members
This factor requires an assessment of the frequency of interaction between group members. Interaction may be mediated or face-to-face, both type of interaction processes are relevant for this factor. It is further relevant to assess whether these interaction processes hold for all group members or only for an active core group. As a consequence this factor results in four items:
- Does the group (as a whole) have face-to-face meetings?
- Do individual members see each other face-to-face (outside joint meetings)?
- Do members have contact (telephone, e-mail, etc.) with other members of the group outside of the joint meetings?
- Do most members participate actively or does an active core group exist with (many) less participating group members?

Success Factor G-IV: High continuity of membership
- How stable is the group? Does the group consist of a steady number of group members or do rapidly changing memberships exist?

Success Factor G-V: High formality of membership
To gain insight into the formality of membership two items are added to the First Scan. The first item addresses whether the group has been set up by management (more formal) or by the personal initiative of some employees (less formal). The second item addresses whether the group is open to anyone who is interested in participating.

- Has the group been set up by management or did it originate through the personal initiative of some employees?
- Is the group open to anyone who is interested in participating? If not, for whom is membership open?

Success Factor G-VI: Small number of people involved
This factor concerns the group size: How many members does the group have? And is this a stable number, or does the group regularly increase or decrease in size?
- What is the group size?
- Is this a stable number? If not, how are the fluctuations?

Success Factor G-VII: Group members motivated to participate in the group.
First this Success Factor is generally assessed. Subsequently an assessment of the SubFactors (factors contributing to motivated group members) is applied. The assessment of subfactors (See Appendix III for a complete list) is relatively straightforward. Some factors are split up into two items. For example, 'Relevance of the group tasks for individual members' is assessed by asking whether the group task is the only task group members are involved in, and, *if not*, whether the group task is directly related to other tasks group members have. Another item does not only assess whether hours are allocated for group membership, but also whether, *if not,* this is a problem for group participation. Also, insight is needed into the constellation of juniors and experts in the group. From the case studies it appeared that if the group consists of a mix of experts and juniors, the motivation of experts to participate in the community might be low as a consequence of (perceived) imbalance effort and benefit. The question will therefore continue with: 'is the mixed setting a problem for motivation of experts?' This results in the following items:
- Are group members enthusiastic and motivated to participate?
- Is the group task central to the user's job?
- Is the group task the only task the group members are involved in? If not is the group task directly related to other tasks group members have?
- Are group members actively motivated to participate by the group leader or facilitator?
- Does the organisation allocate hours for the members to participate in the group? If not, to what extent does this hinder participation of members?
- Is group participation an issue in performance interviews?
- Does the organisation facilitate participation of the members in the group (such as providing budget)?
- What is the constellation of experts and juniors? If mixed, is this a problem for the motivation experts?

Success Factor G-VIII: A cohesive group
A cohesive group is a Success Factor in this setting. The First Scan should address whether the group under evaluation is cohesive. Indicators of cohesiveness are amongst others sense of belonging and trust. Therefore the following two questions are asked:
- Do group members feel a sense of belonging to the group?
- Do group members trust each other?

Social events and group members not being largely dispersed contribute to a cohesive group. These are subfactors, resulting into the following two items:
- How many social events are organised?
- What is the geographical distribution of the group members?

Success Factor G-IX Group members have a solid common ground
In addition to cohesion it is important that group members have common (cognitive) ground or shared understanding. This supports communication and interaction processes between group members.
- Do group members have solid common ground / a shared understanding?

Success Factor G-X: The group operates in an open knowledge sharing culture
Based on literature discussed in Chapter 3 it became clear that for dispersed knowledge groups to function well, an open, knowledge sharing culture is enabling. Although not specifically belonging to the groupness category, this factor will be specified here as well. As it is a relevant factor for dispersed *knowledge* groups. I will address this knowledge sharing culture first by asking whether the group operates in a knowledge sharing culture and second by addressing the willingness of group members to share their knowledge.
- Does the group operate in an open knowledge sharing culture?
- Are group members willing to share their knowledge with the group?

Success Factor G-XI: Other Strong and Weak Factors
The Groupness Success Factors refer to issues which are identified as having a (potential) positive effect on the successful functioning of the group. Adding open questions to this category may inform the evaluator with relevant insights as well. For there may be Factors that are not (yet) identified in this study that positively affect group functioning as well. Therefore I want to complete the list of items in this category with two open questions concerning the strong and weak points of the group. The strong points may function as Success Factors and weak points as 'absent Success Factors' in the socio-technical setting.
- What are strong points of the group?
- What are weak points of the group?

Second group of Requirements: Technical Efficacy

A collaborative application that meets basic technical criteria is more likely to be successful than an application that does not. This section lists Factors that contribute to Technical Efficacy. First basic software quality characteristics as defined by ISO are presented, subsequently technical characteristics which were identified as relevant in the case studies.

Success Factor TE-I: Functionality. The capability of the software to provide functions which meet stated and implied needs when the software is used under specified conditions.

- Does the application provide what is needed to support the group?

Success Factor TE-II: Reliability (Robustness). The capability of the software to maintain its level of performance when used under specified conditions.

In the assessment of the groupware application I will specify this criterion as ‘running smoothly’:

- Does the application run smoothly?

Success Factor TE-III: Usability. The capability of the software product to be understood, learned, used and to be attractive to the user, when used under specified conditions.

In the assessment of usability, the definition of usability is maintained; items that assess learnability, memorability and consistency are added to the instrument. In addition, an item is added that assesses whether the application provides what is promised. An application that provides the functionalities that are in line with expectations of its users is also considered more usable. The last item under usability addresses whether the application can be adjusted to personal or group preferences. This item gives an indication of its flexibility.

- Is the application easy to use for new users?
- Is instruction needed to learn to use the application?
- Is **re-**instruction needed to use the application?
- Is the application consistent in use? If **not** to what extent is it a problem?
- Does the application provide the features promised?
- Can de application be adjusted to personal and / or group preferences? If **not** to what extent is it a problem?

Success Factor TE-IV: (Infrastructural) Efficiency: the capability of the software to provide the required performance, relative to the amount of resources used, under stated conditions.

This criterion is specified as whether the application runs fast enough.

- Does the application run fast enough?

Success Factor TE-V: Maintainability. The capability of the software to be modified. Modifications may include corrections, improvements or adaptation of the software to changes in environment, and in requirements and functional specifications.
Most software applications can be modified to a large extent. In most cases the only restriction is the budget. Therefore in this First Scan maintainability is operationalised as costs for maintenance.
- What are the maintainability costs?

Success Factor TE-VI: Portability (Compatibility). The capability of the software to be transferred from one environment to another.
Portability refers to the extent to which the application can be transferred and thus operate in different environments. For dispersed groups it is relevant that the application can be used throughout the whole organisation, irrespective of department or geographical location. The application should further be compatible with other applications that group members use. A last aspect that is assessed under this criterion is whether the application meets necessary standards, such as ISO norms.
- Is it possible to use the collaborative application on all the operating system in the company (or companies)?
- Is the collaborative application compatible with other applications that group members use?
- Does the collaborative application meet relevant standards?

Success Factor TE-VII: Low costs for purchase, maintenance and other. These costs also involve implementation of peripherals and infrastructure and training of users.
In the First Scan all cost aspects are addressed. Maintainability costs are also addressed for Success Factor TE-V. It should be noted that costs for purchase of a new application (and new supporting infrastructure) are only relevant in case a collaborative application is not yet available (anticipative evaluation), which is not the case in the groups E-MAGINE is focusing on.
- What are the costs of buying licenses and installing the collaborative application?
- Is the required infrastructure available for the implementation of the tool?
    If not, what are the estimated costs What are the costs of buying suitable infrastructure?
- What are the estimated costs of training and instruction?
- What are the estimated cost for maintenance?

Success Factor TE-VIII: **Awareness features**
Awareness features may support dispersed groups in bridging the physical and cultural distance between users. Assessment of these features is added:

- Does the application show what other group members are currently involved in?
- Does the application show whether other group members are on-line?
- Does the application show what everyone’s task and progress is?
- Does the application provide background information on group members’ actions (in the application)?
- Does the application show updates and changes?

Success Factor TE-IX: Groupware applications are compatible to infrastructure applied by group members
This factor highly relates to the ISO norm of portability (Success Factor TE-VI). A relevant item has been formulated under this Success Factor and is repeated here:
- Is it possible to use the collaborative application on all the operating system in the company (or companies)?

Success Factor TE-X: Sufficient infrastructure is available
This factor is relevant because sufficient infrastructure enables that the application runs smoothly. This aspect is addressed under Success Factor TE-II: Reliability and is repeated here:
- Does the application run smoothly?

Third group of requirements: Context match – Matching the Users

A groupware application that matches its users’ characteristics is more likely to be used. This section presents Factors that are likely to increase the fit between collaborative application and its users.

Success Factor A: Users require a collaborative application that is easy to use (Ch. 2).
Easy use of the application is an enabling factor for use of the application. This factor is in line with one of the usability ISO norm. As a consequence several items assessing this factor have been formulated under Factor TE-III.

Success Factor B: Users require easy access to the collaborative application (Ch. 2, 6).
Subfactors of this Factor are:
  - o Group members having access to the application from their own workstation (Ch. 6).
  - o Group members regularly using tools from which the application can be accessed (e.g. desktop computers) (Ch. 6);

This Factor, including its SubFactors, is assessed using three items:
- Do group members always have easy access to the application?
- Do group members have access to the application form their own workstation?

- Do group members regularly use tools from which the application can be accessed (e.g., desktop computer)?

Success Factor C: Users require a collaborative application that they perceive as useful (Ch. 2).
Subfactor of this Factor is:

  - o Group members using the same application for the different, but overlapping, groups they are member of. (Otherwise they may perceive the different applications as being competitive and stick to using only one of them (Ch. 2).).

The usefulness requirement can be interpreted in two ways: either the user perceives the application as useful for his task, or others consider the application useful for task execution, based on task analysis for example. In the first interpretation, usefulness falls under 'Matching the User' in the second interpretation, usefulness falls under 'Matching the Task'. I will incorporate both interpretations in the First Scan. Here, usefulness is interpreted as whether the application is perceived as useful by its users. The second interpretation is presented in the next section (Matching the Task).

Users, except the facilitator/group leader, are not involved however in the First Phase of evaluation. As a consequence it can only be assessed whether the group leader has the opinion that users think the application is useful. This results in the following three items:

- Do group members perceive the collaborative application as useful?
- Do group members participate in other (overlapping) groups and are these groups facilitated with other, but similar collaborative applications?
- Are other applications available to the group which provide similar support? Are these frequently used?

Success Factor D: Matching the users involves a match between the individual interest in access to the collaborative application and the technical and practical procedure for gaining access (Ch. 6)
Subfactor of this factor is:

  - o Rapidly changing memberships require simple procedures for creating accounts (Ch. 6).

Here the match between interest in access and access rules should be addressed. The Subfactor can be assessed by gauging the stability of the group membership on the one hand and the complexity of creating accounts on the other hand. It is relevant to assess whether this procedure is working sufficiently. Stability of group memberships and interest in participation are addressed under Factor G-IV and G-V respectively. This leaves one item to add to the First Scan:

- What are practical as well as technical procedures round gaining access to the tool (creating accounts)? Is the procedure for creating accounts working sufficiently?

Success Factor E: Different group roles require a collaborative application that supports these roles and supports awareness of these roles (Ch. 6).
Factor E implies assessment of the following issues: are group roles defined, do these roles need specific support, and, does the application provide this support? Including the support of awareness of these roles.

- What roles exist in the group and do these roles set requirements for the application?
- Does the application meet the role requirements and does it support awareness of roles?

Success Factor F: Subgroups require a collaborative application that supports them (Ch. 2).
The same argument applies as above: this time concerning subgroups and their specific requirements.

- Does the group consist of subgroups? Do they have different requirements from those of the entire group?
- Does the application meet the subgroups' requirements?

Success Factor H: Group members having specific aims or demands towards the application require a collaborative application that supports these aims or meets these demands as much as possible (Ch. 6).
Here, the match between any specific aims of the group members and the characteristics of the groupware application should be addressed. Under Technical Efficacy it is already addressed whether the application can be adjusted to personal preferences. It will be hard to further specify whether (other) specific demands of group members are met by the application, for group members are not involved yet in the evaluation process. However, based on general human interaction aspects some specific demands may be derived. Experience in ICT, or age of group members affects intention to use ICT for example. In general it holds that younger people use ICT to interact with one another more easily than older people. Furthermore, people with experience in using ICT are more likely to continue to use ICT than people who are not used to it. Therefore these user aspects will be assessed here. This Success Factor will gain further attention in the Second Phase of evaluation, where group members themselves can be asked what their wishes are concerning the application.

- What is the age of the group members (mean and range)?
- How experienced are group members with respect to the group task?
- How experienced are group members with respect to IT tools?

- Are there other relevant group member characteristics?

Third group of requirements: Context Match – Matching the Task

A groupware application that matches the task is more likely to be used. This section lists Factors that are likely to increase the fit between the collaborative application and the group task.

Success Factor I: Matching the task implies that an application is not only useful in supporting task execution, but also provides an added value over other, existing, ways of working (Ch. 2, 6)
Subfactors of this factor are:

- o The group depends on the application in achieving its goals (e.g., the goals of the group cannot be met by cyclic activity in face-to-face meetings).
- o The application is useful in supporting subtasks or processes related to the main task.
- o The application supports a task that is central to the user's job or part of a work process.
- o The application is the only application available that provides task support.

For this question the group tasks needs to be assessed. This has been done under 'Groupness'. Here, two specifications are added to this question: a) whether this task is central to the user's job and b) whether the group depends on the application to achieve its goals. It is further assessed whether the application should support related tasks or activities. Subsequently, the match between group task and collaborative application is assessed with a general question about the quality of support. This assessment is combined with another approach. Based on literature (see Chapter 3) it is known what features are more suitable for supporting certain tasks. I will use these insights to address the match between group task and ICT support as well. The main task and activities of the group are known and this insight can be combined with the knowledge of the features provided by the application, including their frequency of use. The question is whether the application is applied according to the match as prescribed in the literature. In the end, a question will assess whether other applications provide task support as well (supporting assessment of the last Subfactor). Please note, whether users perceive the application as useful for task support is not the focus here, this 'perceived usefulness' by the user is an issue under 'Matching the User'.
See item under Groupness: What is the task of the group?

- Is this task central to the user's job?
- Does the group depend on the application in achieving its goals?
- What (related) tasks and activities should be supported with the application?

- Does the collaborative application provide what is needed to support the group in accomplishing the group task?
- What features are provided by the application?
- What is the frequency of use of these features?
- What *other* applications provide (similar) task support? What are their features and frequency of use?
- Does the group depend on the application in achievings its goals?
- What type of group activities are organised and what group processes are relevant?

Success Factor J: Matching the task may entail providing a collaborative application that guarantees privacy and security. However, this is only done if required, as access rules may hinder easy access.
- Two items are added to the First Scan: is privacy needed and is it provided?
- Should privacy / security be guaranteed?
- Does the application sufficiently guarantee privacy / security?

Success Factor K: Matching the task implies the support of tasks which users consider suitable for ICT mediation. (e.g. creative brainstorming sessions are perceived as unsuitable).
In this Phase of evaluation the group task(s) which the application should support are compared to those activities that are often considered as more appropriate for face-to-face settings, such as brainstorming. An item for assessment of these tasks is formulated under Factor I. Assessment of Factor K will further be postponed to the Second Phase of evaluation where users are involved.

Third group of requirements: Context Match – Matching the Setting

A groupware application is more likely to be used if it matches the setting in which it is used. This section presents Factors that are likely to increase the fit between the collaborative application and the group setting.

Success Factor L: Groups that cross organisational barriers require a collaborative application that can easily be connected and is not hindered by firewalls (this may hold for different departments in large organisations as well) (Ch. 2).
For the assessment of this Factor it is necessary to specify the compatibility of the groupware application with the operating systems available in the organisation. This item is specified under Technical Efficacy, Success Factor TE-VI Portability. In addition it is necessary to assess to what extent security issues are of hindrance to smooth and fast working:

- To what extent are security issues of hindrance to smooth and fast working?

Success Factor M: Groups that differ in many respects (type of member, structure and culture) and are supported by the same application require a flexible application that is able to fulfil different requirements (Ch. 6).
For this Factor aspects of the context and of the application need to be assessed: the number of groups supported by the application, the diversity between these groups, and the flexibility of the application. The latter characteristic is addressed under Technical Efficacy, TE-III. Only number and types of groups needs assessment:
- How many and what types of groups does the application need to support?

Success Factor N: Group members who regularly work outside the company buildings require remote access (Ch. 6).
Relevant questions that inform on this factor are:
- Do group members work regularly at different places in and outside the organisation?
- Does the application provide remote access?

Fourth group of requirements: Group Support – Support of Processes

A groupware application is more likely to be successfully used if it supports group processes relevant for achieving the group objectives. In some cases an application may not be suitable for supporting the (main) group task; it may however be suitable for supporting related processes, such as coordination between group members. In addition, the application may support group processes that contribute to positive group outcomes that do not directly relate to the task, such as cohesion and trust.

As this thesis focuses on knowledge sharing groups, mainly Success Factors on the support of the knowledge sharing process were identified in this category. Dispersed knowledge groups in this study may be teams or communities. This implies that knowledge sharing is a main task of the group (mainly the case in communities) or a supporting process for achieving the main task of the group (mainly the case in teams). If knowledge sharing is the main task of the group, items in the category 'the Support of Knowledge Sharing' can be considered a specification of 'Matching the Task'.

Further, communication is a group process which ha can hardly be separated from knowledge sharing: one has to communicate in order to share knowledge. However, from the literature and the case studies it is clear that a distinction can be made between sharing knowledge in personal interaction between group members and through using a database.

Success Factor O: The application supports the building of trust, the building of a common ground and a sense of belonging to the group (Ch. 3).
It is not only relevant for the group to start as a cohesive group with group members who trust one another (see Groupness), it is also important that cohesion and trust in the group stays on a sufficient level. Ideally the application supports the group to support building trust and stay a cohesive group. Therefore the First Scan assesses the applications support of these processes:

- Does the application support building trust?
- Does the application support building a good common understanding?

Success Factor P: Matching processes implies the support of processes which users consider suitable for ICT mediation (examples of processes that are perceived as unsuitable for ICT mediation are brainstorming and sharing experiences).
Although some collaborative applications aim to support activities such as brainstorming, users often perceive these activities as unsuitable for ICT support. This may be a reason why they fail to use the application. An item that assesses he group processes that need to be supported is formulated under Factor I. In the Second Phase of evaluation group members can give their reaction to the usefulness of support of the application of these processes.

Knowledge sharing is supported if:
In general it holds that a groupware application may support knowledge sharing in two ways: it may support interaction between members and it may support the central storage of knowledge (Ch. 2). In Chapter 3 it is explained that these two manners of support resemble the personalisation and the codification approach respectively. Here, I assume that the application should match the group's preferred way of knowledge sharing in order to support knowledge sharing.

An assessment of the support of knowledge sharing is the focus of the KSSI, the evaluation instrument applied in the Second Phase of evaluation. Therefore only some general questions about the support of knowledge sharing are relevant in the First Phase of E-MAGINE. The assessment of most of the Factors identified in this category is therefore postponed until the Second Phase of evaluation.

Success Factor Q: A groupware application supports interactions between members and/or central storage of knowledge.
Assessment of this Factor implies an assessment of the type of knowledge sharing the group is focusing on and an assessment of features provided by the application including

their frequency of use. These last two aspects are assessed by items formulated under Factor I.

- What type of knowledge is or should be shared in the group?

A finding in this study is that not only technical aspects are important in providing useful support for knowledge sharing; aspects of the content are relevant as well (Chapter 6). Examples of these aspects are the organisation of information, its quality and its quantity. These factors will be assessed in the KSSI.

Success Factor R: Knowledge sharing is supported if active structuring and filtering activities are applied (especially relevant when the application functions as central storage of knowledge).
This Factor addresses the organisation of content; it is assessed in the KSSI.

Success Factor S: Knowledge sharing is supported if there is sufficient and relevant content.
This Factor addresses the amount of content; it is assessed in the KSSI.

Success Factor T: Knowledge sharing is supported if updates and changes of the content are provided (since 'last visit', or since 'date').
This aspect is assessed under Technical Efficacy, Factor TE-VIII Awareness.

Success Factor U: Knowledge sharing is supported if sufficient group members actively use the application for sharing knowledge.
The number of active group members is assessed with an item formulated under Factor G-III. In the KSSI the number of group members actively using the application will be assessed.

Success Factor V: Knowledge sharing is supported if a clear and flexible structure is provided for the content.
This Factor addresses the organisation of content; it is assessed in the KSSI.

Success Factor W: Knowledge sharing is supported if the content is up-to-date.
This Factor addresses the quality of the content; it is assessed in the KSSI.

Success Factor X: Knowledge sharing is supported if the application supports getting to know your group members. (People are more likely to share knowledge if they know each other.)

There are many ways in which an application may support getting to know your group members. The simplest way might be providing 'Yellow Pages' with personal data about these group members. Whether this or other features are available is assessed by items formulated under Factor I.

Success Factor Y: Knowledge sharing is supported if the application shows who added which information. (People are more likely to trust one another's information or knowledge if they know who added it.)
This Factor addresses the quality or trustworthiness of the content. It might be more relevant for groups relying on the codification approach than for groups relying on the personalisation approach. If an application supports interaction between group members it is mostly clear who you are interacting with. A database however often stores anonymous documents. The Factor will be assessed in the KSSI.

Success Factor Z: Knowledge sharing processes are supported which users perceive as suitable for ICT mediation.
Here an argumentation is valid similar to that of Success Factor P. Some knowledge sharing applications aim to support activities such as sharing experiences, although users often consider these activities to be unsuitable for ICT support. This may be a reason why they fail to use the application. Users need to perceive the application as potentially useful for support in order to use it. Relevant knowledge processes are identified in the First Phase of evaluation, so that in the Second Phase of evaluation group members can react to the usefulness of the application in supporting these processes.

Fifth group of requirements: Group Support – Support of Outcomes

A groupware application is more likely to be successfully used if it supports the achievement of group outcomes that contribute to the main objective of the group. Group outcomes are a result of the group context and the group processes. As a consequence, most of the outcomes that are supported by the application are supported through matching the context factors or by supporting group processes. It is still interesting however to identify what types of outcomes are supported by the application, either directly or indirectly.

In the case studies no Factors were specified for this category. However, respondents mentioned a number of group or community outcomes that were relevant for communities. In the First Scan I want to assess whether the group achieves these outcomes and whether the application did support the achievement of these outcomes. These questions are added under a new Factor:

Success Factor AA: The application supports the achievement of specific outcomes, i.e.: Items that provide input for this Factor will firstly assess whether the group meet its objectives (indicating the group's successfulness), and secondly whether the application supported the achievement of specific outcomes. Outcomes will be assessed in general and on basis of findings in the case studies.:

- To what extent does the group meet its objectives? (e.g.:)
  - the development of new ideas to the organisation (community outcome)
  - cost savings for the organisation
  - developing standards, new methods or best practices for the organisation (community outcome)
  - documentation of new information for the organisation, such as knowledge systems, manuals, training instruction or requirements for new products (community outcome)
- And, to what extent did the tool provide support to these outcomes?

Sixth group of Requirements: Adequate Introduction, Adaptation and Development

Groups are dynamic, they go through several stages and as a result they may adapt to tools or stick to existing interaction patterns. These aspects need attention in the evaluation of the fit between group and collaborative application. The quality of the fit has different implications depending on the stage the group is in. It is for example easier to affect the adaptation process in an early group stage than in a later stage.

Success Factor BB: A successful adoption process includes groupware usage pushed by the organisation (Ch. 2).

Success Factor CC: A successful introduction of the collaborative application entails time to learn to work with it (Ch. 2).

Success Factor DD: A successful adoption of the collaborative application to the group entails careful introduction of the collaborative application to the group, for example by hands-on experience in a group meeting (Ch. 6).

Success Factor EE: A successful adoption process requires a facilitator or group leader who motivates use of the collaborative application (Ch. 6).

Success Factor FF: New group members who join the group require an introduction to the collaborative application (Ch. 6).

The assessment of these Success Factors is integrated in one open question about the implementation and introduction of the application. The factors presented above will be added as sub-items that need to be assessed if these are not spontaneously discussed. I expect that an open question here will generate a more complete picture of the entire implementation process.

- How was the application implemented in the organisation and how was it introduced to the group? (Success Factors BBH-FF are addressed as separate items of this main question)

Success Factor GG: A successful adaptation process of the application entails the need for interaction experienced by the group members, even when this implies the change of existing communication structures.
For this Factor it is relevant to know how long the group has been in operation and how long it is expected to last from the moment of evaluation. This provides information on existing structures, their duration and expected rigidness, and on the time that remains to put effort into changing these structures. These aspects are assessed as aspects of Groupness, see Success Factor G-II.

7.4 Generating a First Level Profile

Based on the First Scan interview a First Level Profile of the group and the groupware application should be generated. This Profile should describe the main characteristics of the group and the application and the way and extent of usage of the application. Generating this First Level Profile should not be too complicated or take too much time for the evaluator. Then it does not fit the goal of a cost-effective evaluation approach. Therefore the First Level Profile is specified as consisting of the filled in questions of the First Scan completed with comments from the interviewer. The First Level Profile is completed with a short summary of the interview. However, the First Profile should be useful to direct the next evaluation steps by revealing which aspects of the setting need further attention. To solve this the concept of an 'Evaluation Issue' is introduced. Evaluation Issues are aspects of the setting which might be relevant for its success, but which state is unclear. An evaluation issue is specified in one of the following three manners:

1) It is a question of the First Scan that could not be answered by the first respondent (group leader)
   The First Scan filters the presence of factors that hinder the use of a groupware application and in that way hinder the groupware application in being useful. In case the First Scan cannot reveal whether specific factors are present, their assessment is continued in the Second phase of evaluation.

2) It is a lacking Success Factor in the setting
   In case the First Scan reveals that a Success Factor is lacking, it is assessed whether this is a problem for group members in the Second Phase of evaluation.
3) It is a direction for improvement suggested in the interview (by the first respondent (group leader) or the evaluator).
   This suggestion may have come up during the First Scan interview or in the analysis of the questionnaire.

Whether the Evaluation Issues identified indeed are relevant, and to what extent, needs further assessment. The First Level Profile, including the Evaluation Issues, is basis for Evaluation Step 3.

7.5 Test of the First Scan in an online community

In order to test its reliability, validity and acceptability, the First Scan is applied in the so-called 'Online Community of Practice'. In this community a reliability and validity test was applied. Reliability was tested by applying the First Scan in separate interviews with two respondents who were both facilitator of this group. The assumption was that application of the First Scan in these interviews should lead to similar outcomes. If not, the First Scan would need to be improved. In addition, the interviews were used to test face-validity of the instrument. In other words, the respondents were asked whether they understood the questions and whether they agreed that these types of questions are relevant when evaluating the support of a collaborative application.

The respondents who cooperated in this test of the First Scan are considered experts in the field of knowledge sharing in groups. At the time of research both had experience in facilitating Communities of Practice in sharing knowledge and in supporting these communities with collaborative applications. In addition, they were informed about the mainstream of research in this area and had executed research activities themselves as well.

I studied the Online Community of Practice by participative observation. As a result I knew about many aspects of the group. And, I could compare the answers of both respondents to my own knowledge of the group. This facilitated the discussion on what I intended to address with the First Scan and their perception of the evaluation instrument. The answers and comments of the respondents during the interviews were used to improve the instrument.

7.5.1 Online Community of Practice

Context

The ‘Online Community of Practice’ group consisted of approximately 20 members who were all interested in the topic of Community of Practice. They came into contact with each other in the context of a learning setting. The intention of the two initiators and facilitators of this course was to introduce and discuss the concept of Communities of Practice by forming a community around this concept. In this manner participants could experience being members of a community while discussing the concept. The facilitators announced their initiative using their occupational networks and invited people to join. The members of this group had accepted the invitation and had each paid a fee to become a member of the community.

The online community existed for six weeks in the autumn of 2002, during which the community mainly interacted using the collaborative platform provided by WebCrossing. Three telephone conferences were held and some members also had dyadic telephone contact. During these weeks no face-to-face meetings took place. However, some members of the group were direct colleagues (2 x 2 persons) or worked together in the same inter-organisational project, and had face-to-face meetings in this context (3 x 2 persons).

Community

The members of the community had very diverse backgrounds and worked at a range of different institutions and organisations, all based in the Netherlands. All members were professionally interested in the concept of Community of Practice and related concepts such as e-learning and virtual groups. Members of the community were, for example, consultants in the field of organisational learning, academics in the field of Computer Supported Co-operative Work or Computer Supported Co-operative Learning. Some of them had been active in the field of learning and training for many years, although only a small group had some experience with the concept of Community of Practice. Others had only read or heard about it; some had even never heard of it before. The latter were mostly interested since they planned to use the concept in their own work in order to increase learning within their company.

The group did not have a well-defined group goal, except disseminating and exchanging know-how on the concept of Communities of Practice. The group consisted of a collection of individuals who all shared their interest in the concept of CoP and they all hoped to learn more about it by being a member.

<u>*Groupware Application*</u>

The WebCrossing company provided the interaction platform. The platform supported the features as listed in Table 7-1. The table also provides an overview of the available discussion folders which were all organised in a similar manner but dedicated to different topics. (The community I participated only had Dutch members. For that reason discussion folders on the platform were referred to in Dutch. However, as the folder titles are translations of original English folders, both titles are mentioned in the table.)

7.5.2 Results and implications for the First Scan

Both facilitators of the Online CoP were willing to co-operate in an interview. They were informed about the intention of the interview and that they both separately would be asked the same set of questions. In general the answers provided in both interviews were very similar. It was interesting to notice that even open questions resulted in similar answers. However, there were some differences as well. These differences appeared for example on the items that informed on the Technical Efficacy Factors. Other items resulted in differences on a more detailed level. The two facilitators provided different details of the Online CoP as a response to items of the First Scan. Despite these differences the same conclusions about the presence of Success Factors in this setting could be made. This is a satisfying result for the reliability of the First Scan.

In the next sections 5 main differences in responses are discussed, including some other findings. Where these findings provide reasons adaptations to the Scan are applied.

1) A number of questions appeared not to be quite suitable for this context.

According to the respondents some of the items were not applicable in the setting of the Online community. One of the reasons was that the group was more a collection of individuals participating in the group to achieve individual goals, whereas a number of items of the First Scan address the group as having clear group objectives. The Online CoP did not really have a group goal or an organisation expecting group outcomes. The main goal of the Online CoP was to provide a learning platform for its members. One group of items that spurred these comments assess the organisational support towards the community. The underlying assumption is that organisational support motivates members to cooperate in the group. This organisational support is less relevant in this setting as individuals are intrinsically motivated to cooperate and in that manner achieve their individual learning goals.

In my opinion the First Scan does not need changes as a consequence of this finding, because most of the groups E-MAGINE focuses on will have a group objective and do function in an organisational setting. Moreover, the two respondents could see the relevance of this type of questions in these settings – communities or teams in organisations. Thus questions that assess support of the organisation to the group and that assess the outcomes on an organisational level can be skipped if a group resembles the Online Community presented here in that it does not have a group objective.

2) Facilitators did not know much about the individual context of the group members.
It further appeared that both facilitators did not know much about the individual contexts of the group members. The First Scan assumes the group leader or facilitator knows about this context: about individual access options, about opinions on the tool, about frequency of use of features, about other tasks people are involved in, etcetera. However, this type of questions could not be answered by the respondents.

When the First Scan is applied, it indeed might happen that the respondent (group leader) is not informed well enough to answer the questions. Logging use of the application might in some cases inform the frequency of use. To answer the other questions two options are available. Ask other group members to answer the questions of the Scan. Or, postpone the questions that were left unanswered to the Second Phase of evaluation.

3) Differences in their knowledge about technical aspects of the application
One reason for differences between the answers of the facilitators was due to differences in their knowledge about technical aspects of the application. One facilitator had taken up the role of technical facilitator and he knew more about technical aspects of the platform. He had also received questions from the users about the platform. As a consequence he knew more how group members perceived the application.

The implication for the First Scan is, again, that one could decide to involve more than one respondent to gain answers to the various types of questions.

4) Some items needed explanation
A number of questions needed some explanation because they were unclear to the respondents. This held for example for the question about ‘consistency’: is the application consistent in use? This item informs on the Usability Factor under Technical Efficacy. The underlying assumption is that a consistent application is easier to use. The reaction of respondents was: What is consistency exactly? Does the item refer to consistency between applications or consistency within the application? After the explanation (here it refers to consistency within the application) respondents were able to answer the question.

Table 7-1 The features provided by the collaborative application

Feature	**Explanation**
Chat	Several members tried to initialise a chat session, but unfortunately the feature appeared not to function during the 6 weeks of the course.
Awareness	The platform provided awareness of who was online.
Short messages	It was possible to send a ‘short message’ to another member who was online.
Threaded discussion	A folder structure which supported having a threaded discussion.
Shared document folder	A shared document folder that could be used by every member to upload and download documents, the folder was referred to as ‘Cybrary’.
‘Mark’	This feature offered the option to mark discussion threads; if marked, the user received an e-mail when new messages were added to the marked thread.
Personalised ‘new’ feature	This feature offered the option to see what was new since the last time you had logged in.
Help	The possibility to ask for support for technical problems.

Other typical characteristics of the collaborative application were the following:

Lay-out	The homepage was a picture-like overview of the different folders in which you could browse, ‘meet’ and post messages. It was also possible to see the same folders in a ‘windows explorer’ view (see Figure 7-1).
A range of discussion folders	**Community Circle** (Stamtafel): Intended to support informal discussions. **Practice Lab** (Praktijklab): Intended to support interaction around cases; exchange of experiences or finding solutions for (practical) problems people have related to the topic. **Household** (Opkamer): Several subgroups were initiated here, all with a task in relation to supporting the community itself, including supporting communication, instruments. **Domain Inquiry** (Domeinverkenning): This folder provided the overviews delivered by the facilitators; these overviews highlighted several themes related to the main topic and consisted of introductions and definitions. **Private space** (Privé ruimte): Everyone had their own virtual space to introduce themselves or add other personal information. These folders made it possible to virtually visit someone and leave a message. **Guest speakers** (Buitenwereld): In this virtual space people from outside the group were invited to discuss an issue related to the group topic.

Again it appears that it is important that the evaluator has some insight into Success Factors underlying the First Scan (see also 7.2.3). Otherwise the evaluator will not be able to provide this explanation and will not be able to apply the instrument. This information is provided in the instructions accompanying the Scan. However, the evaluator should still have some general knowledge of usability evaluations to be able to apply the First Scan. This is added to the instructions as well.

A small amendment of one of item of the First Scan might prevent further unclearness relating to that item. The item addressed the extent to which the application meets certain standards. Respondent 1 needed clarification in order to be able to answer this question. The question focuses on the inventory of standards, such as ISO norms. This was clear to respondent 2, so the question is only slightly changed: '(such as ISO-norms)' is added.
Another question that led to a question for clarification was: Does the collaborative tool supply the features that were promised in advance? According to the respondents this question is somewhat confusing, for who has promised what to whom? The word 'promised' is in the question is therefore changed into 'expected'.

Figure 7-1 The entry page of the collaborative platform of the Online Community

5) Support of Outcomes

In the First Scan a distinction was made between the achievement of outcomes by the group (answers should then indicate the groups successfulness) and the extent to which the collaborative application supports achieving these outcomes (answers should then indicate the level of outcome support of the application). In the interviews it appeared that it is difficult for respondents to make this distinction. The respondents felt like filling in the same questions again, especially because the outcomes could *not* be achieved *without support* of the application. An example is: 'Does the application support building trust?' As the community was completely virtual, all its processes and achieving all its outcomes were supported by the platform. Moreover, these processes and outcomes existed by virtue of the platform. If trust is built in the group, then this is supported by the application.

Reflecting on these interviews I came to the conclusion that the evaluation approach needed to be modified. I expected that the comments made by the respondents were also applicable in other settings. In these settings too these two types of items will be hard to discern and will therefore be hard to answer. Although there is a theoretical difference, in practice the items are considered similar: group processes lead to group outcomes, support of these processes is therefore (almost) similar to support of (achieving) these outcomes. I have therefore removed the items that assessed the support of achieving specific outcomes. As a result the Scan only assesses whether the group achieves these outcomes (without referring to level of support provided by the groupware application).

After the First Scan interview, I discussed two more things with the respondents. What was in general their opinion about relevance of the questions and acceptability of the First Scan interview? They both agreed on the relevance of the questions and also with the acceptability of the interview. However, they thought the interview took a bit long for a 'First Scan'. The interviews took more than one and half hours. This comment is partly solved now: some of the adaptations presented above shorten the list of items of the First Scan and as a result the time needed to apply the Scan.

In sum, the adaptations to the First Scan are the following: a few questions are simplified or shortened. Other questions are completed with some instructional information. The questions related to outcomes of the group and support of processes and outcomes are changed and restructured. Two other questions are rephrased. All changes, including shortening the list of items, increase the Scan acceptability and reliability. With these changes the First Scan is ready for a new test. The latest version of the First Scan is presented in Appendix VII.

7.6 Conclusion

This chapter reports on the development of the First Scan and its application in a dispersed knowledge group. The First Scan was developed on the basis of insights presented in previous chapters. It now consists of a specific set of instructions and a checklist that can be applied in a structured interview (See Appendix VII). The Scan serves four goals in the evaluation process, applying the Scan one should be able to (see 7.2.1):

1) identify whether the groupware application is used, what functionalities of the application are used, to what extent, and by whom;
2) assess Factors that facilitate the use of the groupware application;
3) describe the context-of-use of the groupware application;
4) direct the evaluation process in the Second Phase of E-MAGINE.

The first application of the First Scan was performed in order to test whether it meets the four evaluation requirements and to test its reliability, validity and acceptability. The test showed that application of the Scan with two different respondents resulted in similar outcomes. This roughly indicates that the First Scan is reliable. It further turned out that not all items of the First Scan were considered relevant in this context. On some dimensions the Online CoP appeared slightly different than the communities that functioned as input for the First Scan. Still, the respondents, facilitators of the community, could envision the relevance of questions in other settings. As they are considered experts in this field of research, their joint scores indicate limited face-validity of the items as well.

From the answers to the items conclusions could be derived on whether Success Factors were present. The instrument is thus suitable as an instrument to gain insight into Success Factors for groupware usage (requirement 2). However, it appeared that one of the facilitators did not have insight into the frequency use of (features of) the application (requirement 1). This indicates that in some cases not all goals of the First Scan can be achieved in one interview, in these cases two (or more) interviews will be needed. In this dispersed group both facilitators had their own focus in facilitation. Interviews with both these two facilitators appeared to be sufficient for filling in all items of the Scan. Their combined answers resulted in insight into the use of the application (requirement 1) and gave good insight into the setting (requirement 3). Lastly, based on the First Scan interviews a First Level Profile could be generated, at this moment such a Profile seems to be useful to direct the Second Phase of evaluation (requirement 4).

In testing the First Scan it became clear that the first version was too long. Outcomes of the test were used to leave out questions in order to shorten the Scan and to rephrase unclear questions. Both steps resulted in a more acceptable Scan. The test further triggered the relevance of offering instructional information to the instrument. These instructions support the evaluator in informing the respondent in more detail about the intention of the questions. When these instructions are added, the First Scan can more easily be applied in other settings and by other evaluators as well. However, it was also concluded that the evaluator needs some basis knowledge of usability evaluation.

The main instrument of Phase 2 of E-MAGINE, the KSSI is developed in the next chapter. In addition it is specified how the Focus group should be applied.

8

Development of the Knowledge Sharing Support Inventory (KSSI)

8.1 Introduction

This chapter reports on the development of the Knowledge Sharing Support Inventory (KSSI), which evaluates the quality of knowledge sharing support of a groupware application. The Chapter also reports on development of instructions for the Focus Group. First the goals of the KSSI as defined in Chapter 5 are summarised. Subsequently, the issues the instrument needs to assess are operationalised. The chapter concludes with a first application of the KSSI in a case study featuring a dispersed knowledge group.

8.2 Goal of the KSSI

The First Scan filters the presence of factors that hinder the use of a groupware application and in that way hinder the groupware application in being useful. The KSSI, as next step in the evaluation approach, should be able to assess the quality of knowledge sharing support provided by the groupware application. As is put forward in Chapter 5, the KSSI will be developed as a general instrument, which can be adapted to the situation in which it will be applied. The manner in which issues are addressed is developed here, including the type and style of questions. In the actual application of the KSSI the instrument may focus on specific features of the groupware application and / or on the support of specific types of knowledge. The First Level Profile resulting from the First Phase of evaluation is used to direct these adaptations.

8.3 Requirements for the KSSI

8.3.1 Introduction

Design requirements for the KSSI are derived from the design requirements for the E-MAGINE evaluation approach (See Chapter 4, Textbox 4-2). The same holds for the methodical requirements for the evaluation approach; this is discussed later in this Chapter. In the next Sections, implications of design requirements 3 and 4 are specified for the KSSI. Design requirements 1, 2 and 6 have broader implications for the evaluation approach and do not hold for the KSSI specifically. Design requirement 5 for E-MAGINE is mainly achieved by implementing a Focus Group in the Second Phase of evaluation.

In addition to the design requirements, Success Factors identified in this thesis form input for the KSSI. Relevant Success Factors for this instrument fall in the category ‘Support of Success Factors in the KSSI is discussed in section 8.3.4.

First, the subsequent section starts with implications of design requirement 3 for the KSSI.

8.3.2 Design requirement 3: Evaluate the fit between application and context

This design requirement indicates that the KSSI should evaluate the fit between the groupware application and knowledge sharing processes. In literature (see Chapter 3) it can be found that organisations implement knowledge sharing applications for two reasons: Firstly, to centralise the storage of knowledge, which contributes to the standardisation of working methods and techniques, amongst others. Or, secondly, to provide a medium for employees to easily get in contact with colleagues who, for example, might be able to answer question(s). The first implementation strategy fits the codification (or stock) approach and the second the personalisation (or flow) approach (Hansen et al., 1999).

Several opinions can be found in literature on how ICT should be applied in order to facilitate knowledge sharing successfully. As was addressed in Chapter 3, several authors stress that a specific choice should be made between the codification or personalisation approach (Hansen et al., 1999), where other authors argue that a combination of both approaches is preferred (e.g. de Bruijn & de Nerée tot Babberich, 2000). The findings in the case studies in this thesis support the existence of the two main strategies for knowledge sharing in practice, i.e., the codification approach and the personalisation approach. In the case studies mostly a combination of both strategies was implemented with different levels of success. The observations are summarised below.

Two of the collaborative applications studied in the in-depth cases were implemented to support both knowledge strategies, e.g. the Habiforum platform and the platform provided to the Online Community. In Habiform the purpose of the collaborative platform was threefold: Firstly, the organisation wanted to show visitors of their web portal what activities were initiated by Habiforum. Secondly, they wanted to provide the community members with an inter-organisational platform via which they could easily stay in touch and exchange information. Thirdly, they wanted to support discussions between members of different communities. The first purpose is related to promoting the organisation and cannot be related to one of the knowledge sharing strategies. The second purpose is a combination of personalisation (stay in touch) and codification (exchanging information via a collaborative platform). The third purpose of facilitation clearly fits the personalisation approach. In Habiforum the platform was hardly used, only some documents were stored. Processes – Support of Knowledge Sharing' (see Chapter 7). Implementation of these

In the Online Community a clear distinction could be made between features of the collaborative platform that supported the personalisation approach and features that supported the codification approach. The ‘Cybrary’, for example, clearly supported the codification approach, whereas the threaded discussion folders supported a personalisation approach. In this community both types of features were extensively applied by its members.

In AtosOrigin two different applications were implemented, each facilitating one of both knowledge strategies. Performer in AtosOrigin focused on the (standardised) storage of knowledge, whereas the NoP-tool was mainly implemented to support interaction between group members. This different focus of support was not clear to every employee. Consequently, the employees generally used only one of both tools. The applications appeared to be perceived as being competitive by them. I concluded that an application should provide clear added value in order to be used: added value compared to not using the application, and to using another application. In many settings a number of applications are provided to employees. On the basis of this example at AtosOrigin, I conclude that even if applications have different facilitation purposes, they can be perceived as being competitive.

The case studies thus did not provide an answer to the question whether a specific choice should be made between the codification or personalisation approach, or, whether a combination of both approaches is preferred, in knowledge sharing support. What can be done however is evaluate the features that are provided by the application (including their frequency of use) and relate these to the knowledge sharing objectives of the group. For example, if the main goal of the group is sharing standardised knowledge, the groupware application should at least provide a well-organised knowledge base. A general assessment of these aspects is applied in the First Scan. Subsequent, a more specific assessment is possible in the KSSI.

The objectives of the groups, as identified in the KSSI, should thus be interpreted as whether these are in line with, or best supported by, the codification or personalisation approach (or by a combination of both). This instruction will be added to the instructions for setting up the First Level Profile.

A subsequent question then is: How can the fit of the application to the codification approach be assessed? As codification implies storing and finding information, it seems useful to assess for example the extent of support for finding information on topics that are relevant for the group for example. Next question is, how can the fit to the personalisation approach be assessed? As personalisation implies ‘asking colleagues’ for example, the extent of support of the tool for asking questions to group members might be assessed.

Further specification of items related to the two knowledge sharing approaches will be discussed in Section 8.4.1 and 8.4.2 respectively.

In this set-up of the KSSI, the groups objectives and activities lead to requirements for the groupware application and the KSSI assesses the extent to which these requirements are met. The groups objectives and activities are assessed by the First Scan, the KSSI has to address the type and extent of support.

8.3.3 Design requirement 4: Apply Quality in Use

'Apply the concept of Quality in Use' is the fourth design requirement for E-MAGINE. The norm stresses the importance of the opinion of the users in estimating the quality of an application. In addition, it stresses the relevance of evaluating *the result of using* the application. As is specified in Chapter 5: Quality in Use underlines that an indicator of the quality of software is the *perceived* quality of the *result of using* the software by its users. Consequently, Quality in Use can only be measured by involving the users in the evaluation process *and* when the application is in use. Whether the application is in use is assessed in the First Phase of evaluation. In the Second Phase of evaluation, the users should be consulted on whether they are satisfied with the level of support. Therefore, the KSSI should not only check what kind of knowledge sharing support is available, but also to what extent the user is satisfied with this functionality. In order to achieve that goal I will apply combinations of items related to relevant knowledge sharing processes in the group. Where the first item addresses the extent of support for 'knowledge sharing process x' and the second the satisfaction level of users in relation to this support level. Thus first a question such as: "To what extent does the tool support 'knowledge sharing process x'?" With the following question as follow-up: "In your opinion, to what extent does the application need improvements in this respect?" This follow-up question estimates the satisfaction level of users. I assume that in this manner identification of the necessity – 'to what extent' – and direction of improvements can be specified, based on the opinion of the users. I prefer this option to directly asking the user whether they are satisfied. Directly asking users whether they are satisfied, might not reveal whether they consider improvements necessary. It is possible that, although users are unsatisfied, they are not interested in improvements. This may hold for situations in which (support of) the knowledge sharing process itself seems irrelevant to them.

In the case studies it appeared that the opinion of users on the result of using leads to a broadening of the object of evaluation. Not only the groupware application and the features provided are relevant for the perceived level of support. Users also considered other aspects relevant, such as the number of group members using the application and the quantity and quality of the content. They stressed that the application should have a sufficient number of group members using it (=critical mass) and/or provide sufficient and relevant content. The number of group members using the application appeared especially relevant when the personalisation approach was applied. Sufficient and relevant content was relevant when the codification approach is applied. Both findings are illustrated in more detail below.

In Chapter 3 it is put forward that critical mass is especially important for groupware applications, since success of the system often depends on a substantial number of users (Grudin, 1994b). In Chapter 6 this premise, specified in literature, was confirmed in the case studies. A critical proportion of the group needs to be active in answering questions of other group members and uploading information in the application. When a question is asked, the group member should receive an answer quickly, otherwise it is perceived as useless to ask this question anyway. A critical mass of users increases the chance that someone notices the question and reacts within a reasonable time limit. In other words a quick reply is more likely in case a large part of the group actively participates. The critical mass requirement clearly supports the personalisation approach. However, it indirectly may support the codification approach, more group members actively using the tool also increases the chance on more content.

It was also found that for an application to be successful in the support of knowledge sharing a minimum of content is needed. I will refer to this requirement as ‘critical amount of content’. The KSSI should address whether, in the opinion of the users, the requirements of critical mass and critical amount of content are relevant and whether they are met. The specification of these items will be discussed in 8.4.1 (critical amount of users adding information), 8.4.2 (the amount of time it takes before a reply is received), 8.4.3 (sufficient information available).

8.3.4 Identification of Success Factors for Knowledge Sharing

In addition to the design requirements for E-MAGINE, some of the Success Factors are relevant for the KSSI. Relevant Factors are specified in the category ‘Group Support – Support of Processes: Knowledge Sharing’. Some Factors are assessed in the First Scan, such as Success Factor Q: ‘A Groupware applications supports interactions between members and/or central storage of knowledge’ (see Chapter 7). Other Factors should be assessed by the KSSI. The Success Factors related to knowledge sharing support are presented once more in Table 8.1. Here they are re-grouped according to the aspect of knowledge sharing they focus on. (The letters that are used to denote them in Chapter 7 are cited between brackets.)

Factor 1 is a general remark about the possible match of the application to knowledge sharing support. It is in line with the discussion on the support of the personalisation or codification approach presented above. Specification of items related to these two knowledge sharing approaches will be discussed in Section 8.4.1 and 8.4.2 respectively.

Table 8-1 Success Factors related to Group Support – Support of Processes: Knowledge Sharing

Success Factor		Aspect	Assessment
Knowledge sharing is supported if…			
1 (Q)	a groupware application supports interactions between members and/or central storage of knowledge.	general	First Scan & KSSI
2 (T)	updates and changes of the content are provided.	functionality	First Scan
3 (V)	a clear and flexible structure is provided for the content.	content	KSSI
4 (S)	there is sufficient and relevant content.	content	KSSI
5 (W)	the content is up-to-date.	content	KSSI
6 (R)	active structuring and filtering activities are applied (especially relevant when the application functions as central storage of knowledge).	content	KSSI
7 (U)	sufficient group members actively use the application for sharing knowledge.	(number of) users	KSSI
8 (X)	the application supports getting to know your group members. (People are more likely to share knowledge if they know each other.)	indirect support/ functionality	KSSI
9 (Y)	the application shows who added which information. (People are more likely to trust one another's information or knowledge if they know who added it.)	indirect support/ functionality	KSSI
10 (Z)	knowledge sharing processes are supported which users perceive suitable for ICT mediation.	(opinion of) users	First Scan & KSSI

The two subsequent Factors 2 concerns a specific functionalities the application may provide in order to facilitate knowledge sharing. Assessment of Factor 2 is applied in the Fist Scan. Factors 3-6 relate to the quantity and quality of the content provided by the application and relate to what I have called critical amount of content. Items related to the quantity of content are specified in 8.4.3. Factor 7 relates to the (number of) users of the application and thus to the concept of critical mass, related items are specified in 8.4.1 and 8.4.2. Factor 8 and 9 inform what features the application may provide to indirectly affect the likeliness of group members using it to share knowledge. Factor 8 is specified in section 8.4.2, Success Factor 9 in 8.4.1. Lastly, Factor 10 stresses that an application is more likely to be used when it is considered suitable for the support of knowledge sharing processes.

This question is (implicitly) addressed by the follow-up question applied in combination with other items ("In your opinion, to what extent does the application need improvements in this respect?"). The assumption is that if users do not consider the application useful for the type of support that is assessed, they will respond that improvements are not necessary. The table shows that all Success Factors are assessed by E-MAGINE, either in the First Scan or in the KSSI, or in both instruments.

8.3.5 Methodical requirements

Methodical requirements for the KSSI are in line with the methodical requirements for E-MAGINE (see section 5.3): the KSSI should meet the methodical requirements of reliability, validity and acceptability. As was explained in section 5.3, testing the reliability of E-MAGINE and its instruments is however hard in this stage of its development. It implies e.g. application by (an)other researcher(s) or applying the approach twice. This is beyond the scope of this research project. However, the KSSI (which will be developed as a questionnaire, see section 8.4.6) will initially be applied in interviews, so that respondents can comment on the instrument while filling it in. In addition, the results of the interviews will be compared to the outcomes of semi-structured interviews with the same objective in the same setting. It is expected that these research activities increase the validity and acceptability of the instrument.

A first assessment of whether the KSSI meets these methodical requirements is provided in the concluding section of this chapter. A final assessment is provided in Chapter 10.

8.4 Specification of items for the KSSI

8.4.1 Support of the codification approach

The first four questions in the instrument assess to what extent the application supports the codification approach. These questions address two aspects of the codification approach: 1) storage and 2) retrieval of specific types of knowledge or information. In the instrument the availability of in total four types of information are assessed:

- Information on the group topic
- Information concerning experiences of other group members
- Information on related projects (and project groups)
- Information on who added what information

Sharing knowledge and information on the group topic is assessed, as this is one of the basic knowledge processes of dispersed knowledge groups. The sharing of experiences is assessed as several authors have identified this process as an important knowledge sharing activity (Orr, 1990; Wenger, 1998). In the perspective on groups as knowledge carriers in an organisation (see Chapter 3) the application does not only support knowledge sharing within the group, but also knowledge sharing between the group and other groups in the organisation. To facilitate this process, information on related projects might be useful.

For these three types of information assessments, the follow-up question as described in 8.3.3 is added ("In your opinion, to what extent does the application need improvements in this respect?"). A second follow-up question relates to the critical mass concept introduced in section 8.3.3. By asking how many group members added that specific type of knowledge or information, it is expected that insight is gained into the number of actively participating group members.

Other aspects that can be investigated under 'codification approach' are the extent to which the collaborative application provides information on the existence, purpose and activities of the group (e.g. in an overview of groups in an organisation it can be found that there exists a group focusing or working on topic X). Communicating these aspects of the group contribute to the identification of group members to the group and therefore to cohesion and 'groupness' as was put forward in Chapter 3. The collaborative application may contribute to groupness by communicating this information as well. Additionally, this type of information may help new-comers find their way. The evaluation instrument will assess these two aspects:

- Does the application provide information on:
    - the existence and purpose of the group(s) facilitated
    - the topic and activities of the group

For these questions the same follow-up question is specified: 'to what extent are improvements needed?'

8.4.2 Support of the personalisation approach

Several questions are needed to assess to what extent the application supports a personalisation approach. First questions are applied that address indirect support of the personalisation approach. One question addresses finding information on group members, this supports getting to know them, which increases the likeliness of sharing knowledge with each other (Success Factor 8 and 9). Further the support in finding experts is assessed. These two aspects of groupware support, help group members to find each other and to find (other) experts.

- Does the application facilitate finding:
  - background information of group members? (Success Factor 8)
  - information on experts (inside and outside the organisation)?

Another manner of supporting the personalisation approach is supporting direct interaction between group members. The evaluation instrument therefore also addresses to what extent interaction processes such as asking questions to group members is supported. Additionally, it is relevant to address how frequently the user applies the application to ask questions and how long it normally takes before a reply is received. These two questions provide information on the activity level of the group. It is assumed that when the activity level of the group is high (replies on questions are coming in quickly), critical mass is present in the group. The items inform on Success Factor 7.

- To what extent does the application support asking questions to group members?
- If present, how often did you use the possibility to ask questions on-line?
- How long did it (generally) take to receive an answer?

Again, the above questions are followed by a question addressing to what extent improvements are needed.

8.4.3 Group visibility

The following items address to what extent the application supports visibility of the group to group members and new-comers. From the case studies in previous chapters it appeared that visibility of aspects such as purpose of the group may contribute to group identity. Items address two aspects 1) level of support and 2) need for improvements. Items are:

- To what extent does the application support gaining knowledge on the purpose of the group
- To what extent is the tool helpful for new-comers in gaining an overview of activities in your group.

8.4.4 Quality of knowledge and information

Success Factor 4, 5 and 6 in Table 8-1 present relevant aspects of the content, these aspects will be addressed in the KSSI as well. I further add two other aspects of content: reliability and completeness. This results in the following questions:

Does the application provide:

- information that is conveniently arranged (Success Factor 3)
- sufficient information (quantity)? (Success Factor 4)
- information of good quality? (Success Factor 4)
- information that is up-to-date (Success Factor 5)

- information that is complete
- information that is reliable

8.4.5 Access, motivation, usage, user characteristics and overall opinion

The possibility and motivation to work with the application is relevant for the perceived quality of support. The relevance of these factors is the main reason for applying a First Scan, before the KSSI is applied. However, the First Scan consists only of one interview with the group leader, with in some settings an extra interview with another informed person. In this phase of the evaluation process it is relevant to gain more detailed information on access, motivation, and time spend on the groupware application from group members themselves. This information tells us to what extent the user of the tool has worked with the application, and the extent to which the user is motivated to (learn to) use it. This information may be related to (extreme) opinions on the usefulness of the application. The KSSI therefore assesses:

- to what extent the user is motivated to share knowledge and information
- to what extent the user has time to spend on the group
- to what extent primary tasks hinder sharing knowledge with the group

A similar argumentation can be set-up for the frequency of use of different features provided by the tool, as well as for the personal data of respondents. Again, these aspects are generally addressed in the First Scan, but at this stage more detailed information can be obtained and could be informative. These questions are added to the instrument as well:

- the frequency of use of different features
- personal data (such as age and experience)

The KSSI concludes with an assessment of the overall opinion of the user on the collaborative application:

- All in all, to what extent did the total ICT setting provide the knowledge and information you need?
- All in all, to what extent are you satisfied with the total ICT support?

8.4.6 Type of instrument

Just as it held for the First Scan, several types of methods are potentially suitable for the KSSI: interview (unstructured, semi-structured, and structured), questionnaire, checklists, observations, and other. However, the KSSI should assess the *perceived* support of knowledge sharing. Therefore it is important to involve as many group members as possible. This makes a questionnaire more suitable than an interview. Application of a questionnaire also enables the comparison of answers of different group members. This is relevant for, when assessing the 'perception of a group', not only the mean score is relevant, but also and especially the *variance* in scores. This variance gives an indication of the extent to which group members agree with each other.

Actually, an on-line questionnaire suits our purpose best, as it is easy to fill out such questionnaires from different places, a likely reality in dispersed groups[3]. In addition, it is easy to efficiently collect data with on-line questionnaires. In this manner the KSSI will be a practical and efficient instrument to apply, in line with the requirements for E-MAGINE. According to Hamborg, Vehse, and Bludau (2004) online questionnaires are as suitable as paper and pencil questionnaire to assess usability aspects.

For the answering categories again a 5-point Likert scale is applied, just as in the First Scan.

8.5 Analysing outcomes of the KSSI

In this stage of its development the KSSI should be analysed item by item, as items cannot be combined as informing on certain constructs. In the interpretation of the outcomes of the KSSI especially low and high mean scores and scores with a low or high variance are interesting. Low or high mean scores, with low variance, indicate high agreement in the group on aspects of the setting; these may indicate relevant potential improvements. Low or high mean scores with high variance indicate high disagreement in the group on aspects of the setting, these scores are relevant to discuss in the Focus Group.

The following section presents the application of the KSSI in a dispersed knowledge group.

8.6 Application of the KSSI in an online community

To test the KSSI two types of interviews were combined. Firstly, half of the members of an online community were confronted with the KSSI in a face-to-face interview and asked to fill it out while commenting the survey. They were asked to comment on content and format of the questionnaire. Secondly, the other half of the group co-operated in an open interview, also assessing the knowledge sharing support of the groupware application. In these interviews similar questions were asked, however, instead of closed questions, open questions were applied in a less rigid interview structure (see Appendix IV for the KSSI version as applied in this community and Appendix V for the interview formats). The outcomes of the structured interviews were compared to the outcomes of the open

[3] If the software for the application of an on-line questionnaire is not available in the setting, a paper and pencil questionnaire is also suitable, but in that case it will take more time to apply the KSSI. The questionnaires need to be sent by (normal) mail and the data should be handled manually.

interviews in order to improve the KSSI instrument. In total 4 group members were asked to fill out the KSSI while commenting the instrument and 5 respondents cooperated in a semi-structured interview.

8.6.1 Online Community of Practice

For the validation of the instrument the group described in Chapter 7 was chosen. This group, the Online Community, meets the criteria that hold for all groups involved in this research project. It is a knowledge intensive, dispersed group in an organisational context. One difference with the groups studied so far in this thesis appeared in Chapter 7: the group is more focused on the facilitation of individual learning than on achieving collective goals. However, this can be assumed to have no effect on the relevance for sharing knowledge in the group. Sharing knowledge may be important when group members want to achieve group goals, but also when group members want to learn from each other, as is the case in the Online community. As a result I expected the KSSI to be relevant in this context as well.

As a participative researcher I had gained knowledge of using the collaborative platform myself and I had an impression of the type and amount of knowledge and information that was shared. Finally, I could easily gain access to individual group members.

8.7 Results from the interviews

On the basis of the interviews several conclusions can be drawn. Some conclusions can be used to improve the KSSI instrument. Other conclusions contribute to general knowledge on using a collaborative platform for sharing knowledge. The conclusions and implications are provided below.

8.7.1 Implications for the KSSI

Clear instructions

Most community members were member of several groups and used several applications in their work. For that reason they appreciated clear information on the purpose of this questionnaire. What group and what application should be kept in mind while answering the questions? This type of information is added to the instructions of filling out the questionnaire.

<u>*Less complex structure for filling out questions*</u>

In order to be able to gain insight into competing applications and into preferences for using specific applications for certain knowledge sharing activities, in one question several collaborative applications were addressed. As a result one question, actually consists of 5 questions. See for example item 1 of the instrument:

	Give for every single ICT tool a score from 1-5 or 0	collaborat platform	Intranet	Internet	telephone	e-mail
1.a	To what extent does the tool support finding information on the topic your group is working on?					
1.b	To what extent do you think the tool needs improvements in this respect?					

Here, one answer is expected for each application listed. Respondents had to fill out a number ranging from 1 – 5 (indicating 'not at all' to 'very much') in all five cells. This set-up appeared to be too complex and led to many questions. In addition, the second question was not always relevant: respondents could not think of any relevant improvement related to an application such as 'telephone'. As a result, in the next version of the KSSI these types of questions are now limited to the collaborative application under evaluation. The new question reads as follows:

	not at all	some, a bit	neutral	much	very much
To what extent does the tool support finding information on the topic your group is working on?					
To what extent do you think the tool needs improvements in this respect?					

In addition the questionnaire assesses the general frequency of use of other tools available to group members using the following item:

How often do you use the following tools?	daily	2-3 times a week	weekly	monthly	never	not available
'Collaborative application'	5 □	4 □	3 □	2 □	1 □	0 □
E-mail	5 □	4 □	3 □	2 □	1 □	0 □
Telephone	5 □	4 □	3 □	2 □	1 □	0 □

The First Scan should reveal which tools need to be assessed here. This adaptation not only simplifies the format for the questions, but also shortens the questionnaire. This solves another general comment as well: filling out the questionnaire took too much time.

Adapted use of Visibility

The questions in the category 'Visibility the group' were not clear. Questions were asked such as: 'Visible to whom?' This question was originally developed on the basis of the assumption that groups operate in the context of a larger organisation facilitating several groups. However, the Online Community did not function within such a context of a larger organisation. Moreover, the group was not open for people outside the group. As a consequence the Online Community did not need to be visible for people outside the group. This question should be adapted or left out in case group visibility is not relevant. This comment is added to the questionnaire.

Team versus community

In the opinion of the respondents some questions appeared to be more community questions and other more team questions. For example, the question about 'related projects' was perceived to be a typical (project)team question. Just like it was concluded in relation to the First Scan, this difference should be noted and team questions left out in case the group is more like a community and vice versa. This instruction is added to the KSSI.

Share your knowledge

It appeared that in the question: '*To what extent were you motivated to share your knowledge'* the word 'knowledge' kind of impressed some respondents. Reading this question they wondered whether what they had shared was really 'Knowledge', or just information, or some individual reflections etcetera. Some respondents doubted whether they could provide 'real knowledge' on the topic of the group. They preferred a formulation such as '*To what extent were you motivated to share your thoughts, ideas, and knowledge with your group*.' The question is adapted in line with this suggestion.

8.7.2 Other findings

Creative use of tools

Answers to the question "*To what extent did the application support you in finding experts*" indicated that the application was used in a creative manner. Respondents explained for example that they not only used the provided 'yellow pages' but also the source of documents, e.g., the name of the author, to identify experts. This is a good example of the type of support of an application not being related to the availability of specific features.

However, if 'finding experts' is considered an important knowledge process, the evaluator might suggest to add a feature that enables finding experts more easily (e.g., 'yellow pages').

Group versus groupware application

Respondents found it hard to make a distinction between the group and groupware application. As all group activities were performed via the application, the groupware application almost became the group. Responses to questions about the groupware application also included reactions that only related to the group, or its members. For example, one open question was: "What do you think of the groupware application?" One respondent explicitly said:

> *"My opinion about the application is coloured by my opinion about the group. I am enthusiastic about the group and thus about the application." OC3*

This quote illustrates that feelings about the group affect feelings about the application. It increases the relevance of a feedback session in which different stakeholders discuss the evaluation outcomes.

Usability versus content

Another distinction that was hardly made by respondents was the difference between usability of the application and the quality of the content provided by the application. Questions about the look and feel of the platform gained the following reactions for example:

> *"Nice that photos of group members were provided, it enables you to get to acquainted with each other." OC4*

> *"The application provided a good structure, but it was used chaotically." OC5*

These quotes illustrate that it is hard to make a strict distinction between these two aspects. The application may for example provide a convenient structure, but if this structure is not applied consequently by its users, information still cannot be found. The KSSI should assess the perceived support of knowledge sharing. Both aspects might decrease the perceived support and are therefore relevant. However, application of the E-MAGINE evaluation approach should also result in directions for improvement. It is therefore relevant to identify the reason behind low perceived support. For that reason the KSSI includes open questions that ask for more comments in case the respondent has the opinion that the quality of support is low.

<u>*Facilitation of spontaneous interaction between group members*</u>

One discussion folder was presented as the 'Pub'. The intention of applying this metaphor was to initiate spontaneous online discussions, as if participants 'literally just enter the virtual space and start interacting'. However, from the interviews it became clear that group members did not just enter and participate. They read all new contributions since the last time they had logged in, before adding a message themselves. As a result, if they had scheduled one hour to participate and many new contributions were added, they sometimes only had time for reading. This type of use leads to a less dynamic platform than was originally intended by its initiators.

A possible solution for this problem is presented in Preece (2000, p. 92) and referred to as Chat Circles. The so-called Chat Circles (text circles depicting contributions of people being on-line) move over the screen and remain only visible for a limited period of time, giving the collaborative space a more dynamic character.

<u>*Meeting face-to-face*</u>

In the literature it is often suggested to organise a face-to-face meeting before a merely virtual group starts collaborating. McDermott (2000) for example states that "Virtual teams need to build a relationship, often through face-to-face meetings, before they can effectively collaborate electronically" (p. 22). In this group, however, opinions differed on the relevance of such a meeting. Some respondents thought it was easier to participate just starting from behind your own desk.

> *(...) "Yes, you are feeling safely behind your own computer and, then I thought, even if I ask a stupid question, they do not see me anyway" OC6*

The group topic was new to this group member and in this way he could more or less anonymously find his way and ask 'stupid' questions. Other group members however, would have preferred to have a group meeting in advance. They thought it would have influenced the group interaction processes in a positive manner.

8.8 Final Profile

In Step 5 the Final Profile for the setting under evaluation is constructed based on the outcomes of steps 1 to 4. Not only the outcomes of the specific evaluation instruments are presented in the Final Profile, but also (first) answers to the evaluation questions specified in Step 3 (at least the questions that were assessed in evaluation Step 4). The Final Profile is input for the Focus Group session in Step 6.

8.9 Focus Group

The last step in the E-MAGINE evaluation approach is a Focus Group session. The meeting is applied to verify the results of evaluation and to develop of a plan of action for improving the situation. In order to achieve this goal it is important that the Focus Group consists of different representatives of groups of users and other stakeholders of the groupware application. This enables creating compliance for the evaluation outcomes. In Appendix VII an agenda for such a meeting is suggested.

8.10 Conclusions

In this chapter the development of the KSSI was presented. The KSSI evaluates the extent of knowledge sharing support of a groupware application. It is developed on the basis of insights developed in this thesis. It consists of an on-line questionnaire format with group members as respondents.

In the first test of the KSSI group members were confronted with the KSSI and asked to fill it out while commenting it. This exercise gave insight into its face-validity and relevance of questions. It appeared that the first version of the KSSI was considered too complex; questions needed to be simplified and the KSSI needed to be shortened. The outcomes of this test were used to improve the KSSI. In other interviews, with other group members of the same group, more background information on the group and the collaborative application was found. These results were used to gain further understanding of these concepts and to generate an improved version of the KSSI questionnaire.

The interviews also revealed that some users have problems in making a distinction between features of the technology and the content of the system, including contributions of other users. The same holds for being be critical in evaluating an application, if users have 'nice experiences' participating in the group, they tend to be less critical and vice versa. E-MAGINE should deal with these challenges when applying participative evaluation.

In the following chapter the entire evaluation approach, including the two evaluation instruments First Scan and KSSI, are applied in an in-depth case study.

Research Phase III:

Reflection and Conclusion

9

Application of E-MAGINE

9.1 Introduction

This chapter presents a first complete application of E-MAGINE in the following case study. The case study presents the application of the approach at the !Effective organisation. E-MAGINE is applied to evaluate a groupware application in use by a dispersed knowledge group working for this organisation.

To test the E-MAGINE evaluation approach all its steps were applied in this case study, including the application of the two instruments First Scan and KSSI. The last step 'Focus Group' was not only applied as intended in the evaluation approach – to discuss the relevance of the findings and directions for improvements for the setting – but also to receive general feedback on the process and outcomes of the evaluation. In the evaluation process I fulfilled the role of the evaluator.

In the next sections the application of E-MAGINE is discussed step by step. This chapter reports on the process of each evaluation step and the main evaluation outcomes. In addition a reflection on each evaluation step is included. Detailed findings that relate to the quality of support of the groupware application (the evaluation focus of E-MAGINE) are only presented in this chapter in case these are relevant for reflecting on the quality of E-MAGINE. All evaluation outcomes are presented in Appendix VIII: 'E-MAGINE applied at !Effective'. First the organisation and the groupware application are introduced.

9.2 E-MAGINE applied at !Effective

9.2.1 Organisation

!Effective focuses on the development of innovative concepts for e-business and mobile-commerce related to stock broking. These concepts are the foundation for the products of !Effective. !Effective develops software solutions that support banks and other financial organisations in communicating faster and more easily with their customers. It develops these solutions for example by integrating internet, telephone and mobile devices.

The organisation is relatively small; at the moment of study it has around 25 employees. However, in the Netherlands !Effective has a market share of fifty percent. Since 2001 !Effective has become part of Ordina, a large consultancy organisation focusing on business and information technology related issues.

The products of !Effective, software solutions for the financial market, are developed in project groups. The constellation of these groups depends on the type of project at hand.

However, project groups always consist of employees of !Effective, mostly completed with employees of the customer. In some cases employees of Ordina or free-lancers are added to the project groups as well.

The project groups always are dispersed, with some project members working at the customer's place and others at !Effective. The groups further are knowledge intensive: they have to incorporate knowledge of the customer organisation into the new software solution. That is the main reason for project groups consisting of a combination of employees of !Effective and employees of the customer organisation. Together they are responsible for combining knowledge about new technologies and software development with knowledge of the customer organisation.

A software development project consists of several phases. In each of these phases a different number of people co-operates in the project. Project groups start small with a few software analysts. After the software analysts have determined the criteria for the software programme and developed the software architecture, software engineers join the group. These software engineers develop the application. In the subsequent phase, software testers complete the project group. They test the application and inform the software engineers in case it does not meet its requirements (yet). After implementation of the software solution the group is dissolved. Only a few people remain responsible for maintaining the software and stay in contact with the customer.

9.2.2 Groupware application

At the moment of study !Effective has recently applied JIRA as a tool to support the co-ordination of large software development projects in the organisation. JIRA supports tasks such as software development, engineering and testing activities, and software maintenance. However, it is applied most intensively in the software development phase.

JIRA is a so-called issue management system; the application supports software development by supporting the organisation of 'issue workflows'. Software analysts specify the software programme in to be developed issues. Each issue is submitted to JIRA and the system supports keeping track on these issues. Software engineers transcribe these issues into software code. While working on the software the engineer documents its progress in JIRA and closes his contribution when finished. Subsequently, testers test the software code. If that specific part of the programme meets its requirements the issue is marked as solved. Otherwise it is 'returned' to one of the software engineers. In that case the test results are used to direct improvements in the software. This iterative process lasts until the software programme is completed. After the application is implemented at the customer organisation, JIRA is only used to support maintenance.

JIRA also supplies features to search the lists of issues. It further supplies a notification feature. When this feature is activated the user receives an alert in case a specific issue is changed or solved.

JIRA is a technology platform that supports project groups in !Effective to collaborate. As such it falls in the category of groupware.

9.2.3 Research approach

The Management Team of !Effective is interested in evaluating JIRA, it is especially interested in identifying improvements for this application. Secondly, JIRA is a tool which supports collaboration processes in which several aspects of knowledge sharing play a role. Therefore this organisation and this tool is suitable for a case study aiming to test the E-MAGINE evaluation approach.

However, the main purpose of this case study is to evaluate the qualities of E-MAGINE. The case study should identify whether E-MAGINE fulfils its goal and meets its requirements. Does E-MAGINE support a dispersed knowledge group to assess the usefulness of a groupware application for sharing knowledge? And does it enable the group to decide on improvements or alternatives? (See also section 1.1, Research objectives.) If possible, improvements for the evaluation method should be identified. Therefore, each evaluation step is reflected on in this case study.

9.3 The case study: 6 evaluation steps

The first contact for this case study was established with one of the software analysts working for !Effective. This analyst knew the organisation well, as he had been working for !Effective for more than four years. In these four years the analyst had collaborated in several projects. First, he fulfilled the function of software developer and in a later phase he became software analyst. In this case study this analyst (the contact person) guided the evaluation process on behalf of !Effective.

The E-MAGINE evaluation strategy is presented in Table 9-1, instructions for each evaluation step can be found in Appendix VII: 'E-MAGINE: An Evaluation Method to Assess Groupware in Use'. This Appendix presents the final version of E-MAGINE. (Additions that are based on the findings of this case study are in *italic*; these were not available in advance.)

Table 9-1 Steps in E-MAGINE

		What	Whom	Result
Phase 1	**Step 1**	Inventory Meeting	Client and Evaluator	Evaluation plan
	Step 2	First Scan Interview	Evaluator and Group leader	First Level Profile
	Step 3	Implications of First Level Profile	Evaluator and Group leader/Client	Choice of Evaluation Instruments
Phase 2	**Step 4**	Application of Specific Evaluation instruments	Evaluator and Group members	Evaluation data
	Step 5	Data analysis and Interpretation	Evaluator	Final Profile
	Step 6	Focus Group	Evaluator, Group members, and Client	Finished Evaluation

9.3.1 Step 1: Inventory Meeting

Evaluation process and results – Step 1 Inventory Meeting

The first evaluation step, the Inventory Meeting, consisted of an interview with the contact person. The interview was used to gain knowledge of the project teams working for !Effective and of the JIRA application and its functionalities. The respondent explained in more detail how JIRA supported the development of software applications. He illustrated that JIRA as an issue management system appeared to function relatively well. Project groups supported with this application had successful outcomes. He added that !Effective nevertheless was interested in evaluating the use of JIRA. The organisation was especially interested in the possible need for features that support interaction processes including knowledge sharing. The respondent explained that the support of JIRA focused mainly on organising software issues and not so much on supporting group interaction processes such as knowledge sharing and co-operation. However, this main support function of JIRA, organising software issues, enabled users to interact and share knowledge through use of the tool. Project members used the tool for example to discuss software issues: how to solve them? These types of interactions could be considered more or less creative uses of the tool: using JIRA for interaction and knowledge sharing was originally not intended by its developers. !Effective was interested in exploring these types of uses. The respondent concluded that !Effective was interested to find out whether it would be worth-while to extend JIRA in order to better support interaction and knowledge sharing processes.

A last subject in the meeting was the evaluation process. We agreed on an evaluation process as E-MAGINE prescribes it, with one of their recently finished project groups' use of

JIRA as object of evaluation. The evaluation process would consist of an interview with the project leader (Step 2 of E-MAGINE: First Scan Interview), a survey sent out to the group members (Step 4 of E-MAGINE: the KSSI, maybe combined with other surveys) and a focus group session with some group members (Step 6 of E-MAGINE: Focus Group). The selected project group will function as an example of how the collaborative platform is perceived and used in general at !Effective. It was assumed that improvements for this specific group hold for other project groups in the organisation as well.

This first meeting lasted 1.5 hours and provided enough information for a rough description of the organisation, the groups and the facilitating application.

The Inventory Meeting resulted in increased insight into the evaluation goals of the organisation, into the software application and into the project groups using it. The meeting further resulted into a more detailed evaluation plan. The project group that was selected for evaluation had many similarities with other groups working for !Effective. It existed for example for almost one year and this was common for project groups at !Effective. The group was however relatively large for !Effective. The organisation has around 25 employees and this group consisted of 22 project members. Still the organisation suggested to select this group as future project groups were expected to be of similar size. Software development projects increased in complexity, leading to a larger size of project teams.

Reflection on Step 1 and implications for E-MAGINE

The results of the Inventory Meeting are in line with its objectives. However, the current version of E-MAGINE is developed to evaluate one setting: one group provided with one groupware application. At !Effective E-MAGINE is applied to evaluate the use of a collaborative application provided to all project groups in the organisation, assuming that one project group is representative for other project groups in the organisation. Currently E-MAGINE does not provide directions to decide on the representativeness of groups in organisations. Such instructions may increase the quality of the evaluation method. Organisations, especially large ones, are not likely to be willing to assess all of the groups that are provided with a specific groupware application. This is not cost-effective. So in these organisations it is necessary to select representative groups for evaluation. This additional instruction for E-MAGINE will be added to this first evaluation step.

No other implications leading to changes of the evaluation approach are identified in this evaluation step.

9.3.2 Step 2: First Scan Interview

Evaluation process and results – Step 2 First Scan Interview

The project leader of the selected group at !Effective was willing to co-operate in a First Scan Interview. The interview started with a short introduction of the researcher and of the goal of the interview. Before starting with the interview the respondent was provided with a copy of the First Scan questionnaire. This version enabled him to keep track of the questions and to scan optional answers. As the interviewer, I also had a copy of the questionnaire and used it to fill in the answers of the respondent and add my own comments if applicable.

The respondent had a good overview of all kinds of project and team related issues and of the tool JIRA. He could answer almost all questions of the First Scan. In general the respondent was positive about the level of support by JIRA, even more, he was very enthusiastic. He only had a few complaints and suggestions for improvement. For example, he explained that remote access sometimes was a problem using JIRA and that all project groups at !Effective he knew of had encountered this problem.

There was however one uncertainty during the interview. In first instance the respondent found it hard to answer questions about 'the group'. He explained that project groups at !Effective are very fluid. Because of the different roles and activities applied in software development projects, groups change during a project. For example their sizes fluctuate: e.g. software engineers do not join from the start, they join after the information analysts have specified the criteria for the software programme. Only from that moment the software engineers have to be granted access to JIRA. In that stage of the project, a project group consists of several subgroups: software engineers, software testers and software maintainers. This held for his project group as well. He wondered what 'group' was relevant for answering the questions of the First Scan. He was instructed to apply the group as a whole including all its stages where possible (e.g. a question about the life cycle of the group). He was instructed to apply the stage in which the number of group members was the largest if the former was not applicable (e.g. a question about the number of active group members). For, JIRA is applied most heavily in that stage.

The interview lasted as long as it is planned in E-MAGINE, around 1.5 hours, the same length as the Inventory Meeting. So this element of the instructions can be maintained

Based on the First Scan Interview a First Level Profile was generated by the evaluator. Generating this Profile did not cost much time, around 1.5 hours. In fact, the First Level

Profile consists of the filled in questions of the First Scan completed with comments from the interviewer. In addition the evaluator wrote a short summary of the setting and identified the Evaluation Issues according to the instructions. (Instructions for identification of these issues can be found in the instructional information of E-MAGINE, which is provided in Appendix VII.) The six Evaluation Issues identified are presented in Textbox 9-1, the First Level Profile can be found in Appendix VI.

1) The group appears to have three different types of members with different tasks and roles, they form three subgroups.
2) The group leader was not sure how often group members used each of the tools available to them.
3) Remote access is limited from the customer's place; this functions as a hindrance for some group members.
4) The quality of content in JIRA highly depends on how the group members use the tool, not on characteristics of the application.
5) Most discussions and interactions are linked to so-called software issues, this may result in issues with long cluttered discussion threads related to it.
6) Online awareness might be an interesting optional feature.

Textbox 9-1 Evaluation Issues identified in evaluation Step 2

Evaluation Step 2 resulted in a First Level Profile of the setting, including six Evaluation Issues. Purpose 2, 3 and 4 of the First Scan Interview (see Appendix VII) were achieved. However, purpose 1 – insight into usage details – could not completely be achieved, since the respondent could not provide detailed information on usage of JIRA. However, it became clear that JIRA is used extensively. It is therefore useful to continue with Phase 2 of the evaluation approach and consult users on the quality of use of JIRA.

Reflection on Step 2 and implications for E-MAGINE

The First Scan appeared to be suitable for generating a First Level Profile of group and collaborative application. Not all details on use of the application could be provided by the respondent. Still, enough information was acquired to inform on purpose 1 of the First Scan. With that the First Scan fulfilled its evaluation purposes.

From the Inventory Meeting it was already known that project groups at !Effective highly fluctuate in size. As a consequence the respondent needed more instructions in answering questions about the group: he needed to know what stage of the group functioned as input for the questions. This will be added as instructional information to the current version of the First Scan.

From the interview it also became clear that project groups at !Effective not only change in size; group dynamics and usage of the application change as well. This is an important aspect in considering the match between group and application, it entails specific requirements for the supporting application. The First Scan appeared to be suitable to identify these specific matching requirements.

The respondent appeared to be very enthusiastic about the level of support provided by JIRA, as a consequence he may overlook shortcomings of JIRA. However, (part of) the First Scan outcomes will be verified by asking other group members in the next phase of evaluation.

The instructions for the specification of Evaluation Issues were straight forward. As a consequence, no further implications leading to changes of the First Scan interview were identified in this evaluation step.

9.3.3 Step 3: Specification of the Implications of the First Level Profile

Evaluation process and result – Step 3

1) Do group members of different subgroups have different requirements for the tool?
2) What is the frequency of use of tools available?
3) Does limited remote access function as a hindrance for group members?
4) Is training in using JIRA needed to improve the quality of the content of JIRA?
5) Do the threaded discussions in JIRA provide sufficiently useful interaction support or is more sophisticated interaction support needed?
6) Is online awareness an interesting optional feature?

Textbox 9-2 Evaluation Questions specified in evaluation Step 3

In this step 'Evaluation Questions' are specified that need to be assessed in the Second Phase of E-MAGINE. Each of the Evaluation Issues identified leads to one or more Evaluation Questions. At !Effective six Evaluation Questions were identified, these are presented in texbox 9-2. The argumentation behind the specification of the questions is presented in Appendix VI.

Reflection on Step 3 and implications for E-MAGINE

The deduction of Evaluation Questions that *directly* relate to the lack of Success Factors appeared to be relatively easy and straightforward (Questions 1, 2, 3, and 6). This suggests that E-MAGINE provides sufficient directions for other evaluators to identify these Evaluation Questions as well. Evaluation Questions that *indirectly* relate to Success Factors however, in this case Questions 4 and 5, can only be identified by an evaluator who is familiar with the theory of the Success Factors underlying the First Scan. This requirement for the evaluator will be added to the instructions of E-MAGINE.

9.3.4 Step 4: Application of Specific Evaluation Instruments

Evaluation Process and Results – Step 4

In Phase 2 all kinds of group or technology factors might be assessed. The !Effective organisation was interested in improvements of JIRA, including improvements for its knowledge sharing support. This makes The Knowledge Sharing Support Instrument (KSSI) suitable for application in this study. The instrument assesses the quality of knowledge sharing support of a groupware tool.

In addition to the KSSI, the six Evaluation Questions resulting from the First Evaluation Phase should be assessed here. Some of the evaluation questions are covered by the items of the KSSI, or by combinations of these items. Other questions require adjustments of the KSSI. The assessment of Evaluation Questions 3 and 6 is however postponed to the Focus Group (Step 6 of E-MAGINE). It is expected that a discussion in the Focus Group is more insightful than addressing these questions in a survey. Both questions relate to the fact that remote access is limited at the customer's place. From the First Scan Interview it appeared that not all group members are aware of this and that the quality of remote access also depends on the type of customer. This makes it a complex issue to address in a questionnaire.

E-MAGINE prescribes that the KSSI is adapted as a consequence of the outcomes of the First Evaluation Phase. Adaptations are described in the appendix. The resulting KSSI version can be found in Appendix VI.

An online survey was used to collect the data. In total 22 people, all members of the project group under evaluation were invited to fill out the questionnaire. The invitation message explained the goal of the study. Respondents were further informed that answers to the survey would be treated confidentially: results would only be presented anonymously to !Effective.

In two weeks 12 respondents filled out the online questionnaire. Three other respondents asked for a 'paper version' of the survey, as they had no access to the Internet form their workstation. From the online respondents, 5 quitted at different levels in the survey. Upon inquiry it appeared that group members perceived it hard to fill out the questions about knowledge sharing support; they did not consider JIRA to be a knowledge sharing tool. In their opinion the questionnaire, or at least some of its items, was not suitable in this context. See for example the following quotes:

> *"JIRA is an issue tool. Not a knowledge or information tool (Resp. 3; first round respondent)."*

> *"In case you use the tool to share information and keep track of incidents, bugs etc. it works fine. In my opinion it is too limited to contain 'everything' (Resp. 7; second round respondent)"*

A second invitation was sent to group members who did not complete the survey (including non-respondents). In this invitation it was explicitly stated that the research was initiated to evaluate JIRA and possibly define new functionalities for the application. This new round increased response rate to 55%. However, again 3 respondents quitted half-way through the survey. The set-up of the survey did not enable identification of these respondents. It is therefore unclear whether the same respondents quitted halfway or new respondents (former non-respondents).

For handling of the data the incomplete responses were left out. Appendix VI provides an overview of the results of the survey. The data of the KSSI are analysed in Step 5 and not further discussed here.

Reflection on Step 4 and implications for E-MAGINE

It seemed that the current version of the KSSI is not so suitable for assessing whether a groupware application supports processes or functions that are not the main focus of support. Not even, when group members (unintentionally) have applied the groupware application to support these functions. Maybe this type of assessment needs more preparation: One could think of testing the KSSI with one of the group members in advance (and not only with group management). Or by asking/investigating more details on the types of uses of the groupware application, including the type and frequency of more creative uses. Lastly, more instructional information could be added to the KSSI. These suggestions will be added to the current version of E-MAGINE.

9.3.5 Step 5: Construction of the Final Profile

Evaluation Process – Step 5 Construction of the Final Profile

The Final Profile has to provide information on the quality of knowledge sharing support of JIRA. In order to construct the Final Profile first the data of the KSSI were analysed and combined with the results from the First Scan. The analysis thus also needs to inform on the Evaluation Questions that were identified as relevant to assess in Step 4.

In the interpretation of the outcomes of the KSSI especially low and high mean scores and scores with a large variance are taken into consideration. This is also explained in the instructions of E-MAGINE. Low or high mean scores (with low variance) indicate high agreement in the group on aspects of the setting; these may indicate relevant potential improvements. Mean scores with high variance indicate high disagreement in the group on aspects of the setting; these scores are relevant to discuss in the Focus Group. The KSSI data will also be used to answer Evaluation Questions 1, 2, 4 and 5. If applicable, follow-up evaluation questions are specified as input for the Focus group.

The outcomes of the KSSI are presented in Appendix VI. One section in this Appendix presents the raw data and another section presents the interpretations of the data. In the appendix the answers to the evaluation questions can also be found. However, Evaluation Question 3 and 6 are not discussed, as the assessment of these Questions was postponed to evaluation step 6.

Evaluation Question 1

1. Do group members of different subgroups have different requirements for the tool?

The First Scan revealed that the project group using JIRA consists of three subgroups. To answer the relating Evaluation Question the mean scores for the different subgroups need to be compared. The data of the KSSI were analysed to see whether these different groups had different requirements for the tool.

The number of respondents is too small to analyse the scores in three groups. However, some tendencies can be described when the data of the 12 respondents are divided into one group of software engineers (N=7) and one group ‘other’ (N=5). The ‘other’ respondents have in common that they all are from !Effective, while the software engineers on the other hand all, but one, are from other organisations.

Based on this analysis a first conclusion would be that these two subgroups do not have different requirements for JIRA. However, they differ in their opinion on the quality of support provided by JIRA for two knowledge sharing activities (gaining knowledge on the purpose of the group and JIRA being helpful for new-comers). The Focus Group now can be used to derive more details on these outcomes.

Input for Focus Group (1)
- What might be the reason for the different opinions of subgroups about the support of the tool in gaining knowledge on the purpose of the group?
- What might be the reason for the different opinions of subgroups about the importance of JIRA being helpful for new-comers?

Evaluation Question 2

2. What is the frequency of use of tools available?

One item of the KSSI assesses the frequency of use of several applications. Analysis of its outcomes did not lead to very surprising outcomes. E-mail and telephone are as often used as JIRA is: minimal 2-3 times a week, almost always daily. However, there is a large variance in the frequency of use of chat (M=3.00; s=2.00). As is stated in the introduction of this section a large variance in scores indicates large differences between group members. Here, it indicates a different interaction style of group members. It is interesting to discuss in the Focus Group how chat is used and to what extent more group members would like to use chat. This should provide information than can be used to decide on improvements and new features.

Input for Focus Group (2)
- Is chat an interesting feature for the groups using JIRA?
- Would it lead to a further dispersion between group members and is that acceptable for them?
- What is its relation to online awareness?

Evaluation Question 4

4. Is training in using JIRA needed to improve the quality of the content of JIRA?

Firstly, items on the quality of the content were analysed to answer this Evaluation Question. In all, the mean scores on the 5 content items were reasonably high (M=3.42 - 4.08 on a 1-5 scale (not at all-very much)). However, several remarks were made suggesting that the quality of the content depends to a large extent on who adds the information. These remarks were in line with the outcome of the First Phase of evaluation. Apparently not only the group leader, but also (some) group members think the quality of the content can be increased when group members would apply another strategy in using the system. One way to achieve this is to instruct group members. The Focus group session will be used to further address this issue.

Input for Focus Group (4)
- Is training in using JIRA a suitable way to improve the quality of its content?

<u>*Evaluation Question 5*</u>

5. Do the threaded discussions in JIRA provide sufficiently useful interaction support?

From the First Scan it appeared that JIRA is used to ask questions to group members, after which long threaded discussion may follow. The KSSI was applied to find out how many group members use these threaded discussions to ask questions and how they like it.

From the mean score on the item ‘necessity of improving support for asking questions’ it appeared that group members do not think improvements are needed (M=2.33; s=1.15). However, the standard order of items about ‘asking questions’ in the KSSI did not seem to be suitable for addressing the creative use of JIRA for asking questions. It appeared that the question was not specific enough. Respondents commented that features for asking questions were not available. These respondents are right; a specific feature is not available. The KSSI items assessing the quality of such a feature should have addressed creative uses of JIRA to ask questions. Line of argument behind the items was that the tool is applied to ask questions *although* it is not so suitable doing that. Actually, the intention was to assess the extent of ‘adapted tool use’. Analysis of the outcomes should have indicated how many group members apply JIRA in this way, although it is not specifically designed for it. This unclearness may have contributed as well to the large diversity in answers; group members may have interpreted the items differently. In all, the standard questions of the KSSI did not seem to be useful to assess creative use.

In all, from the answers to the items on ‘asking questions using JIRA’ it does not become clear whether the resulting long threads hinder working with issues. However, these threaded discussions are part of the content of JIRA. And from the items relating to the content of JIRA it appeared that some group members have the opinion that content could be more carefully added. Therefore it was decided to link the discussion in the Focus group on this issue, interaction support, to Evaluation Question 6, which addresses the quality of content.

In all, Evaluation Question 5 not really could be answered by the KSSI questionnaire. Improvements in interaction support did not seem to be necessary, however, group members complained about other group members inaccurately adding data. An interesting (seemingly?) contradiction which can be further explored in the Focus Group

Input for Focus Group (5):
- Ask for specification; how is JIRA used to ask questions?
- are threads under issues used to ask questions?
- Should JIRA be improved and made more suitable for interaction and asking questions, why and why not?
- If yes, what are possible solutions for interaction support?

Other results of the survey: Scores on 'improvement questions'

An interesting result from the KSSI survey concerns the scores on the seven 'improvement' questions'. The survey assesses for several aspects of JIRA 'To what extent does JIRA need improvements in this respect'? High scores on these questions suggest specific improvements for the tool. Two of these seven questions share the highest sore, a mean score of almost 3. These questions relate to the 'support of finding information' (M=2.92; s=0.81) and to 'finding information on related projects' (M=2.92; s=2.08). A mean score of 2.9 on a 5-point scale is not very high, suggesting improvements are not so much considered necessary. However, the variance in the scores on the last question is relatively large (s=2.08). This implies that opinions highly differ and a closer look indeed reveals that scores range from 1-5. This is enough reason to discuss this issue during the focus group session.

Input for Focus Group (7):
- Is it useful to improve 'finding information on related projects' via JIRA?

Other results of the survey: Directions for improvements suggested in comments

The following lists provide an overview of comments (quotes) in the KSSI not discussed so far. The comments and answers to open questions are clustered into three categories: 1) Search and filter options, 2) Functionalities, and 3) Usability. Comments in the categories are listed in the Appendix. In each category a concluding notion is derived that will be addressed in the Focus Group, these remarks are presented below:

Input for Focus Group (8)
- What search and filter options would be advisable for the tool JIRA?

Input for Focus Group (9):
- The functionalities suggested will all be discussed in the Focus group.

Input for Focus Group (10):
- The usability issues specified will all be discussed in the focus group

Other results of the survey: Are group members enthusiastic about JIRA?

For the evaluation of JIRA, the answer on item 27 of the KSSI is the most relevant: *'In all, to what extent are you satisfied with JIRA?'* The mean on this item is relatively high and variance is low (M=3.58; s=0.27) indicating that respondents are 'moderately' to 'much' satisfied with JIRA and that they highly agree on this total evaluating score.

Reflection on Step 5 and implications for E-MAGINE

From the analysis applied to answer evaluation question 1, it seemed useful to apply the KSSI to identify differences between subgroups. It further appeared that differences in opinion on the quality of the application do not always imply differences in requirements for the tool. This finding is in line with one of the assumptions in the development of the KSSI. By asking about the quality of an aspect of the tool and subsequently about the necessity to improve it, the evaluation of each aspect of a tool can lead to four evaluation outcomes:

- Bad quality, needs improvements (evaluation outcome: 'it is bad, make it better')
- Bad quality, no improvements needed (evaluation outcome: 'it is bad, but I do not need it)
- Good quality, needs improvements (evaluation outcome: 'it is not good enough')
- Good quality, no improvements needed (evaluation outcome: 'it is good enough')

Here, within one group, two evaluation outcomes were reality.

In this analysis differentiation between all relevant subgroups was not possible; the number of respondents per subgroup was not large enough. A lesson learned is that the analysis of differences between subgroups may result into interesting outcomes. Therefore it is relevant to ensure that the number of respondents per subgroup is large enough when applying the KSSI. This recommendation will be added to E-Magine and the KSSI specifically.

In the analysis applied to answer evaluation question 2, a large variance in the scores on tool use leads to input for the Focus Group. A very straightforward manner for formulating input for the Focus Group. In this case, the large variance not only indicates a difference in opinions on JIRA. It indicates a difference in tool use that may even lead to an undesirable reinforcement of the split up of the project team into different sub groups. This makes it even more relevant to pay attention to this outcome in the Focus Group. This example of an effect of differences in tool use on the dynamics of a group, will be added to the instructions for applying E-MAGINE.

From the analysis applied to answer evaluation question 4 it appeared that group members agree with the group leader that quality and consistency of the content depends largely on how users apply the system. However, the KSSI does not provide items yet on whether training users would improve the quality. This might be a useful addition for the KSSI, it is therefore added to the questionnaire.

In the analysis applied to answer evaluation question 5 it appears that the KSSI needs some amendments in order to asses 'adapted use' of an application. Instead of the item 'To what extent does the application (here: JIRA) support asking questions to group members?' the item 'To what extent are you able to use the application to ask questions to other group members' is added to the KSSI. This leaves aside whether the feature is available in the application. The item order is changed as well. The subsequent questions then will be 'How often do you use the application to ask questions to group members?'; 'How long does it (generally) take to receive an answer?' with the final question: 'To what extent do you think the application needs improvements for asking questions?'.

1. Do group members of different sub groups have different requirements for the tool?
What might be the reason for the different opinions of subgroups about the support of the tool in gaining knowledge on the purpose of the group?
What might be the reason for the different opinions of subgroups about the importance of JIRA being helpful for new-comers?

2. What is the frequency of use of tools available?
Is chat an interesting feature for the groups using JIRA?
Would it lead to a further dispersion between group members and is that acceptable for the group?
What is its relation to online awareness

3. Does limited remote access function as a hindrance for group members?

4. Is training in using JIRA a suitable way to improve the quality of its content?

5. Ask for specification; how is JIRA used to ask questions?
are threads under issues used to ask questions?
Should JIRA be improved and made more suitable for asking questions, why and why not?
What are possible solutions?

6. Is online awareness an interesting optional feature?

Textbox 9-3 Evaluation Questions and input for the Focus Group

In this study comments and answers to open questions appeared to be very useful as these directly indicate improvements for the application. The comments therefore were used to formulate input for the focus group as well. However, the number of respondents was limited in this study, implying that the number of comments was limited as well. When the number of respondents substantially increases other filter methods for these comments need to be applied.

In this step of the evaluation process the goal was a) determine whether group members agree with the group leader on the high quality of support of the application and b) address the Evaluation Questions resulting from Phase 1. The information generated by applying the KSSI appears to be suitable to answer both questions. It further appeared that especially answers to the open question and inserted comments provided very useful feedback for the Final Profile. Some comments even almost literally were the same as comments of the project leader, indicating that project members and project leader agree on certain issues.

Summarizing, the application of the KSSI provided a rich source of information on several relevant issues, including the evaluation questions. This information also resulted in formulating follow-up questions for the Focus group.

9.3.6 Step 6: Focus Group

Evaluation Process

The last step in the evaluation process is a focus group session with some group members. The intention of this focus group is to verify the results of the earlier applied evaluation instruments, to discuss possible contradicting requirements and to identify and prioritise improvements. In this case study, the session is also used to reflect on the evaluation outcomes. The discussion was structured according to the evaluation issues, and related questions identified in the previous steps of evaluation (see Textbox 9-3 for the Evaluation Issues and related Questions). See Appendix VII for the agenda of the meeting.

Evaluation issue 1

The three different group roles are confirmed in the group. The employee responsible for maintaining the application adds that the role of ‘maintenance’ might be added to the list of three roles. As a maintainer he has different aims as well.

It appeared that JIRA provides a feature that can be used to share information on the group topic. However this feature was never used. It further appeared that not all group members were aware of this feature. In addition, some group members had been working for confidential projects, where this type of information could not be shared. These seemed to be the reason for different opinions in the group about usefulness of finding information on the group. The feature might be used in the future for those groups not working on confidential projects.

Evaluation issue 2

It appeared that group members thought chat might be nice as new feature. However, they also expected that if chat was implemented, too much information would only be shared in a small sub group of the project group.

Evaluation issue 3

In the meeting it is confirmed that some of the group members working outside !Effective, do not have always access to the project environment. Most group members present do not see why this is a problem. However, these members usually work at the office of !Effective, and not at the customer's place, where this problem mostly occurs. As a consequence they do not experience related problems themselves.

The evaluator explained that differences in access to the application might have a so-called ingroup-outgroup effect. It appeared that not all group members had realised this. Group members present agree that if possible this problem should be solved. This implies that the customer needs to be informed and sometimes to be convinced to cooperate. Based on their experiences group members thought the problem was not only technical. For, they knew of cases, where colleagues could not be granted access, while access for software maintainers could be organised in a later phase.

Evaluation issue 4

The question about the quality of content confirmed that this quality indeed depends to a large extent depends on how the group members provide input. In the group discussion three possible solutions for this problem were identified. (These solutions are provided in the Appendix).

Evaluation issue 5

Group members present acknowledged that indeed JIRA is applied to ask questions to group members. And indeed, mostly the discussion threads related to the issues are applied for this aim. In some cases this results in long threads, where sometimes even the project leader interferes and stops the discussion.

It further appeared that group members present apply different manners to ask questions to other group members. Some frequently apply the telephone, others apply JIRA. From the discussion a distinction between two types of questions appears relevant: 1) Asking a question to a specific group member or 2) asking a question to a random group member. In the first case the most applicable manner is chosen, depending on the relation between the two group members at hand. Group members present agree that a feature supporting 'asking a question to the group' would be convenient for the last type of questions.

In the discussion of this evaluation issue group members present become more convinced that being online and having continuous access to the application makes a difference. For, the moment someone is not online, he can not be reached by other group members using JIRA.

Evaluation issue 6:

The discussion on evaluation issues 6 was combined with the discussion on evaluation issue 3.

Other evaluation issues

The other evaluation issues where discussed as well. This resulted in a few useful comments (these are listed in the Appendix).

What problems in using JIRA were missed?

A last question of the evaluator was whether group members had missed some evaluation issues. Issues mentioned are listed in the Appendix. In all, one issues was missed that could have been inditifed in the first Scan interview. However, not all group members group members acknowledge this problem existed. The group leader might not have been aware of the issue either.

Reflection in Focus Group

In order to inform this case study one extra subject was addressed during the Focus Group. How did participants perceive this evaluation process, including this focus group session?

The Group leader was interested in the role of the First Scan interview in the evaluation process. How does the evaluation process prevent that the opinion of the project leader (respondent of First Scan Interview) is dominant?
The evaluator explained that several steps in the evaluation process are executed in such a way that this is prevented as far as possible.

- regular consultation of contact person
- items in KSSI verifying (some) results of the First Scan
- open questions in KSSI
- discussion in Focus Group

Other group members commented that the evaluation outcomes were not surprisingly new. However, topics discussed in this session concerned issues in using JIRA that are relevant, but were not discussed in this organisation till this moment. This gave some insight into the quality of support of JIRA.

Reflection and implications for E-MAGINE

During the Focus Group session group members usually working at the customer's place appeared to be far in the minority. This resulted in an unbalanced and not well informed discussion about the effect of not having constant access to JIRA. The relevance of a balanced representation of subgroups is therefore added to the instructions for applying E-MAGINE.

An unexpected process during the Focus Group was the exchange about how JIRA actually is applied. Group members were for example surprised about other group members using specific features. Or, about creative uses that were applied. Some group members even decided to apply JIRA differently, more in line with other uses they heard of.

This Focus Group session gives no other reason for changing (the instructions for) E-MAGINE.

9.4 Discussion and Conclusion

In this chapter E-MAGINE was applied at the !Effective organisation in order to evaluate its qualities. The case study should identify whether E-MAGINE fulfils its goal and meets its requirements. Does E-MAGINE support a dispersed knowledge group to assess the usefulness of a groupware application for sharing knowledge? And does it enable the group to decide on improvements or alternatives? In addition, improvements for the evaluation method should be identified if possible.

The organisation in which E-MAGINE was applied was interested in the identification of possible improvements to the collaborative application it provides to its groups. The setting under evaluation was reasonably successful, still E-MAGINE facilitated the identification of potential improvements. These issues were related to team aspects as well as to application aspects and to a relation between these two. The findings were used as input for a concluding Focus Group, evaluation step 6. At the end of the Focus Group session, group members present could return what findings they missed as an outcome of the evaluation process. Only three aspects were mentioned and these aspects were relatively small. Although the results of the evaluation did not really surprise group members or facilitators of the organisation, they thought it was relevant to have these findings explicit now. An indication that E-MAGINE indeed fulfils its goal: It supported the group under study to assess their groupware application and specify suggestions for improvement for their setting.

The application of E-MAGINE generated new insights regarding its usefulness. Several lessons were learned and implications for the evaluation method were identified. These implications are added to Appendix VII, where the complete method is described. Implications are for example some desirable competencies of the evaluator, extra instructions accompanying the KSSI, and extra suggestions for organising the Focus Group.

Insights related to the methodical requirements for E-MAGINE are discussed in Chapter 10.

10

Discussion and Conclusions

10.1 Introduction

The aim of this research project was to develop an evaluation approach that supports dispersed knowledge groups in the assessment of the usefulness of a groupware application for sharing knowledge. The approach should enable dispersed groups to evaluate their current use of a groupware application with the support of a usability expert and decide on adjustments or alternatives. As a result the E-MAGINE evaluation approach was developed. In Chapter 3 the goal of developing the evaluation approach is specified:

> E-MAGINE should establish to what extent a groupware application supports a dispersed knowledge group in sharing knowledge within the group and between the group and the organisation. In addition, E-MAGINE should identify barriers for optimal support and suggest improvements.

In this chapter I reflect on the qualities of the evaluation approach and on the process of its development.

10.2 Requirements for E-MAGINE

In order to achieve its evaluation outcomes six design requirements were specified for the E-MAGINE evaluation approach. Three initial design requirements were derived from the project goal, requirement 1, 2 and 6. The other three design requirements were based on the outcomes of the case studies described in Chapter 2 and literature discussed in Chapter 3 and Chapter 4. All requirements are re-listed in Textbox 10-1.

In the sections below for each requirement it is assessed whether and how E-MAGINE meets the requirement. Further a reflection on the usefulness of the design requirement in the development of E-MAGINE is presented. For the newly added requirements it is specified why the design requirement was added and how useful the requirement was in developing E-MAGINE. If applicable, it is discussed to what extent E-MAGINE would be useful outside the context prescribed by the requirement.

10.2.1 Design requirement 1: Concentrate on the support of dispersed knowledge groups

The first design requirement specifies that E-MAGINE should focus on groupware support for *dispersed knowledge groups*. In the discussion on group dynamics it is explained that groupness is a dimension on which three main categories can be discerned: collections, communities and teams. In the context of this research project collections were excluded. In the case studies the other two types, communities and (project) teams, were studied to inform development of the method. E-MAGINE was also tested in these types of groups: its main instruments were applied in a community (First Scan in Chapter 7 and KSSI in Chapter 8) and the complete evaluation method was applied in a team (Chapter 9). Both case studies indicated that the evaluation method is useful for these two types of dispersed knowledge groups. It may however also be applicable for types that resemble collections, especially the First Phase of evaluation. This is explained in the next section.

E-MAGINE should:
1) concentrate on the support of dispersed knowledge groups;
2) concentrate on groupware in use, e.g. apply operational evaluation;
3) evaluate the fit between application and context
   To evaluate the fit between application and context the evaluation approach should evaluate (1) the application, (2) the group and its context, and (3) the fit between these two.
4) apply the concept of Quality in Use;
   The concept of Quality in Use implies that the method should (1) estimate the extent to which software quality characteristics are met by the collaborative application (see Textbox 4-1) and (2) consult the user on the quality of the collaborative application in use.
5) apply participative evaluation;
   Participative evaluation is applied in order to (1) gain insight into details of the context of use; (2) be able to identify potential contradicting requirements by consulting different stakeholders and (3) create compliance for the evaluation outcomes.
6) be practical (cost-effective).

Textbox 10-1 Design requirements for E-MAGINE

The level of knowledge sharing support in dispersed groups is assessed in two steps. First, the First Scan identifies, amongst others, whether the groupware application is used and to what extent. And it assesses whether the basic structures of the groupware application fit the main group characteristics. In the Second Phase of evaluation the KSSI assesses the *quality of knowledge sharing support.* Since in Phase 1 general characteristics of the group are identified, such as size, life cycle, type of tasks and the presence of subgroups, this Phase 1 might not only be suitable for dispersed *knowledge* groups, but for other types of dispersed groups as well.

10.2.2 Design requirement 2: Concentrate on groupware in use

The concentration on groupware *in use* (instead of groupware under development) was an initial design requirement, presented in the first chapter of this thesis. As a consequence, E-MAGINE has this focus and as such contributes to existing formative evaluation methods.

In Chapter 2 dispersed knowledge groups were discussed which were provided with groupware, but did not use the groupware. Three reasons appeared to be the cause of this non-use:

- factors related to the application;
  e.g. applications incompatible with other applications used in the organisation
- factors related to the group and its context;
  e.g. group members not motivated to interact with other group members
- factors related to the fit between application and its context-of-use;
  e.g. an application only suitable for central storage of standardised documents and a community focusing on sharing experiences.

These reasons for non-use appeared to be quite relevant in the evaluation, but they cannot be identified when analysing groupware in-the-making. The fact that E-MAGINE now takes these group and contextual factors into account increases its practical use. If dispersed groups, or their facilitators, start to investigate the reasons for low or no use of their groupware application using E-MAGINE, the identification of failing group or context related factors may also be the outcome of the evaluation process. In other words, the results of evaluation may indicate that adjustments need to be made to the group and its context instead of to the application. This increases the usefulness of the evaluation method.

Still it is interesting to address the question: ‘To what extent would E-MAGINE be useful for the evaluation of groupware applications that are not in use (yet)?’ The answer is: ‘Only to some extent.’ Some items assess aspects of the group and its context in order to evaluate the fit of the application to this group and its context-of-use. These items may be applied to compare *potential* facilitating groupware applications. The application that best fits the ‘context-of-use to be’ can be expected to be most successful as a facilitating groupware application. In other words, if aspects of the setting in which the groupware application is to be used are known, ‘Matching Success Factors’ underlying the First Scan that are related to these aspects, can be used to evaluate a potential tool. In addition, the Success Factors specified under ‘Groupness’ can be used by managers and group leaders to increase the level of ‘groupness’ of a group. And, Success Factors under Adequate introduction, Adaptation and Development, can be used to enlarge the effectiveness of the introduction of a groupware application into a group. However these two groups of Success Factors cannot are not directly related to groupware applications and cannot support a selection between groupware them. E-MAGINE is not suitable for comparing two applications or evaluating one application in case no information on the context of use is available (yet). For these settings the evaluation method focuses too much on aspects of ‘usage’ and ‘fit to the context-of-use’.

10.2.3 Requirement 3: Evaluate the fit between application and context

From the case studies and literature, it appeared that a collaborative application in itself cannot be evaluated as being ‘good’ or ‘bad’. The quality of the application, especially of an application in use, should be assessed in relation to the group (and its context) it aims to support. For that reason design requirement 3 was specified: E-MAGINE should assess the fit between the groupware application and its context-of-use (the group and its context). This implies a fit assessment for the evaluation approach and a broad focus. In this section more information is provided on these two aspects.

Assessment of fit

The assessment of quality of fit is implemented in the evaluation approach at two levels and in two manners. In the First Phase of E-MAGINE the evaluator determines whether there is a fit between groupware application and context-of-use based on an analysis of characteristics of both. Actually, here, an expert judgement of fit is applied on general aspects of fit in the setting. The applied perspective on fit is that the application should match the group and its context of use (and not vice versa or both adapting to each other). In the Second Phase of evaluation, users and other stakeholders are consulted on their perception of fit. Here a user judgement of fit is applied. In this phase the fit assessment is more specific and focuses on the fit of the application to knowledge sharing activities of the group.

Finally, both approaches of fit assessment are combined in the last evaluation step. Here the evaluator presents his perspective on the fit of the application to the group. He also presents the results of the KSSI, results that represent the perspective of the users. In the discussion these two perspectives are combined and confronted.

The combination of the two fit assessments is a strength of the evaluation approach. It compensates for the disadvantages of both types of fit assessment. Experts for example may overlook important contextual details in their evaluation. Whereas users may for example be unable to see that ICT support can be more efficiently applied, because they are unaware of new technology developments or other ways of working that might be more efficient (Davern, 1996). At !Effective the expert perspective provided the insight that the use of chat by a subgroup of users may result in subgroups drawing apart. In the same case study it appeared that not all users were aware of the potential of all features of their new application.

Broad focus

The E-MAGINE evaluation approach goes beyond the more classic existing usability testing and usability inspection methods presented in Chapter 4. In that chapter, four trends were identified leading to a more broadened and extended focus of software (usability) evaluation: Not only the application, but also its context of use needs to be evaluated. And, not only evaluation experts should be involved in the evaluation process, but also the (intended) users of the system. However, no existing evaluation method could be identified that provided actual directions in applying a more broadened groupware evaluation approach. E-MAGINE now provides these directions. Applying these directions, it became clear (see Chapter 9) that the approach is able to assess and identify aspects of the group and aspects of the application that may be improved. It identified for example the drawback of not all group members being continuously online and the drawback of the application not always enforcing specific formats for adding information.

10.2.4 Requirement 4: Apply the concept of Quality in Use

In Chapter 4 the concept of Quality in Use is introduced and added as an object and process requirement for E-MAGINE. Quality in Use is a concept developed to highlight that the quality of an application should be measured in terms of the *result of using* the software, rather than properties of the software itself (Bevan, 1999, p. 5). The concept further implies that *the user* should evaluate the application. The concept of Quality in Use implies that two evaluation activities should be applied in the evaluation method: it should (1) estimate the extent to which software quality characteristics are met by the groupware application (see Textbox 4-1 for an overview of these software requirements) and (2) consult the user on the quality of the collaborative application *in use*. (Please note, Requirement 2 specifies the *object* of evaluation, i.e. groupware *in use,* where Quality in Use prescribes aspects of the *object* and of the *process* of evaluation, e.g. do not evaluate the application as such, but evaluate the *result of using the application* (object) and 'consult the user on the quality of the application in use (process)'.)

The first evaluation activity prescribed by Quality in Use is applied in the First Phase of E-MAGINE: Software quality characteristics are input for several items of the First Scan. Each of the quality characteristics is addressed with a maximum of three items in order to prevent that the Scan takes too long. In the case study in Chapter 9 however, it became clear that only consulting the group leader on software quality characteristics does not guarantee that all issues indeed are revealed at that stage. In the group under study, the group leader did not know about usability problems for example. As a consequence usability problems were not the focus of the Second Phase of evaluation. However, the open questions in the KSSI identified a few usability problems. This indicates that the Scan supports covering relevant topics, but that applying the Scan in one interview with the group leader does not guarantee that all issues are identified. On the other hand, it also indicates that the open questions in the second phase partly compensate. In this example still some usability issues were identified.

The second evaluation activity prescribed by Quality in Use is applied in the Second Phase of E-MAGINE, in the KSSI. The KSSI investigates the opinion of users on the application they are currently using. As a consequence, a large part of the KSSI questions is not suitable for assessment of applications that are not (yet) implemented. This is discussed under design requirement 2 as well.

From the testing case study (see Chapter 9) it becomes clear that consulting users about the quality of a software application *in use*, also provides insight into their opinion about the quality of the *content* in the system. When answering items addressing quality aspects of the groupware *application*, users almost automatically evaluate *content* aspects such as structure and quantity of the available information and the activity level of group members contributing content. It seems that evaluation of *'knowledge sharing support systems' in use,* always should include items addressing content quality and network size of users involved. With respect to network size it is also relevant to address how many members 'bring' knowledge and information and how many members 'take' it. The KSSI provides items addressing these aspects.

10.2.5 Requirement 5: Apply participative evaluation

User involvement can be characterised as being somewhere on the continuum from informative, through consultative to participative (Damodaran, 1996). Quality in Use, Requirement 4, prescribes that the *user* schould be *consulted* on the quality of the application *in use*. However, participative evaluation takes user involvement a bit further: users have an active role and influence decisions (Kujala, 2008). Participative evaluation is applied in order to (1) gain insight into details of the context of use; (2) identify contradicting requirements for the application evaluated and prioritise these, preferably by consensus; (3) create compliance for the evaluation outcomes (see section 4.7). Especially for achieving the last two goals user *consultation* is not sufficient. To be able to identify contradicting requirements and in order to create compliance users should be actively involved in the evaluation process. Involvement of users is applied in three manners in E-MAGINE. The group leader is consulted in the First Phase of evaluation, the group members in the Second Phase. However, these two evaluation steps can better be described as user consultation than user participation. Eventually a Focus Group is held in the Second Phase of evaluation. Here, group members and other stakeholders in the setting are invited to participate in interpreting the evaluation outcomes and specify recommendations for the setting. This evaluation step can be specified as participative evaluation.

The Focus Group session in the !Effective case supported the achievement of all three goals of participative evaluation. In this session more insight into details of the context of use was generated. Especially more insight was gained into aspects that differ for the different types of users of the application. In addition, a few contradicting requirements were identified. Whether participative application, as applied in E-MAGINE, supports the creation of compliance for the evaluation results is hard to say at this stage. This was not tested in the cases of the thesis. However, group members present were interested in the evaluation outcomes, they did assent to these outcomes and were curious about next steps. These are indicators for compliance of the results.
From the !Effective case it further appeared that the Focus Group in itself generated insightful discussions for the participants. By discussing use of the applications they found out that differences in access to the applications had led to status differences between group members. Although group members knew about these differences in access, they never had realised this effect on the group. This finding resulted in consensus about the high necessity to change this. To achieve these goals different stakeholders should be present in balanced representations.

From the !Effective case it became also clear that users should be carefully consulted. A number of respondents of the KSSI did not finish filling out the survey. Some of them commented that the intention of the survey was not clear to them; they perceived a mismatch between the items and the type of support provided by their support tool JIRA. This makes it unlikely that these group members will assent to the evaluation outcomes.

In all, user involvement is applied in different ways in E-MAGINE. In the Focus Group user participation is applied and it appeared really useful: it supported gaining information on details of the setting, contradicting requirements and in some cases information about the degree of impact of evaluation issues (e.g. the number of stakeholders experiencing this problem). In other evaluation instruments of E-MAGINE user consultation appeared to be ‘good enough’ to gain information about the setting (see e.g. the First Scan).

10.2.6 Requirement 6: Be practical (cost-effective)

By developing E-MAGINE several strategies were applied to develop a cost-effective method. The combination of requirements led to the two-phase approach. Another aspect that contributes to the cost-effectiveness of E-MAGINE is the well-considered involvement of respondents. More details on modularity and cost-effectiveness of the method are provided below.

Modularity

E-MAGINE is developed as a modular, two-phase approach. Modular means constructed with standardized units or dimensions for flexibility and variety in use. A modular evaluation approach thus consists of different modules that can be applied in the evaluation process in a flexible way. As modular approach E-MAGINE provides room to vary the intensity and especially the focus of the evaluation process. Identification of most relevant evaluation issues in the first phase enables the focus of available resources. In other words, the two-phase approach enables a well-considered choice of evaluation modules that should be applied. This is more cost-effective than a more general approach of which all steps should be applied.

In the literature review of groupware evaluation methods presented in Chapter 4, only one other modular evaluation approach was identified, i.e. the MEGATAQ approach presented by Andriessen, Koorn & Arnold (1998). However, this approach intends to support a broad range of software applications and starts with a very generic framework. E-MAGINE on the other hand focuses on the evaluation of groupware provided for dispersed (knowledge) groups from the start. The First Scan focuses on identification of Success Factors specific for this setting.

The same literature review did not reveal a two-phase usability evaluation approach. However, two-stage approaches may be and often are implicitly applied in evaluation processes. When getting to know the group, its members, their way of working and other relevant characteristics, an evaluator develops an idea of the issues that hinder the group in being successful in applying their collaborative application. He may develop this 'hunch' based on his experience with the ICT facilitation of dispersed (knowledge) groups. As a result he may choose to apply a specific evaluation instrument. Still E-MAGINE may support these experienced evaluators: The First Scan ensures that the scan is thorough and more complete.

User involvement

Involving users in an evaluation process is considered costly. Herskovic, Pino, Ochoa and Antunes (2007) for example propose evaluation costs to be a function of the process duration and the effort required to conduct the evaluation. The effort then should be estimated based on the activities that must be done and the required human resources. In E-MAGINE user involvement is well-considered, in order to limit the required human resources. First, only one to two group leaders (facilitators) are involved in an interview.

Subsequently, group members are involved in a questionnaire. This questionnaire focuses on selected topics in order to limit the number of items. Lastly, a Focus Group is applied. This step is most costly in terms of human resources. However, not all stakeholders need to be present: it is assumed that a balanced representation is sufficient.

Actually, in their review of existing groupware evaluation methods, Herskovic et al. (2007) include a review of a previous version of E-MAGINE (see Huis in 't Veld, Andriessen & Verburg, 2003). The authors estimate that E-MAGINE costs medium effort and medium time span in relation to other existing evaluation methods. In their qualification E-MAGINE is, together with the 'Perceived Value' evaluation approach (see Antunes & Costa, 2003), the 'cheapest' evaluation method that involves users.

Evaluation outcomes of E-MAGINE

Application of E-MAGINE leads to the identification of barriers that hinder the successful use of the groupware application in dispersed knowledge groups. It further delivers suggestions for improvements. When the identification of these barriers is followed by removing or otherwise solving them, the group should function better and / or it should more effectively apply the groupware application. When the functioning of dispersed knowledge groups is of increased quality, their contribution to their organisation being more competitive can be expected to increase as well (Newman, 1997). And, when use of the groupware application is more effective in these groups, this – indirectly – leads to the same result.

Usability evaluation can in several manners contribute to improved effectiveness of use of the application. Bias & Mayhew (2005) name a total of nine potential contributions:

- increase success rate, reduce error
- increase efficiency / productivity (reduce time to complete task)
- increase user satisfaction
- increase job satisfaction / decrease job turnover
- increase ease of use
- increase ease of learning
- increase trust in systems
- decrease support costs
- reduce training / documentation costs

The authors illustrate these potential contributions with interesting examples and references. For example concerning '2) increase efficiency / productivity' they refer to usability guru Jakob Nielsen who states that any investment in making an intranet easier to use can pay off by a factor 10 or more, especially at large companies (based on Kalin, 1999). One finding in this thesis is in line with this statement: when users could not easily find the information they needed, they tended to stop using the groupware application at all. And concerning '3) increase user satisfaction' the authors refer to a 1992 Gartner Group study, where usability methods raised user satisfaction ratings for a system by 40% (based on Harrison et al, 1994, p219). These findings advocate application of usability studies in general and as a consequence application of E-MAGINE as well.

E-MAGINE is developed as a broad evaluation method, it superficially addresses almost all usability aspects presented in the list of Bias and Mayhew (2005). However, when specific usability aspects are a problem, a more thorough assessment of that aspect is relevant. The Second Phase is developed to focus on these aspects. Such an assessment is likely to generate more specific and more useful suggestions for improvement.

Time investment

In their overview Pinelle and Gutwin (2000) identified eight groupware evaluation studies that evaluated – to some extent – the impact the software had on the group, just like E-MAGINE does. In these evaluation studies, evaluating the impact of the software on the group was time-consuming; the time the evaluator spent with the group ranged from 4.5 - 36 months (regardless of whether this was continuous or intermittent). Compared to these data E-MAGINE takes less time, but applying the evaluation methods takes place during a few weeks (in case of applying the First Scan in combination with the KSSI and the Focus Group). Main reason for this time-reduction is that no observation methods are included in E-MAGINE. Observation as an evaluation method is usually very time-consuming for the evaluator. For, not only observing takes time, but especially analysing and reporting the results. Kujala (2008) gives several examples of studies reporting that observations are very time-intensive. Structured interviews and especially on-line questionnaires are much easier to analyse.

Not only the evaluator has to invest time in evaluation activities, group members have to invest their time as well. From the overview presented by Pinelle and Gutwin (2000) it does not become clear how much time group members invest in evaluation activities. However, when observation methods are applied in real world implementations the facilitator or group members often 'just continue with their tasks' and do not invest extra time in the evaluation study. They have to invest more when they cooperate in an interview or questionnaire. E-MAGINE applies these interviews and questionnaires, but does not demand much effort of the respondents. The First Scan (interview) takes a maximum of 1.5 hours and the on-line questionnaire a maximum of 15 minutes. The Focus Group is most costly in time, it demands a contribution of at least 1,5 hours of one representative of all the stakeholders. But it is a very informative step in the evaluation method, justifying this investment. (A focus group as evaluation method is not frequently applied: only ten percent of the studies reported in the paper of Pinelle and Gutwin, apply 'discussion' as an evaluation method.)

All in all, the evaluation outcomes of E-MAGINE seem promising in their contribution to effective group functioning and the time investment seems to be reasonable (in comparison with other groupware evaluation approaches that take context into account). Still the approach has practical aspects to overcome. The evaluation approach focuses on dispersed knowledge groups. Group members of these groups may be widely dispersed: a focus group in such a setting may involve a lot of effort and high travel costs. Whether evaluation steps can be executed 'at a distance' is not tested. It is not unlikely that mediated communication, e.g. the use of video conferencing can be applied to enable these steps. In addition, many dispersed groups consist of group members with different cultural backgrounds, they even may not share their native language. This complicates an evaluation process as prescribed by E-MAGINE.

10.3 Methodical requirements

In addition to its design requirements E-MAGINE has to fulfil methodological requirements. These were specified in section 5.3 and are the following: 1) be reliable; 2) be valid and 3) be acceptable (and face-valid). Reliability is the extent to which an instrument is able to produce accurate data, and the same data when measured at different times, or by different users (assuming that the phenomena being measured have not changed). Validity concerns the 'truth of measurement' and in evaluating the validity of a method *'we should evaluate whether the methods actually measures what we think it should measure'* (Doyle, 2003, p. 274). Acceptability implies that the method is perceived as relevant and fair by respondents (see for example Stanton & Young, 1999). The three methodical criteria hold for the complete evaluation approach E-MAGINE, as well as for its two main instruments which are developed in this thesis, the First Scan and the KSSI.

Reliability

In section 5.3 it was explained that testing the reliability of E-MAGINE and its instruments is hard at this stage of its development. Two possible options were not be applied here as they are beyond the scope of the research: 1) application of the evaluation approach by (an)other researcher(s) and 2) applying the approach twice. The broad focus in building the evaluation method did not leave room for extensive validation studies. However, the First Scan was applied twice in the same setting (see Chapter 7). Here the outcomes were similar, except for those aspects of the setting the separate respondents did not both know of. This indicates that the First Scan is a reliable evaluation instrument. It also indicates however, that the quality of the outcomes depend to a large extent on the knowledge of the respondent. This is a weakness of the evaluation instrument. Is the method reliable even though the First Scan is applied in an interview with only one respondent? It would perhaps be wise to involve more than one respondent. In practice however there is generally only one (maybe two persons) that has (have) the role of group leader (group facilitator). Applying the instrument in an interview, and not as a questionnaire, partly compensates for this weakness. In an interview the evaluator can encourage the respondent to be open about whether or not he is sure about his answers. And, in case the respondent is not sure about some items, the evaluator may try to gain the information in other ways.

The reliability of the E-MAGINE evaluation method partly depends on the reliability of the First Scan. It is therefore relevant to be alert on signals that indicate that outcomes of the First Scan interview are not (completely) right. In Chapter 9, open questions in the KSSI revealed some small usability problems the group leader had not specified. In other words, the KSSI revealed evaluation issues that had not been identified by the First Scan. One could say that the open questions of the KSSI functioned as a verification of the outcomes of the First Scan. The new identified evaluation issues were added to the list of issues identified so far and all issues were discussed in Focus Group. Actually, next to the open items in the KSSI, some other aspects of the evaluation approach support verification of the First Scan outcomes as well. These are:

- regular consultation of contact person
- items in KSSI verifying (some) results of the First Scan
- discussion in Focus Group

So, indeed reliability of E-MAGINE partly depends on the reliability of the First Scan. And, the First Scan has its weakness because it is usually applied with only one respondent. However, several aspects of E-MAGINE, such as the open items in follow-up instruments like the KSSI, help to prevent that evaluation issues are completely missed. In this manner, the reliability of E-MAGINE is increased and depends less on reliability of the First Scan alone.

In the case study presented in Chapter 9 the Focus Group also partly functioned as a reliability test. Participants of this Focus Group stated that the evaluation outcomes were not surprisingly new, but insightful. They This indicates that the evaluation approach indeed is able to produce accurate data.

<u>Validity</u>

The project focused on the development of a useful and valid evaluation approach. Validity refers to 'truth of measurement' as stated above; '*(...) does the method measure what we* *think it should measure*'? E-MAGINE should measure to what extent a groupware application supports a dispersed knowledge group in sharing knowledge within the group and between the group and the organisation. In addition, E-MAGINE should identify barriers for optimal support and suggest improvements. A broad development approach was chosen in order to achieve these goals. Developmental steps consisted of observations, interviews with experts and identification of relevant concepts in literature, all to identify how knowledge is shared using a collaborative application and what barriers are. A combination of these research steps resulted in a long list of Success Factors that functioned as input for E-MAGINE and its two main instruments. These Success Factors were structured according to a framework identified in the literature. Factors were for the greater part evenly divided over categories, indicating a list that covers all kinds of relevant aspects of the setting under evaluation. Stated differently the evaluation approach is based on a list of Success Factors that seems to be reasonably complete for this setting. This list supports validity of the evaluation approach.

E-MAGINE consists of two evaluation instruments, i.e. First Scan and KSSI. Although these instruments are based on a framework and success factors that are the result of extensive research, case studies as well as literature, development and validation steps of these two instruments were not as rigorous as they could have been. The sample size in testing the instruments was small. Construct validation was therefore not possible. To test the validity of E-MAGINE it is however possible to present the outcomes of the evaluation approach (and its instruments) and ask respondents whether these outcomes are in line with what they expected. This was done in the case studies presented in Chapter 9, in the last step of the evaluation process. Here group members stated that they thought the outcomes were interesting and that the outcomes did not surprise them. Some of the issues were considered implicit notions about JIRA, which E-MAGINE had made explicit. This is an indication for the reliability of the evaluation approach (see above), but also for the validity of the instrument.

Acceptability

Acceptability can be verified by asking respondents cooperating in the study what they think of the approach and its instruments. This was also done, whenever possible. The first version of the First Scan was considered too long; this version was shortened. The first version of the KSSI was considered too complex; this version was simplified. In Chapter 9 it became clear that it is necessary to provide clear instructions with the KSSI, especially when it is applied to assess new or creative uses of the application under evaluation. These suggestions were added to the instructions of applying the KSSI. In Chapter 9, the entire evaluation approach was applied, here respondents supported all steps of the evaluation process. And, although the Focus Group is most time intensive, users and other stakeholders considered this step as very insightful.

10.4 Contributions and limitations

10.4.1 Theoretical contributions

E-MAGINE presents a new approach to execute socio-technical evaluations. As such it contributes to the domain of software evaluation and the trend in this field for more broadened evaluation approaches. In addition to this evaluation approach, the main result of this research project, some other theoretical contributions can be specified.

An interesting finding in this thesis are the three main type of criteria that users value in groupware applications that intend to support knowledge sharing. The study initially was started in order to develop a (broadened) groupware evaluation approach in the tradition of software evaluation. However, it appeared that groupware applications that aim to support knowledge and information sharing (processes), not only should meet criteria related to concepts such as usability and usefulness. It is as important that the groupware applications contain ‘content’ and have a ‘critical mass’ of users. In other words, it should be filled with useful knowledge or information in order for users to appreciate the application. In addition, users find it relevant that the application is (actively) used by a minimal number of users.

The evaluation approach further contributes to the discussion about measuring fit. Several fit assessments are applied in the method. This provided further insight into pros and cons of different methods to assess fit, these are discussed in 10.2.3.

The research project also informed on the specification of fit in a socio-technical setting. Based on a framework presented by Andriessen (2003) a new framework was presented that supports specifying fit in the context of dispersed knowledge groups using ICT. The Success Factors that are specified in the research project can be considered a specification of what fit of a groupware application to a dispersed knowledge group (may) imply. It very specifically describes how groupware applications may meet requirements such as ‘matching the users’ and ‘matching the task’. As a consequence, this list of Success Factors is a useful contribution to existing research on successful groupware support of dispersed knowledge groups. In addition, the Success Factors in the first category ‘Groupness’ add to the literature on the successful functioning of dispersed knowledge groups.

Lastly, the research project contributed to the identification of success factors for sharing knowledge using ICT. The search for these success factors continues in recent studies, see for example the study of Chris and Bourdon (2008) into success factors for the communal management of knowledge. However, the group of technical Success Factors identified in the present study are more specific than those presented in the study of Chris and Bourdon.

10.4.2 Practical implications

To specify the practical usefulness of the evaluation method the discussion under 10.2.6 is relevant. Here, general potential contributions of usability evaluation methods are specified. It is argued that E-MAGINE has the potential of contributing to these 'effectiveness of use' aspects as well. If the approach is applied in dispersed knowledge groups these groups will be able to identify possible improvements for their setting. At the same time, because it is so cost-effective the approach can easily be applied. However, expert knowledge is necessary in order to apply the approach. From the case studies it appeared that the evaluator applying the evaluation approach should have some knowledge of software evaluation, group dynamics and groupware usage. He / she further should be familiar with the Success Factors underlying the First Scan. It is expected that evaluators with this type of background knowledge are able to apply the current version of E-MAGINE. Therefore, the evaluation approach is completed with instructions and examples of how to apply the approach and its instruments. This information also entails instructions on how to go from the First Evaluation Phase to the Second (See Appendix VII, where a complete version of E-MAGINE is provided).

10.4.3 Limitations

Several limitations to this research must be acknowledged. Due to the broad focus of the research project, it was not possible to collect enough data in order to fully test for reliability and validity. Although a number of reliability and validity checks were performed, the full approach could only be tested in one dispersed group and the First Scan and KSSI instruments were tested in two settings. Future applications of E-MAGINE will render sufficient data for improving the psychometric properties of the evaluation approach but this could not be accomplished within the constraints of this extensive study.

The cost-effectiveness of E-MAGINE may relate to another limitation of the approach. E-MAGINE meets its criterion of cost-effectiveness by, amongst others, scanning all kinds of aspects of the setting under evaluation. At this stage however, it cannot be proven that E-MAGINE identifies all relevant issues that hinder successful groupware support. The First Scan is developed to support the scanning of relevant aspects in the evaluation setting and in that way contributes to the cost-effectiveness of the evaluation approach. The Scan is a strong feature of the evaluation approach, it may prevent that evaluators overlook relevant aspects. However, this strength may result in a limitation as well: The structure of the Scan may force evaluators to view the setting in a fixed, pre-defined way that can limit their ability to identify some problems. Pinelle and Gutwin (2008) identify the same strength and weakness of their 'list of issues' when presenting their tabletop groupware application evaluation method. To compensate for the weakness of the First Scan, the Scan is applied in an interview setting. In the instructions the evaluator is encouraged to discuss the topics provided by the Scan and to continue asking questions when he suspects a related issue might hinder adequate support of the application.

Other limitations relate to new technology and knowledge sharing developments since the development of E-MAGINE. E-MAGINE is developed based on groupware applications that were in use at the time of the study. Rapid technological developments in the area of group support has yielded new applications that were not available during the data collection for E-MAGINE. As a consequence, new types of groups interactions have emerged. See for example Wenger, White and Smith (2009) for an overview of developments in technologies for community support. They describe that new technologies enable new modes of engagement. "The evolution of publishing and interaction tools enables both stronger individual voices, through self-expression tools like blogs, as well as stronger group manifestations, through collaboration tools like wikis." (p. 187) At the same time the authors stress that the successful use of these technologies, still depend on the dynamics, goals, practices etcetera, of the communities using them. For they continue saying that: "(…) again the successful use of these capabilities for communities depends on the practices members develop around them." (p. 187) For that reason they present several linkages between (community) activities on the one hand and tool features on the other hand. In other words, they apply and prescribe the fit approach as well in order to successfully support these groups. An interesting research step would therefore be a comparison between (matching) Success Factors of E-MAGINE and their list of success factors for the support of new types of communities.

In parallel, new ways of sharing knowledge have emerged. Grudin (2006) for example describes so-called emerging technologies that support sharing knowledge in organisations. Features of these emerging technologies are e.g. unstructured tagging and weblogs. These technologies mostly are not institutionalised in organisations, but emerge as knowledge sharing tools as a consequence of individual initiatives. In this context Efimova (2009) describes in more detail how employees apply weblogs to share knowledge. These emerging uses of technology to support knowledge sharing may not always be suitable for evaluation by E-MAGINE. E-MAGINE focuses on a specific application that is used by a specific group. As a consequence E-MAGINE is not suitable for more 'emergent settings'.

The approach is thus not suitable for a setting in which a dispersed knowledge group has 'spontaneously organised itself' and as a result is invisible to management (see also Andriessen & Verburg, 2004). Let alone a setting, where different individuals are member of several, overlapping dispersed knowledge sharing groups and use different applications to share knowledge.

However, the framework developed in this thesis, including its Success Factors may (partly) hold in these settings. In addition, some of these new developments have emerged from being incidentally present to being largely present. Knowledge workers of DelftCluster for example (see Chapter 2 in this thesis) were often members of several, visible and invisible, overlapping dispersed knowledge groups. I expect this holds for more knowledge workers, more often, nowadays. As a consequence, the dilemmas identified in this setting (see Chapter 2) still hold. The solutions to handle the dilemmas, in this thesis specified as Success Factors, may however be different. It might for example be that knowledge workers nowadays are more convenient in combining uses of different applications in order to share knowledge with colleagues. Verburg and Andriessen (2011) highlight the different ways in which knowledge sharing and creating can be organised. The current diversity of knowledge sharing networks requires different technological support. It would be interesting to elaborate to what extent dilemmas still hold and in this way verify the framework of Success Factors E-MAGINE is built on.

Another technology development since the start of this study is the more frequent application of mobile technologies. With this new development studies into the (technological) support of mobile work have emerged as well (see for example Andriessen and Vartiainen, 2005). The future of mobile work and its support may lead to novel forms of collaboration that would call for additional evaluation features in E-MAGINE. Success Factors under 'Matching the User', may be necessary to adapt for example. Consider the specification of the success factor 'Easy access' for example. The overview of recent ICT developments showed that knowledge workers may have access to groupware application using their handheld. A handheld is usually more easily to access than a fixed workstation. However, can the smaller interface provide a good overview on the content of the shared application? Is this overview as useful as is the overview that can be shown on larger screens? In this example, the 'easy access' criterion interrelates with the usefulness criterion. With the trend of diversifying physical interfaces, more of these interrelating and contradicting criterions can be expected.

10.5 Usefulness and applicability of E-MAGINE

In the future more and more groups will be dispersed and or virtual, and computer mediated communication becomes more and more common (see for example Castells, 2010). And still globally dispersed organisations are confronted with the need to integrate knowledge that is geographically dispersed (see for example Agterberg, van den Hooff, Huysman, & Soekijad, 2010). Nonaka and von Krogh (2010) argue that iinnovation and organizational knowledge creation is often temporarily organized in project teams composed of people who represent various functions, units, groups, or organizations. They add that communities as well as teams may be applied to transcend knowledge. Researchers still study how knowledge can be shared in these groups, see for example Agterberg et al. (2010) and Ribeiro, Kimble and Carins (2010). Dispersed groups may apply groupware to support these knowledge processes, which makes E-MAGINE also useful for future settings.

However, since the development of the E-MAGINE evaluation approach (around 2002), new technologies for group and knowledge sharing support have been developed. An overview of the main developments is provided in Chapter 3. In parallel new contexts of work have emerged, e.g. the number of mobile knowledge workers has increased. The use of new technologies such as Web 2.0 applications is generally not institutionalised. They emerge as knowledge sharing tools as a consequence of individual initiatives. Efimova (2009), for example, describes in more detail how employees apply blogs to share knowledge. These emerging uses of technology to support knowledge sharing may not always be suitable for evaluation by E-MAGINE. The critical distinguishing factor is that E-MAGINE is only applicable for the evaluation of the level of support of a groupware application for a ‘specific group’, performing a ‘specific (knowledge sharing) task’. It is for example hard to apply E-MAGINE to evaluate a Social Network Service (SNS) in general, without focusing on a specific group using this application for its own purposes. The method evaluates whether an application supports a group or community in achieving its goals. The group or community should therefore fulfil a minimal level of groupness in order for E-MAGINE to be applicable. Groupness refers to a dimension, the more a collection of individuals have a common task, the longer and more often they interact, the longer and more formal their group membership and the smaller the number of members, the higher their level of groupness. Only with a minimal level of groupness, the method can be applied to evaluate whether there is a fit between characteristics of the group, task and context on the one hand and features of the technology on the other hand.

However, E-MAGINE may be applied to evaluate whether a group or community within the organisation is served by a SNS. Especially, because these types of Web 2.0 applications can easily be adapted to create (sub)groups and support interactions in these groups (e.g., finding like-minded people). In that case, E-MAGINE can be applied to evaluate the SNS features provided to the group and specify their level of support for performing the group task. In these cases E-MAGINE is applicable because there is a group, a group task and a collaborative tool supporting the group.

An interesting aspect of this context is the automatic imbedding of the group in a large network when SNS is used. When a SNS is applied to support a group, all group members have subscribed to the SNS (otherwise they cannot join the group). These group members can be assumed to have linkages to people outside the group as well. In this way, each group member automatically brings in his own network into the group. For, these group-member-related-networks outside the group, are mostly visible for other group members. Thus group members can 'see' to whom other group members are connected. And they can 'see' what other groups colleague group members are member of. Therefore E-MAGINE may be extended for the evaluation of this kind of settings. Items may be added to the First Scan or KSSI that assess whether 'imbedding', a feature provided by the SNS, provides added value for the group and whether this imbedding is ideally implemented.

Summarizing, which of the five Web 2.0 applications, discussed in Chapter 3 might be a candidate for evaluation by E-MAGINE? Firstly, Wiki's and SNS's may be applied by groups or communities to support their specific interaction and task execution. E-MAGINE can then be applied. Also *Tagging* can be used by groups, to sort and filter large amounts of content. However, as is explained in Chapter 3, a minimal group size is needed in order to generate a useful effect of tagging. In addition, tagging is more a feature that can be applied in a groupware application than an application itself. So evaluation by E-MAGINE seems to be less relevant.

Lastly, Blogs and Feeds were discussed in Chapter 3. Of these two, Blogs are considered not suitable for evaluation by E-MAGINE. Blogs are too much centred round individuals, not round groups or group tasks. Feeds can be considered 'alerts' and can be very useful as a feature in collaborative applications. So, if a groupware application provides a 'Feed-feature' this may be very valuable to the group: it supports group members to keep up-to-date very easily, and is therefore a candidate for E-MAGINE evaluation.

In section 10.7 'Future research' it is described how E-MAGINE may be extended in order to support groupware evaluation in these contexts as well.

10.6 Research method

In a concluding chapter a reflection on the applied research methods should also be included. The combination of different research methods applied in this research project resulted in a broad evaluation approach. In this research project mainly case studies were applied to achieve this result. These case studies included research activities such as observations, interviews and the application of questionnaires. In addition, a literature study was included. These research activities were applied in different combinations in the three research phases. E.g. outcomes of the case studies of the First Research Phase were applied to address issues in the case studies of the Second Phase more structurally and more in-depth. In addition, first versions of the questionnaires in development, e.g. First Scan and KSSI, were applied here. The case study in the Third Phase can be considered an experimental case study (see 1.2.1); here a first complete version of E-MAGINE was applied. This last type of case study is less exploratory than the case studies applied in the first two research phases. Relevant questions are: Could the same result, the broad evaluation approach, be achieved using other research approaches or another combination of research approaches? And what would the result be if more or less case studies were applied in each research phase? In the next section the research strategy applied in this thesis is compared to alternative research strategies. This reflection is structured in three main sections, each research phase of this thesis is discussed.

However, some general notes on the selection of case studies are provided here first. Selection found place by defining the 'object' of evaluation, dispersed knowledge groups and subsequently trying to gain access to these types of groups. No other selection criteria were applied. As a consequence access was gained by joining other research projects for example. In this manner a diverse range of groups could be studied. Selecting case study research as a research method implies dependency in gaining access to data. However, this access was gained relatively easily, no concessions were necessary in selecting cases, although possible research activities were not always similar.

10.6.1 Reflection on Research Phase 1

My strategy for developing E-MAGINE was open and exploratory as is explained in the introduction of this thesis. The assumption was that an open attitude in the development of the evaluation approach provides the best opportunity to make the approach meet its design requirements, including the requirement to take the context-of-use into account. This was also the basis for the application of case studies. An alternative strategy would be to start with existing groupware evaluation approaches as a basis for the development of E-MAGINE. The case studies especially delivered input for understanding the 'object' of the evaluation approach: 'dispersed knowledge groups'. A relevant observation in the case studies was the role of group related factors in the successful use of groupware applications. It appeared that in some settings the quality of the application was not the direct reason for non-use. This observation was applied in the evaluation approach in order to increase its usefulness in daily practice. If the research approach for example was based on existing usability and groupware evaluation approaches instead, this aspect might have been overlooked; most of these evaluation approaches focus on technology aspects.

The relevance of group related factors might also have been overlooked when structured questionnaires were used to gain insight into dispersed knowledge groups. This observation was a direct result of open interviews. In both cases the resulting evaluation approach would as a consequence not have been (partly) based on group related success factors. So although case studies take relatively much (research) time, I think the addition of group related factors increases the practical usefulness of the evaluation approach.

I expect that more case studies in this first research phase would, in this form, not generate substantially more new or other insights. The first list of barriers and success factors and the related first structure for success factors, remained unchanged during the rest of the research, it was only further specified. Case studies in this first phase were not in-depth enough to further specify this structure.

Fewer case studies in this phase might have resulted into the same first main structure for success factors. However, the different contexts of the case studies ensured a broad base for the structure.

10.6.2 Reflection on Research Phase 2

The case studies in the Second Research Phase supported detailed specification of Success Factors. These case studies were also extensive and time consuming. Here, for example a literature study could have been applied instead. However, not many previous studies report at this level of detail on Success Factors for the technical support of dispersed knowledge groups. For a practical evaluation approach this level of detail was very useful. It supported the development of questionnaires addressing specific issues (e.g. First Scan and KSSI). This prevents that an evaluator applying E-MAGINE has to 'translate' a generic list of recommendations (Success Factors) into specific requirements for the evaluation setting at hand. So, it increases the practical usefulness of E-MAGINE. However, it may limit the diversity of settings that the evaluation approach is suitable for. See the discussion on this issue in other sections of this chapter.

At this stage it is not clear whether more case studies would have led to the identification of new Success Factors. In the last case study informing the development of E-MAGINE, AtosOrigin, still 20 new factors were identified. This number is around the same amount as in the preceding case study Habiforum. However, in the final and test case study of this thesis, group members and the facilitating organisation declared that the results of E-MAGINE seemed to be fairly complete. They did not miss relevant aspects in the outcomes of the evaluation. Additional case studies in the Second Phase of the research project might however have enabled a first determination of the relative importance of success factors. If the same Success Factors are identified in more case studies, these can be supposed to be more important than Factors that are identified in only one case study - provided that research settings are comparable. Fewer case studies in this phase would have resulted in an omission of around 20 success factors.

Another step in the second research phase was the application of a first version of the two evaluation instruments First Scan and KSSI. This application resulted in relevant improvements of both instruments: questions were formulated in a different way and more instructional information was added to the instruments. It is likely that further refinements can be made when these instruments are applied again. However, a result of the final case study was that these instruments served their purpose in the evaluation method. Meeting this basic quality, in my opinion these instruments should only be further tested and refined in the context of the entire evaluation approach, so, in the context of E-MAGINE.

10.6.3 Reflection on Research Phase 3

In the last phase one test case study was applied. This test case study resulted in an improvement of E-MAGINE including its evaluation instruments the First Scan and KSSI. An alternative strategy would be expert evaluation for example: What do usability experts think of E-MAGINE? However, the proof of the pudding is in the eating: a real test is in applying the evaluation method in practice. For the same reason, fewer case studies, meaning none, in this phase was not an option. However, more case studies in this phase could have resulted in further improvements of the evaluation method. A few suggestions for new test cases are provided in section 10.7 below. Having made the choice to invest much time and energy in developing the evaluation method implies that less time is left for testing it.

Naturally, not only case studies are applied to develop the E-MAGINE evaluation approach, but a literature study is included as well. This project is based on extensive literature research covering the 'object of evaluation' e.g. 'groups using groupware to share knowledge' and the 'process of evaluation' e.g. 'usability evaluation'. As a consequence, the literature study covered topics such as the dynamics of groups, dispersed and virtual groups, knowledge management, groupware (usage), see Chapter 3. And, literature on usability and groupware evaluation, see Chapter 4. These theoretical steps in the development of the evaluation approach ensured that the approach was built on broad theoretical grounds as well.

10.7 Further research

For further research first validation of E-MAGINE seems useful. A first suggestion for further research would therefore be application of the approach in a new setting, by another researcher, in line with application of the evaluation approach as presented in Chapter 9. Especially a test executed by another evaluator is in line with the original requirements for E-MAGINE. In Chapter 1 it is described that the approach should enable dispersed knowledge groups to evaluate their current use of a groupware application with the support of a usability expert and decide on adjustments or alternatives. It is therefore relevant to test whether other usability experts than myself can apply the method as well.

Second, to enable a smooth evaluation process suitable for all kinds of dispersed knowledge groups, a test of applying evaluation steps 'at a distance' is necessary. As explained in 10.2.5, group members of dispersed knowledge groups may be largely dispersed. In these groups the usefulness of E-MAGINE is increased when evaluation steps can be executed at a distance, e.g., is the First Scan interview suitable to be executed with interviewee and evaluator located at different places?

Third, it would be interesting to extent the applicability of the evaluation method to other types of groups as well, for example to large knowledge sharing communities. In that case these types of groups would also benefit from the insights E-MAGINE can provide. A possible downside is that the evaluation method becomes too generic and has no useful outcomes anymore. As a consequence each extension should be carefully considered.
The modular two phase approach provides a structure in which new elements can be easily added. For large knowledge sharing communities for example, first success factors typical for that setting should be identified. These can be expected to partly overlap with the success factors that are currently foundational for E-MAGINE. Newly identified factors should be translated into new items for the First Scan. In addition factors and related items that do not match the setting of large knowledge groups should be left out. Similarly, some changes to the KSSI may be applied.

E-MAGINE might also be extended in such a way that the evaluation approach becomes suitable for the evaluation of recently developed groupware technologies and trends in group support. Some of these options are discussed in section 10.5.3. If, however, settings deviate too much from the settings E-MAGINE is based on, an extension in this manner is not possible.

Another option would be to extend the Second Phase of evaluation and enlarge the list of evaluation instruments that may be selected here. In the First Scan several group and technology related factors are addressed. Outcomes of this Scan may for example indicate that a further assessment of group cohesion or network reliability is in place. Currently the Second Phase cannot provide these tests and its set of available instruments may thus be enlarged.

Other suggestions for further research relate to the theory E-MAGINE is based on the Success Factors identified in this thesis.

In Chapter 3 of this thesis it is explained that the fit approach and utilization approach as described by the Technology Acceptance Model (TAM) are related. Both concepts are still focus of study. This has resulted in specifications of these concepts in new work settings, such as the mobile work context. See for example Bouwman and van de Wijngaert (2010) on the adoption of mobile applications. Other examples of studies related to technology adoption are from Shin on effects of trust, security and privacy on adoption (2010) and Pontiggia and Virili (2010) on network effects in technology acceptance. Yuan, Archer, Connelly and Zheng (2010) as well as Gebauer, Shaw and Gribbins (2005) studied the specification of fit in the context of mobile work. Some of these studies have a more individual focus, it is explored how individuals best can be supported to perform their (individual) tasks. It would be interesting to explore how the Success Factors identified in this thesis add to, or can be combined with the results of these studies. Yuan et al. (2010) for example recently presented a research model for the fit of mobile task characteristics to mobile work support functions. They base their model on Task-Technology Fit theory (TTF) and attitude/behaviour models, including the Technology Acceptance Model (TAM). (See Chapter 3 of this thesis for an introduction into both theories.) It would be interesting to extend their research model and explore how the ‘fit’-related Success Factors identified in this thesis can be integrated. In addition, the focus on the individual in a mobile context might be extended or transferred into a focus on group support. (i.e., supporting the individual in performing group tasks.) In this manner insights of this thesis can be applied in the emerging field of mobile technology support.

In this thesis a difference is made between the codification and personalisation approach. In their paper on the value of networks of practice (NoPs) Van den Hooff, de Leeuw van Weenen, Soekijad and Huysman (2010) focus on two sets of variables influencing performance of NoPs: the embeddedness of the network and the use of different media. They conclude that the value of networks mainly resides in being embedded in practice and in social relations. They also conclude that the media used in these NoPs influence the degree of social embeddedness and embeddedness in practice. They speculate that different functionalities of ICT support might have different consequences for the embeddedness of communities and make a distinction here between functionalities such as (1) storage/retrieval, (2) expertise finding and (3) social interaction support. Functionalities thus are related to the codification approach (1) or the personalisation approach (2 and 3). If these functionalities indeed have different consequences for the value of communities, this indicates new Success Factors for knowledge sharing support. Embeddedness was not a factor taken into account in this thesis. It would be interesting to test the hypothesis formulated by Van den Hooff et al. and add the result as a Success Factor into the framework developed in this thesis. The Success Factor identified then may be incorporated into the First Scan and/or the KSSI, in order to increase the quality of E-MAGINE.

10.8 Concluding remarks

By applying E-MAGINE a group indeed can assess the support of its groupware application for sharing knowledge. E-MAGINE provides a step-wise evaluation approach that incorporates a large range of relevant factors. This is achieved by first applying a scan and subsequently focusing on notable results of this scan. In addition, the method alternates expert evaluation with user involvement in order to gain ‘the best of both worlds’. In this manner the evaluation approach distinguishes itself from other existing evaluation methods in (a) its broad focus, (b) its extensive conceptual basis, (c) its modularity, and (d) its practicality and cost-effectiveness.

In developing this evaluation method, more insight is generated into success factors for groupware support in dispersed knowledge groups. The thesis has generated a valuable overview for researchers who study these groups, and for managers and members that are involved in such groups. These factors are presented in an insightful framework. This framework, including its success factors, is a valuable outcome in itself; it can (partly) be considered a specification of the concept of fit in this setting. As such it adds to the literature on task-technology fit (TTF), because it also specifies ‘matching’ success factors. These are success factors that match group characteristics to functionalities of the groupware technology. However, the framework is not rigid in this respect; it includes and specifies the relevance of introduction and adaptation processes.

Moreover, more insight is generated into the challenges of evaluating groupware - developed to support knowledge sharing - in use. Especially in case participative evaluation is applied. It appears that users may have problems in making a distinction between features of the technology and the content of the system, including contributions of other users. The same holds for being critical in evaluating an application, if users have ‘nice experiences’ participating in the group, they tend to be less critical and vice versa. Evaluation methods that have this focus have to deal with these challenges; E-MAGINE provides first suggestions.

References

Äborg, C., Sandblad, B., Gulliksen, J., & Lif, M. (2003). Integrating work environment considerations into usability evaluation methods: The ADA approach. *Interacting with Computers, 15,* 453-471.

Agterberg, M., van den Hooff, B., Huysman, M., & Soekijad, M. (2010). Keeping the wheels turning: The dynamics of managing Networks of Practice. *Journal of Management Studies, 47,* 85-108.

Amoako-Gyampah, K. & Salam, A. F. (2004). An extension of the Technology Acceptance Model in an ERP implementation environment. *Information & Management, .41,* 732-745.

Andriessen, J. H. E., Koorn, R., & Arnold, A. G. (1998). Multidimensional evaluation of generic aspects of telematics applications quality: The MEGATAQ model. In R. Traunmüller, & E. Csuháj-Varjú (Eds.), *Proceedings of the XV. IFIP World Computer Congress,* (pp. 272-283). Vienna, Austria and Budapest, Hungary: Schriftenreihe der Österreichischen Computer Gesellschaft.

Andriessen, J. H. E. & Verburg, Robert M. (2004). The development and application of the community assessment toolkit. In *Proceedings OKLC, 5th European Conference on Organizational Knowledge, Learning and Capabilities*. Innsbruck, Austria.

Andriessen, J. H. Erik (2003). *Working with groupware: Understanding and evaluating collaboration technology*. London: Springer-Verlag.

Andriessen, J. H. E., Soekijad, M., Huis in 't Veld, M. A. A., & Poot, J. (2001). *Dynamics of knowledge sharing communities: An overview* Delft: Delft University of Technology.

Antunes, P., & Costa, C. J. (2003). Perceived value: A low cost approach to evaluate meetingware. In J. Favela, D. Decouchant (Eds.). *Groupware: Design, Implementation, and Use, 9th International Workshop, CRIWG. Proceedings. Lecture Notes in Computer Science 2806* Autrans, France: Springer (pp. 109-125).

Arnold, A. G. (1998). *Action facilitation and interface evaluation.* (Doctoral dissertation). Delft University of Technology, Delft.

Awad, Elias & Ghaziri, Hassan M. (2004). *Knowledge management*. New Jersey: Pearson Education.

Baker, K., Greenberg, S., & Gutwin, C. (2001). Heuristic evaluation of groupware based on the mechanics of collaboration. *Proceedings of the 8th IFIP Working Conference on Engineering for Human-computer Interaction (EHCI),* Toronto, Ontario, Canada.

Bannon, Liam J. (1991). From human factors to human actors: The role of psychology and human-computer interaction studies in system design. In J. Greenbaum & M. Kyng (Eds.), *Design at work: Cooperative design of computer systems* (pp. 25-44). Hillsdale, NJ: Lawrence Erlbaum.

Barley, S. R. (1986). Technology as an occasion for structuring: Evidence from observations of CT scanners and the social order of radiology departments. *Administrative Science Quarterly, 31,* 78-108.

Barret, M., Cappleman, S., Shoib, G., & Walsham, G. (2004). Learning in knowledge communities: Managing technology and context. *European Management Journal, 22,* 1-11.

Bayerl, P. S. & Lauche, K. (2010). Technology effects in distributed team coordination: High-interdependency tasks in offshore oil production. *Computer Supported Cooperative Work, 19,* 139-173.

Bell, B. S. & Kozlowksi, S. W. J. (2002). A typology of virtual teams: Implications for effective leadership. *Group & Organization Management, 27,* 14-49.

Benford, S., Schnädelbach, H., Koleva, B., Anastasi, R., Greenhalgh, C., Rodden, T., . . . Steed, A. (2005). Expected, sensed, and desired: A framework for designing sensing-based interaction. *ACM Transactions on Computer-Human Interaction, 12,* 3-30.

Bevan, N. (1999). Quality in Use: Meeting user needs for quality. *Journal of Systems and Software, 49,* 89-96.

Bias, R. G., & Mayhew, D. J. (2005). *Cost-Justifying Usability: An update for an Internet age*. (second ed.) San Francisco: Morgan Kaufmann Publishers.

Bikson, T. K., & Eveland, J. D. (1990). The interplay of work group structures and computer support. In J. Galegher, R. E. Kraut, & C. Egido (Eds.), *Intellectual teamwork: Social and technological foundations of cooperative work* (pp. 245-290). Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Block, P. (2000). *Flawless consulting: A guide to getting your expertise used*. (second ed.) San Francisco: Jossey-Bass/Pfeiffer Publishers.

Bouwman, H., & van de Wijngaert, L. (2010). Coppers context, and conjoints: A reassessment of TAM. *Journal of Information Technology, 25,* 259-272.

Briggs, R. O., Nunamaker, J. F., Jr., & Tobey, D. (2001). The Technology Transition Model: A key to self-sustaining and growing communities of GSS users. In *Proceedings of the 34th Annual Hawaii International Conference on System Sciences*. Computer Society Press.

Brooking, A. (1996). *Intellectual capital*. London: Thompson Press.

Brown, J. S. & Duguid, P. (1991). Organizational learning and Communities of Practice: Toward a unified view of working, learning and innovation. *Organization Science, 2,* 40-57.

Brown, J. S., & Duguid, P. (2000). *The social life of information*. Boston: Harvard Business School Press.

Carillo, K., & Olkoli, C. (2011). Generating quality open content: A functional group perspective based on the time, interaction, and performance theory. *Information & Management, 48,* 208-219.

Castells, M. (2010). *The rise of the network society*. (second ed.) Chichester, West Sussex, UK: Wiley-Blackwell.

Chang, A., & Bordia, P. (2001). A multidimensional approach to the group cohesion-group performance relationship. *Small Group Research, 32,* 379-405.

Chris, K., & Bourdon, I. (2008). Some success factors for the communal management of knowledge. *International Journal of Information Management, 28,* 461-467.

Clark, H. H., & Brennan, S. E. (1993). Grounding in Communication. In R. M. Baecker (Ed.), *Readings in Groupware and Computer-Supported Cooperative Work: Assisting Human-Human Collaboration* (pp. 222-233). San Francisco, California: Morgan Kaufmann Publishers, Inc.

Coleman, D. (1995). Groupware technologies and applications: An overview of groupware. In D. Coleman & R. Khanna (Eds.), *Groupware: Technology and applications* (pp. 3-41). New Jersey: Prentice Hall.

Costa, A. C., Roe, R. A., & Taillieau, T. (2001). Trust within teams: The relation with performance effectiveness. *European Journal of Work and Organizational Psychology, 10,* 225-244.

Crabtree, A. (2003). *Designing collaborative systems: A practical guide to ethnography*. London: Springer.

Daft, R. L., & Lengel, R. H. (1984). Information Richness: A new approach to managerial behavior and organization design. *Research in Organizational Behavior, 6,* 191-233.

Damodaran, L. (1996). User involvement in the systems design process - a practical guide for users. *Behaviour & Information Technology, 15,* 363-377.

Davenport, T. H. & Prusak, L. (1997). *Information ecology: Mastering the information and knowledge environment*. New York: Oxford University Press.

Davenport, T. H. & Prusak, L. (1998). *Working knowledge: How organizations manage what they know*. Boston, MA: Harvard Business School Press.

Davis, F. D. (1993). User acceptance of information technology: System characteristics, user perceptions and behavioral impacts. *International Journal of Man-Machine Studies, 38,* 475-487.
Davis, F. D. (1989). Perceived usefulness, Perceived ease of use and user acceptance of Information Technology. *MIS Quarterly, 13,* 319-342.
Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science, 35,* 292-1003.
de Bruijn, H., & de Nerée tot Babberich, C. (2000). *Opposites attract: Competing values in knowledge management*. Utrecht: Lemma.
de Rooij, J. P. G., Verburg, R. M. Andriessen, J. H. E., & Den Hartog, D. N. (2007). Barriers for shared understanding in virtual teams: a leader perspective. *The Electronic Journal for Virtual Organizations and Networks, 9,* 64-77.
de Wit, D., & Huysman, M. H. (2000). Falling into the ICT trap: The practice of knowledge sharing. In Chauvel, D. and Despres, C. (Eds), *Proceedings of the BPRC Conference on 'Knowledge Management: Concept and Controversies*. Butterworth-Heinemann, Boston, MA.
DeSanctis, G. & Poole, M. S. (1994). Capturing the complexity in advanced technology use: Adaptive Structuration Theory. *Organization Science, 5,* 121-147.
Dixon, N. M. (2000). *Common knowledge: How companies thrive by sharing what they know*. Harvard: Harvard Business School Press.
Doherty, N. F., King, M., & Al-Mushayt, O. (2003). The impact of inadequacies in the treatment of organizational issues on information systems development projects. *Information & Management, 41,* 49-62.
Doyle, C. E. (2003). *Work and organizational psychology: An introduction with attitude*. Hove, East-Sussex, UK: Psychology Press/Taylor & Francis Group.
Duggan, E. W. (2003). Generating systems requirements with facilitated group techniques. *Human-Computer Interaction, 18,* 373-394.
Efimova, L. (2009). *Passion at work*. (Doctoral dissertation.) Novay PhD Research Series, Enschede.
Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review, 14,* 532-550.
Essens, P., Vogelaar, A., Mylle, J., Blendell, C., Paris, Carol, Halpin, S. et al. (2005). *Military command team effectiveness: Model and instrument for assessment and improvement*. Soesterberg: TNO Human Factors.
Forsyth, D. R. (1990). *Group dynamics*. (second ed.) Belmont, California: Brooks/Cole Publishing Company.
Gebauer, J., Shaw, M. J., & Gribbins, M. L. (2005). *Towards a specific theory of task-technology fit for mobile information systems*. Urbana, IL: Working Paper Series, College of Business, University of Illiniois at Urbana-Champaign.
Gediga, G., Hamborg, K.-C., & Düntsch, I. (2002). Evaluation of software systems. In A. Kent & J. G. Williams (Eds.), *Encyclopedia of Computer Science and Technology, Volume 44* (pp. 162-196).
Giddens, A. (1984). *The constitution of society: Outline of the theory of structuration*. Berkeley and Los Angeles: University of California Press.
Golder, S. and Huberman, B. (2006). The structure of collaborative tagging systems. *Journal of Information Science*. *32,* 198–208
Goodhue, D. L. & Thompson, R. L. (1995). Task-Technology Fit and individual performance. *MIS Quarterly, 2,* 213-236.
Grudin, J. (1994a). CSCW: History and focus. *IEEE Computer, 27*(5), 19-26.
Grudin, J. (1994b). Groupware and social dynamics: Eight challenges for developers. *Communications of the ACM, 37*(1), 92-105.
Grudin, J. (2006). Enterprise knowledge management and emerging technologies. In *Proceedings of the 39th Annual Hawaii International Conference on System Sciences*. Computer Society Press.

Hackman, J. R. (1987). The design of work teams. In J. W. Lorsch (Ed.), *Handbook of organizational behavior* (pp. 315-342). Englewood Cliffs, NJ: Prentice Hall.
Hamborg, K.-C., Vehse, B., & Bludau, H.-B. (2004). Questionnaire based usability evaluation of hospital information systems. *Electronic Journal of Information Systems Evaluation, 7,* 21-30.
Hansen, M. T., Nohria, N., & Tierney, T. (1999). What's your strategy for managing knowledge? *Harvard Business Review, 76,* 106-116.
Herskovic, V., Pino, J. A., Ochoa, S. F., & Antunes, P. (2007). Evaluation methods for groupware systems. In J. M. Haake, S. F. Ochoa, & A. Cechich (Eds.), *Groupware: Design, Implementation, and Use, 13th International Workshop, CRIWG* (pp. 328-336). Berlin Heidelberg: Springer-Verlag.
Hibbard, J. (1997, October). Knowing what we know. *Information Week Online*. Retrieved from http://www.informationweek.com/653/53iukno.htm
Hiltz, S. R., Dufner, D., Holmes, M., & Poole, S. (1991). Distributed group support systems: Social dynamics and design dilemmas. *Journal of Organizational Computing, 2,* 135-154.
Holtzblatt, K., & Beyer, H. (1996). Contextual design: Principles and practice. In D. Wixon & J. Ramey (Eds.), *Field methods for software and systems design* (pp. 301-333). New York: John Wiley & Sons.
Horvath, J. A. (1999). Preface: Tacit knowledge in the profession. In R. J. Sternberg & J. A. Horvath (Eds.), *Tacit knowledge in professional practice: Researcher and practitioner perspectives* (pp. ix-xiii). Mahwah, New Jersey: Lawrence Erlbaum Associates.
Howcrofft, D. & Wilson, M. (2003). Paradoxes of participatory practices: The Janus role of the systems developer. *Information and Organization, 13,* 1-24.
Huis in 't Veld, Mirjam A. A., Andriessen, J. H. Erik, & Verburg, Robert M. (2003). E-MAGINE: The development of an evaluation method to assess groupware applications. In S. Kawada (Ed.), *Twelfth IEEE International Workshops on Enabling Technologies: Infrastructure for Collaborative Enterprises* Linz, Austria: IEEE Computer Society.
Hutchinson, C. (1999). Virtual teams. In R. Stewart (Ed.), *Handbook of teamworking*. Aldershot, Hampshire, UK: Gower.
Huysman, M.H. & de Wit, D. (2002). *Knowledge sharing in practice*. Dordrecht, The Netherlands: Kluwer Academic Publishers.
Huysman, M.H., Steinfield, C., Jang, C.-Y., David, K., Huis in 't Veld, M. A. A., Poot, J. J. et al. (2003). Virtual teams and the appropriation of communication technology: Exploring the concept of media stickiness. *Journal of Computer Supported Cooperative Work, 12,* 411-436.
ISO IEC 9126 (1991). *Software product evaluation - Quality characteristics and guidelines for their use*.
ISO IEC DTR 9126-4 (2001). *Software engineering - Product quality Part 4: Quality in use metrics*.
ISO IEC FCD 9126-1 (1998). *Software product quality - Part 1: Quality model*.
Jarvenpaa, S. L. & Leidner, D. E. (1998). Communication and trust in global virtual teams. *Journal of Computer Mediated Communication, 3*(4), 0-0.
Jashapara, Ashok (2004). *Knowledge Management: An integrated approach*. New York: Prentice Hall.
Jenkins, D.P. Stanton, N.A., Salmon, P.M., & Walker, G.H. (2011). Using work domain analysis to evaluate the impact of technological change on the performance of complex socio-technical systems. *Theoretical Issues in Ergonomics Science, 12*(1), 1-14.
Johansen, R. (1988). *Groupware: Computer support for business teams*. New York: The Free Press.
Ju, W. & Leifer, L. (2008). The design of implicit interactions: Making interactive systems less obnoxious. *Design Issues, 24*(3), 72-84.
Kakabadse, N. K., Kakabadse, A., & Kouzmin, A. (2003). Reviewing the knowledge management literature: Towards a taxonomy. *Journal of Knowledge Management, 7*(4), 75-91.

Kane, G.C., & Alavi, M. (2007). Information Technology and Organizational Learning: An investigation of exploration and exploitation processes. *Organization Science, 18, 796-812.*

Karat, John (1997). User-centered software evaluation methodologies. In M. Helander, P. Landauer, & P. Prahbu (Eds.), *Handbook of Human-Computer Interaction* (pp. 689-704). Amsterdam: Elsevier Science.

Kimble, Chris, Hildreth, Paul, & Wright, Peter (2001). Communities of Practice: Going virtual. In Y. Malhotra (Ed.), *Knowledge management and business model innovation* (pp. 220-234). Hershey, USA: Idea Group Publishing.

Kirakowski, J. (1997). MUMMS: Measuring the Usability of Multi-Media Software. Retrieved from http://www.ucc.ie/hfrg/questionnaires/mumms/info.html

Kirakowski, J. & Corbett, M. (1993). SUMI: The Software Usability Measurement Inventory. *British Journal of Educational Technology, 24,* 210-212.

Kittur, A., Suh, B, Pendleton, B.A., Chi, E.H. (2007). He says, she says: conflict and coordination in Wikipedia. In *Proceedings of the SIGCHI conference on Human factors in computing systems* (pp. 453-462).

Knuttila, A. J., Steves, M. P., & Allen, R. H. (2000). Workshop on evaluating collaborative enterprises - Workshop report. In *Proceedings of the IEEE 9th International Workshops on Enabling Technologies: Infrastructure for Collaborative Enterprises (WET ICE)*. IEEE Computer Society.

Kraemer, K. L. & Pinsonneault, A. (1991). Technology and groups: Assessment of the empirical research. In R. E. Kraut, C. Egido, & J. Galegher (Eds.), *Intellectual teamwork: Social and technological foundations of cooperative work* (pp. 373-404). Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Kujala, S. (2008). Effective user involvement in product development by improving the analysis of user needs. *Behaviour & Information Technology, 27,* 457-473.

Kuutti, K. (1996). Activity Theory as a potential framework for human-computer interaction research. In B. A. Nardi (Ed.), *Context and consciousness: Activity Theory and human-computer interaction* (pp. 17-44). Cambridge: MIT Press.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge: University Press.

Legris, P., Ingham, J., Collerette, P. (2003). Why do people use information technology? A critical review of the technology acceptance model. *Information & Management, 40,* 191-204.

Lewis, C., & Norman, D. A. (1986). Designing for error. In D. A. Norman & S. W. Draper (Eds.), *User centered systemsDesign: New perspectives on human-computer interaction.* (pp. 411-432). Hillsdale, NJ: Erlbaum Associates.

Limburg, D. O. (2002). *Making telework a reality: A method for introducing a new way of working into an organisation*. (Doctoral Dissertation). Twente University Press, Enschede.

Lipnack, J., & Stamps, J. (1997). *Virtual teams: Reaching across space, time, and organizations with technology*. New York: John Wiley & Sons.

Lurey, J. S., & Raisinghani, M. S. (2001). An empirical study of best practices in virtual teams. *Information & Management, 38,* 523-544.

Mayer, R. C., & Davis, J. H. (1999). The effect of the performance appraisal system on trust for management: A field quasi-experiment. *Journal of Applied Psychology, 84,* 123-136.

Maznevski, M. L., & Chudoba, K. M. (2000). Bridging space over time: Global virtual team dynamics and effectiveness. *Organization Science, 11,* 473-492.

McDermott, R. (2000). Why Information Technology inspired but cannot deliver Knowledge Management. In E. L. Lesser, M. A. Fontaine, & J. A. Slusher (Eds.), *Knowledge and Communities* (pp. 21-26). Boston: Butterworth-Heineman.

McGrath, J. E. (1990). Time matters in groups. In J. Galegher, R. E. Kraut, & C. Egido (Eds.), *Intellectual teamwork: Social and technological foundations of cooperative work* (pp. 23-62). Hillsdale, New Jersey: Lawrence Erlbaum Associates.

McGrath, J. E. (1993). Time, interaction and performance (TIP): A theory of groups. In R. M. Baecker (Ed.), *Readings in groupware and computer-supported cooperative work: Assisting human-human collaboration* (pp. 116-129). San Francisco, California: Morgan Kaufmann.

McGrath, J. E. & Hollingshead, A. (1994). *Interacting with technology: Ideas, evidence, issues and an agenda*. Thousand Oaks: Sage Publications.

Mintzberg, H. (1979). *The structuring of organizations: A synthesis of the research*. Englewood Cliffs, N.J.: Prentice-Hall, Inc.

Moffet, S., McAdam, R., & Parkinson, S. (2003). An empirical analysis of knowledge management applications. *Journal of Knowledge Management, 7*(4), 6-26.

Moorhead, G. & Griffin, R. W. (1995). *Organizational behavior: Managing people and organizations*. Boston: Houghton Mifflin Company.

Newell, S., Scarbrough, H., & Swan, J. (2001). From global knowledge management to internal electronic fences: Contradictory outcomes of Intranet development. *British Journal of Management, 12,* 97-111.

Newman, V. (1997). Redefining knowledge management to deliver competitive advantage. *Journal of Knowledge Management, 1,* 123-128.

Nielsen, Jacob (1993). *Usability Engineering*. London: Academic Press.

Nielsen, J. & Molich, R. (1990). Heuristic evaluation of user interfaces. In J. Carrasco & J. Whiteside (Eds.), *Proceedings of the ACM CHI 90 Human Factors in Computing Systems Conference* (pp. 249-256).

Nonaka, I. & Takeuchi, H. (1995). *The knowledge-creating company: How Japanese companies create the dynamics of innovation*. New York: Oxford University Press.

Nonaka, I. & von Krogh, G. (2009).Tacit knowledge and knowledge conversion: Controversy and advancement in organizational knowledge creation theory. *Organization Science, 20, 635-652*.

O'Dell, C. S. & Grayson, C. (1998). *If only we knew what we know: The transfer of internal knowledge and best practice*. New York: Free Press.

Orlikowski, W. J. & Robey, D. (1991). Information technology and the structuring of organizations. *Information Systems Research, 2,* 143-169.

Orr, J. E. (1990). Sharing knowledge, celebrating identity: Community memory in a service culture. In D. Middleton & D. Edwards (Eds.), *Collective remembering* (pp. 169-189). London: Sage.

O'Reilly, T. (2007). What is Web 2.0: Design patterns and business models for the next generation of software. *Communications & Strategies, 65,* 17. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1008839

Paroutis, S., & Saleh, A.A. (2009). Determinants of knowledge sharing using Web 2.0 technologies. *Journal of Knowledge Management, 1*(4), 52-63.

Palmer, J. W. & Speier, C. (1998). Teams: Virtualness and Media choice. *International Journal of Electronic Commerce,3*(1), 27-48.

Pinelle, D. & Gutwin, C. (2000). A review of groupware evaluations. In *Proceedings of the IEEE 9th International Workshops on Enabling Technologies: Infrastructure for Collaborative Enterprises (WET ICE)*. IEEE Computer Society.

Pinelle, D. & Gutwin, C. (2008). Evaluating teamwork support in tabletop groupware applications using collaboration usability analysis. *Personal and Ubiquitous Computing, 12,* 237-254.

Prilla, M., & Ritterskamp, C. (2010). The interplay of Web 2.0 and collaboration support systems: Leveraging synergies. In D. Randall & P. Salembier (Eds.), *From CSCW to Web 2.0: European Developments in Collaborative Design, Computer Supported Cooperative Work* (pp. 193-218). London: Springer Verlag.

Polanyi, Michael (1958). *Personal knowledge*. Chicago: University of Chicago Press.

Polanyi, Michael (1966). *The tacit dimension*. London: Routledge & Kegan Paul.

Pontiggia, A. & Virili, F. (2010). Network effects in technology acceptance: Laboratory experimental evidence. *International Journal of Information Management, 30,* 68-77.

Poole, M. S. & DeSanctis, G. (1990). Understanding the use of Group Decision Support Systems: The theory of adaptive structuration. In J. Fulk & C. Steinfield (Eds.), *Organizations and communication technology* (pp. 173-193). Newbury Park, CA: Sage Publications.

Poppe, R. W., Rienks, R. J., & van Dijk, E. M. A. G. (2009). Evaluating the future of HCI: Challenges for the evaluation of emerging applications. In Th. S. Huang, A. Nijholt, M. Pantic, & A. Pentland (Eds.), *Artificial Intelligence for Human Computing* (pp. 234-250). Berlin: Springer Verlag.

Post, W. M., Huis in 't Veld, M. A. A., & van den Boogaard, S. A. A. (2007). Evaluating meeting support tools. *Personal and Ubiquitous Computing, 12,* 223-235.

Preece, J. (2000). *Online communities: Designing usability and supporting sociability*. Chichester: John Wiley & Sons.

Preece, J., Rogers, Y., Sharp, H., Benyon, D., Holland, S., & Carey, T. (1994). *Human-Computer Interaction*. Wokingham, England: Addison-Wesley Publishing Company.

Prilla Ramage, M. (1996). *CSCW evaluation in five types* (Rep. No. CSEG/17/96). Lancaster, UK: Computing Department, Lancaster University.

Rasker, Peter (2002). *Communication and performance in teams*. (Doctoral dissertation). Universiteit van Amsterdam, Amsterdam. Wageningen: Ponsen & Looijen BV.

Ravden, S. J., & Johnson, G. I. (1989). *Evaluating usability of human-computer interfaces: A practical method*. Chichester: Ellis Horwood Limited.

Ribeiro, R., Kimble, C., & Carins, P. (2010). Quantum phenomena in Communities of Practice. *International Journal of Information Management, 30,* 21-27.

Scapens, R. W. (1990). Researching management accounting practice: The role of case study methods. *British Accounting Review, 22,* 259-281.

Scholtz, J., Damianos, L., Greenberg, A., & Kozierok, R. (1999). CSCW 98 Workshop on evaluation of CSCW systems. *SIGGROUP Bulletin, 20*(2)*, 26-30*.

Shih, H.-P. (2005). Extended Technology Acceptance Model of Internet utilization behavior. *Information & Management, 41,* 719-729.

Shin, D.-H. (2010). The effects of trust, security and privacy in social networking: A security-based approach to understand the pattern of adoption. *Interacting with Computers, 22,* 428-438.

Short, J., Williams, E., & Christie, B. (1976). *The social psychology of telecommunication*. London: John Wiley & Sons.

Soekijad, M. & Huis in 't Veld, M. A. A. (2002). Knowledge sharing communities in practice. In J. H. E. Andriessen, M. Soekijad, & H. J. Keasberry (Eds.), (pp. 35-56). Delft: Delft University Press.

Soekijad, M., Huis in 't Veld, M. A. A., & Enserink, B. (2004). Learning and knowledge processes in inter-organizational Communities of Practice. *Knowledge and Process Management, 11,* 3-12.

Solomon, C. M. (2001). Managing virtual teams. *Workforce, 80,* 60-64.

Stanton, Neville A. & Young, Mark S. (1999). *A guide to methodology in ergonomics: Designing for human use*. London: Taylor & Francis.

Steinfield, S., DiMicco, J.M., Ellison, N.B., & Lampe, C. (2009). Bowling Online: Social networking and Social Capital within the organization. In *Proceedings of the fourth Conference on Communities & Technologies,* (pp. 245-254).

Steinfield, C., Jang, C. Y., Huysman, M., Poot, J. J., Huis in 't Veld, M. A. A., Mulder, I. et al. (2001). New methods for studying global virtual teams: Towards a multi-faceted approach. In *Proceedings of the 34th Annual Hawaii International Conference on System Sciences.* Computer Society Press.

Steinfield, C., Jang, C.-Y., & Pfaff, B. (1999). Supporting virtual team collaboration: The TeamScope system. In *Proceedings of the International ACM SIGGROUP Conference on Supporting Group Work* (pp. 81-90).

Swan, J., Scarbrough, H., & Preson, J. (1999). Knowledge management - The next fad to forget people? In J. Pries-Heje, C. U. Ciborra, K. Kautz, J. Valor, E. Christiaanse, D. Avison, & D. Heje (Eds.), *Proceedings of ECIS* (pp. 669-678).
Townsend, A., DeMarie, S., & Hendrickson, A. (1998). Virtual teams: Technology and the workplace of the future. *Academy of Management Executive, 12*(3), 17-29.
Thomas, D., Bostrom, R., (2008). Building trust and cooperation through technology adaptation in virtual teams: Empirical field evidence. *Information Systems Management, 25*, 45-56.
Tullis, T. & Albert, B. (2009). *Measuring the user experience: Collecting analyzing and presenting Usability Metrics*. New York, USA: Morgan Kaufmann Publishers.
Turoff, M., & Hiltz, S.R. (2009). The future of professional Communities of Practice. In C. Weinhardt, S. Luckner, & J. Stösser (Eds.), *WEB 2008, LNBIP 22* (pp. 144-158). Berlin Heidelberg: Springer-Verlag.
Twidale, M. B., Randall, D., & Bentley, R. (1994). Situated evaluation for cooperative systems. In *Proceedings of the ACM Conference on Computer Supported Cooperative Work,* 441-452.
van den Anker, F. W. G. (2003). *Scenarios@Work: Developing and evaluating scenarios related to cooperative work mediated by mobile multimedia communications*. (Doctoral disseration). Delft University of Technology, Delft. Wageningen: Ponsen & Looijen BV.
van den Anker, F. W. G. & Lichtveld, R. A. (2000). Early evaluation of new technologies: The case for mobile multimedia communications in emergency medicine. In C. Vincent & B. Mol (Eds.), *Safety in medicine* (pp. 193-215). Oxford: Elsevier Science.
van den Hooff, B., de Leeuw van Weenen, F., Soekijad, M., & Huysman, M. (2010). The value of online networks of practice: The role of embeddedness and media use. *Journal of Information Technology, 25,* 205-215.
van der Spek, R., & Spijkervet, A. (1997). Knowledge management: Dealing intelligently with knowledge. In J. Liebowitz & L. C. Wilcox (Eds.), *Knowledge management and its integrative elements* (pp. 31-60). Boca Raton, Florida: CRC Press.
Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the Technology Acceptance Model: Four longitudinal field studies. *Management Science, 46,* 186-204.
Venkatraman, N. (1989). The concept of fit in strategy research: Toward verbal and statistical correspondence. *Academy of Management Review, 14,* 423-444.
Verburg, R. M., & Andriessen, J. H. E. (2006). The assessment of Communities of Practice. *Knowledge and Process Management, 13,* 13-25.
Wenger, E. (1998). *Communities of Practice: Learning, meaning and identity*. Cambridge: Cambridge University Press.
Wenger, E. (2001). *Supporting Communities of Practice: A survey of community-oriented technologies*. Retrieved from http://www.archive.nmc.org
Wenger, E., White, N., & Smith, J. D. (2009). *Digital habits: stewarding technology for communities*. Portland, USA: CP Square.
Yin, Robert K. (2003). *Case study research: Design and methods*. (third ed.) Thousands Oaks, California: Sage Publications.
Yuan, Y., Archer, N., Connelly, C. E., & Zheng, W. (2010). Identifying the ideal fit between mobile work and mobile work support. *Information & Management, 47,* 125-237.
Zigurs, I. & Buckland, B. K. (1998). A theory of task/technology fit and group support systems effectiveness. *MIS Quarterly, 22,* 313-334.

Appendices

Appendix I CommShare Commonalities

This list of topics is used to address general aspects of the communities participating in the CommShare project.

Context (what the group is/ has)

- Name of group
- Purpose of the group (practice, group goals, personal goals)
- Size and duration of the group
- Group's structure (roles, structure, hierarchy, formal rules and obligations, facilitators – coordinator, organisational support)
- Origination (management set up or from the ground level up)
- Intraorganisational or interorganisational setting
- Geographical base
- Group identity (does it exist)
- Additional information (statements on trust, groupness, shared understanding)

Processes (what the group does)

- Knowledge sharing, extent and manner
- Cooperation, extent and manner
- Social interaction, extent and what type of social activities communciation, extent and manner
- Types of meetings
    - Frequency of meetings
    - ICT use
    - Other types of activities and activity rate
- Community facilitation (ICT tools availability and use, ICT requirements)

Outcomes

- Effectiveness
- Contributions, benefits and results

General

- Strong and weak points of the community

Respondent

- About yourself (personal information and experience)

Appendix II Overview of Respondents

INTEND - LadderMill C

Code	Type of interview	Role	Organisation	Interviewer
LM1	3 interviews: introductory, mid-term and concluding	Student/ group member	Delft University of Technology	MHV*, JP*
LM2	3 interviews: introductory, mid-term and concluding	Student/ group member	Delft University of Technology	MHV, JP
Other research activities				
	Observations of all group meetings (video meetings, observed from the Dutch side)			MHV, JP
	Weekly: short questionnaires to all group members			

Unilever

Code	Type of interview	Role	Business Unit	Interviewer
U1	Orienting	Manager	Knowledge Mapping and Structuring Unit	EA*, MHV, MS*, JP
U2	Commonalities	Facilitator of Communities	Knowledge Mapping and Structuring Unit	MHV, JP
U3	Commonalities	Facilitator of Communities	Knowledge Mapping and Structuring Unit	MHV, MS
U4	Commonalities	Facilitator of Communities	Knowledge Mapping and Structuring Unit	MS, JP

Delft Cluster

No.	Type of interview	Role	Interviewer
1	Commonalities	Initiator and Facilitator	MHV, MS
2	Commonalities	Facilitator	LW*, MHV,
3	Commonalities	Group Leader	LW, MHV
4	Commonalities	Facilitator	MHV, MS
5	Commonalities	Group member	MHV, MS
6	Commonalities	Group member	MHV, MS
7	Commonalities	Group member	MHV, MS
8	Commonalities	Group member	MHV, MS
9	Commonalities	Group member	MHV, MS
10	Commonalities	Group member	MHV, MS

	Telephone interviews		
11	Common. (short)	Group member	MHV
12	Common. (short)	Group member	MHV
13	Common. (short)	Group member	MHV
14	Common. (short)	Group member	MS
15	Common. (short)	Group member	MS
16	Common. (short)	Group member	MS

Habiforum

Code	Type of interview	Role	Organisation	Interviewer
HF1	Commonalities and success factors	Group leader	MultiSpace	MHV
HF2	Generating requirements for website	Group leader and member core-team	MultiSpace	MHV
HF3	Commonalities and success factors	Group leader	Other community withinin Habiforum	MHV, MS
HF4	Commonalities and success factors	Web-editor	Other Community withinin Habiforum	MHV
HF5	Commonalities and success factors	Consultant	Hired by Habiforum	MHV, MS
HF6	Commonalities and success factors	Consultant	Hired by Habiforum	MHV
Other research activities				
	Participation in meetings of core-team MultiSpace			MHV, MS
	Participation in meetings of community MultiSpace			MHV, MS
	Small questionnaire to community members MultiSpace			MHV, MS
HF-SI	Small interviews at community meetings of Multispace			MHV, MS
	Participation in instructional meeting for community web site			MHV
	Participation in meetings of Overall community			MS

AtosOrigin

code	Type of interview	Role	Interviewer
AO1	Orienting	Manager involved in Knowledge Management	MHV, LW
AO2	Orienting	Manager involved in Knowledge Management	MHV, LW
AO3	Orienting	Manager / Facilitator of NoPs	MHV, LW
AO4	Common.	Business Consultant Knowledge Management	MHV, LW
AO5	Common.	Project Manager / Manager Expertise Group	MHV, LW
	- including visit meeting of EG		
	- CAT tool to members of EG Oracle and EG Projectmanagement		

AO6	Moderator Expertise Groups	MHV, LW
AO7	Comeptence Manager of 12 Expertise Groups	LW
AO8	Moderator Expertise Group	LW
AO9	Leader Expertise Group	LW
AO10	Leader Expertise Group	LW
AO11	Owner Performer Group / Member of several NoPs	MHV
AO12	For several years involved in Knowledge Management activities for AotsOrigin	MHV
AO13	Member of Expertise Group	LW
AO14	Member of Expertise Group	LW
AO15	Member of Expertise Group	LW
AO16	‘Moderator of Moderators’ Performer Groups	MHV
AO17	Member of Performer and NoPs	LW

Online Community

code	Type of interview	Role	Interviewer
OC1	First Scan	Facilitator	MHV
OC2	First Scan	Facilitator	MHV
OC3	Filling out and commenting KSSI	Group member	MHV
OC4	Filling out and commenting KSSI	Group member	MHV
OC5	Filling out and commenting KSSI	Group member	MHV
OC6	Filling out and commenting KSSI	Group member	MHV
OC7	Filling out and commenting KSSI	Group member	MHV
OC8	Semi-structured interview	Group member	MHV
OC9	Semi-structured interview	Group member	MHV
OC10	Semi-structured interview	Group member	MHV
OC11	Semi-structured interview	Group member	MHV

Interviewers:

EA: Erik Andriessen

MHV: Mirjam Huis in ‘t Veld

MS: Maura Soekijad

LW: Linda Wright

JP: Jan Poot

Appendix III Complete list of Success Factors

Groupness

A collection of individuals is more likely to use a facilitating collaborative platform if it meets factors that contribute to a high level of groupness. This section lists Factors that contribute to groupness. The first 6 factors are derived from definition of groupness presented in Chapter 3, the subsequent factors have been identified in the cases.

- High interdependency in goal and task performance of group members (Ch. 3).
- Long period of interaction between group members (Ch. 3).
- Frequent interaction between group members (Ch. 3).
- High continuity of membership (Ch. 3).
- High formality of membership (Ch. 3).
- Small number of people involved (Ch. 3).
- Group members motivated to participate in the group. Motivating factors are:
    - group members interested in interaction with other group members (Ch. 2);
    - a group task which is relevant for the individual members (Ch. 6, HF);
    - an active and inspiring group leader or facilitator (Ch. 6, AO)
    - the possibility to allocate hours and meet in work time (community factor) (Ch. 6, AO);
    - group participation as rating factor in performance interviews (community factor) (Ch. 6, AO);
    - financial support of the group (e.g. providing travel budget) (community factor) (Ch. 6, AO);
    - a balance in effort for and benefit from being a member of the group (which is more likely in groups with homogeneity in expertise) (Ch. 6, AO).
- A cohesive group
  Subfactor is:
    - social events in the group (Ch. 6, AO);
    - group members not largely dispersed (Ch.3).
- Group members having a solid common ground (Ch. 3).
- The group operating in an open knowledge sharing culture (Ch. 3).

Technical efficacy

A collaborative application that meets basic technical criteria is more likely to be successful than an application that does not. This section lists Factors that contribute to Technical Efficacy. First basic software quality characteristics as defined by ISO are presented, subsequently technical characteristics which were identified as relevant in the case studies.

- ISO Characteristics (see Textbox 4-1 for the definitions):
    - Functionality;
    - Reliability (Robustness) ;
    - Usability;

- o (Infrastructural) Efficiency;
- o Maintainability;
- o Portability (Compatibility).

The ISO requirements enclose the technical success factors identified in Chapter 2, these are not separately specified here. Except for the 'Easy access', 'Easy to use' and 'Usefulness' requirements, these are specified under 'Matching the User'.

- Awareness features (Ch. 3).
- Low costs (for purchase, implementation, maintenance and other) (Ch. 6).

Context match – Matching the Uses

A groupware application that matches its users' characteristics is more likely to be used. This section presents Factors that are likely to increase the fit between a collaborative application and its users.

- Users require a collaborative application that is easy to use (user-friendly) (Ch. 2).
- Users require easy access to the collaborative application (Ch. 2; Ch. 6, HF).
  Subfactors are:
  - o group members having access to the application form their own workstation (Ch. 6, HF);
  - o group members regularly using tools from which the application can be accessed (e.g. desktop computers) (Ch. 6, HF).
- Users require a collaborative application that they perceive as useful (Ch. 2).
  Subfactor is:
  - o Users using the same application for the different groups they are member of. (Otherwise they may perceive the different applications as being competitive.) (Ch.2)
- Matching the users involves a match between the individual interest in access to the collaborative application and the technical as well as practical procedure for gaining access (Ch. 6, AO).
  Subfactor is:
  - o Rapidly changing memberships require simple procedures for creating accounts (Ch. 6, HF).
- Different group roles require a collaborative application that supports these roles and supports awareness of these roles (Ch. 6, HF).
- Subgroups require a collaborative application that supports these subgroups (Ch. 2).
- Group members having specific aims or demands towards the application require a collaborative application that supports these aims or meets these demands as much as possible (Ch. 6, HF).

Context match – Matching the task

A groupware application that matches the task is more likely to be used. The application should be useful in supporting task execution; preferably the tool provides an added value in executing the task (in relation to not using the application, or using another application). This section lists factors that are likely to increase the fit between collaborative application and the group task.

- Matching the task implies that an application is not only useful in supporting task execution but also provides an **added value** over existing ways of working (including not using the application) (Ch. 2; Ch. 6 AO, HF).

Subfactors are:
  - the group depends on the application in achieving its goals (e.g., the goals of the group cannot be met by cyclic activity in face-to-face meetings) (Ch. 6, HF);
  - the application is useful in supporting subtasks or processes (Ch. 6, HF);
  - the application supports a task that is central to the user's job or part of a work process (Ch. 6, AO);
  - the application is the only application available that provides task support (Ch. 6, AO).
- Matching the task may entail a collaborative application that guarantees privacy and security. However, this is only done if required, as access rules may hinder easy access.
- Matching the task implies the support of tasks which users consider suitable for ICT mediation (see also support of processes) (Ch. 2).

Context match – Matching the Setting

A groupware application is more likely to be used if it matches the setting in which it is used. This section presents Factors that are likely to increase the fit between the collaborative application and the group setting.
- Groups that cross organisational barriers require a collaborative application that can easily be connected and is not hindered by firewalls (this may hold for different departments in large organisation as well) (Ch. 2).
- Groups that differ in many respects (type of member, structure and culture) and are supported by the same application require a flexible application that is able to fulfil different requirements (Ch. 6, HF).
- Group members that regularly work outside the company buildings require remote access (Ch. 6, AO).

Group support – Support of Processes

A groupware application is more likely to be successfully used if it supports group processes relevant for achieving the group objectives. In some cases an application may not be suitable for supporting the (main) group task; it may however be suitable for supporting related processes, such as coordination between group members. In addition, the application may support group processes that contribute to positive group outcomes that do not directly relate to the task, such as cohesion and trust.

As this thesis focuses on knowledge sharing groups, mainly Success Factors on the support of the knowledge sharing process were identified in this category. In dispersed knowledge groups knowledge sharing is a main task or a supporting process for achieving the main task. If knowledge sharing is the main task of the group, items in the category 'the Support of Knowledge Sharing' can be considered a specification of 'Matching the Task'.

Further, communication is a group process which can hardly be separated from knowledge sharing: one has to communicate in order to share knowledge. However, from the literature and the case studies it is clear that a distinction can be made between sharing knowledge in personal interaction between group members and through using a database.

- The application supports the building of trust, the building of a common ground and a sense of belonging to the group (Ch. 3).
- Matching processes implies the support of processes which users consider suitable for ICT mediation (examples of processes that are perceived as unsuitable for ICT mediation are brainstorming and sharing experiences) (Ch. 2).

Knowledge sharing is supported if:

- a groupware application supports interactions between members and/or central storage of knowledge (Ch. 2);
- active structuring and filtering activities are applied (especially relevant when the application functions as central storage of knowledge) (Ch. 2);
- there is sufficient and relevant content (Ch. 6, HF);
- updates and changes are provided (since ‘last visit’, or since ‘date’) (Ch. 6, AO);
- sufficient group members actively use the application for sharing knowledge (Ch. 6, AO);
- a clear and flexible structure is provided for the content (Ch. 6, AO);
- content is up-to-date (Ch. 6, AO);
- the application supports getting to know your group members. (People are more likely to share knowledge if they know each other.) (Ch. 6, AO).
- the application shows who added what information. (People are more likely to trust one another’s information or knowledge if they know who added it.) (Ch. 6, AO);
- knowledge sharing processes are supported which users perceive as suitable for ICT mediation (Ch. 2).

Group support – Support of Outcomes

A groupware application is more likely to be successfully used if it supports the achievement of group outcomes that contribute to the main objective of the group. Group outcomes are a result of the group context and the group processes. As a consequence, most of the outcomes that are supported by the application are supported through matching the context factors or by supporting group processes. It is still interesting however to identify what types of outcomes are supported by the application, either directly or indirectly.

- The application supports the achievement of specific outcomes (Ch. 7).

Adequate Introduction, Adaptation and Development

Groups are dynamic, they go through several stages and as a result they may adapt to tools or stick to existing interaction patterns. These aspects need attention in the evaluation of the fit between group and collaborative application. The quality of the fit has different implications depending on the stage the group is in. It is for example easier to affect the adaptation process in an early group stage than in a later stage.

- A successful adoption process includes groupware usage pushed by the organisation (Ch. 2).
- A successful introduction of the collaborative application entails time to learn to work with it (Ch. 2).

- A successful adoption process entails careful introduction of the collaborative application to the group for example by hands-on experience in a group meeting (Ch. 6, AH).
- A successful adoption process requires a facilitator or group leader who motivates use of the collaborative application (Ch. 6, HF).
- New group members who join the group require an introduction to the collaborative application (Ch. 6, AO).
- A successful adoption process of the application entails the need for interaction experienced by the group members, even when this implies the change of existing communication structures (Ch. 2).

Appendix IV KSSI as applied in the Online Community

Introduction: The Knowledge Sharing Support Inventory (KSSI) assesses whether the collaborative application you have access to is supporting you in sharing knowledge with your group. Does the ICT setting support you in finding, storing and exchanging knowledge and information with your colleagues?

Depending on the question asked, please give for every single ICT tool a score from 1-5 or 0 where:
1 = not at all; 2 = hardly; 3 = moderately; 4 = much; 5 = very much; and 0 = not applicable; or, choose one of the options provided.

Finding knowledge and information

Give for every single ICT tool a score from 1-5 or 0	CP Square	Telephone conference	E-mail	Telephone
1. a To what extent did the tool support finding information on the topic your group is working on?				
1. b To what extent do you think the tool needs improvements in this respect?				

Choose one of the options provided	everyone	almost everyone	half of the group	a few members	no-one	not applicable
1.c How many groupmembers added information to CPSquare?	5 □	4 □	3 □	2 □	1 □	0 □

Give for every single ICT tool a score from 1-5 or 0	CP Square	Telephone conference	E-mail	Telephone
2. a To what extent did the tool support finding experiences of other people?				
2. b To what extent do you think the tool needs improvements in this respect?				

Choose one of the options provided

		everyone	almost everyone	half of the group	a few members	no-one	not applicable
2. c	How many groupmembers added their experiences to CPSquare?	5 □	4 □	3 □	2 □	1 □	0 □

Give for every single ICT tool a score from 1-5 or 0

		CP Square	Telephone conference	E-mail	Telephone
3.a	To what extent did the tool support finding information on related projects?				
3.b	To what extent do you think the tool needs improvements in this respect?				
4.a	To what extent did the tool support you in finding experts **outside** your organisation?				
4.b	To what extent do you think the tool needs improvements in this respect?				
5.a	To what extent did the tool support you in finding 'background information' from persons in your group?				
5.b	To what extent do you think the tool needs improvements in this respect?				

Visibility of the groups

6.a	To what extent did the tool support getting to know the existence, purpose and activities of the group?				
6.b	To what extent do you think the tool needs improvements in this respect?				
7.a	To what extent is the tool helpful for new-comers in getting an overview of the topics your group is working on?				
7.b	To what extent do you think the tool needs improvements in this respect?				

Interaction with other group members

	Choose one of the options provided	very much	much	moderately	hardly	no at all	not applic.
8.a	To what extent did CPSquare support asking questions to groupmembers?	5 □	4 □	3 □	2 □	1 □	0 □
8.b	To what extent do you think the tool needs improvements in this respect?	5 □	4 □	3 □	2 □	1 □	0 □

	Choose one of the options provided	a day	a week	a month	a year	never	not applic.
8.c	If present, how often did you use the possibility to ask questions on-line?	5 □	4 □	3 □	2 □	1 □	0 □
	I used it more than once						
8.d	How long did it (generally) take to receive an answer?	5 □	4 □	3 □	2 □	1 □	0 □

Access

	Give for every single ICT tool a score from 1-5 or 0	CP Square	Telephone conference	E-mail	Telephone
9.	Did you in general have easy access to the tools?				

10. How many hours per week did you spend on the group? ________________________
11. How many hours per week did you spend using CPSquare? ________________________
12. How many hours per week did you spend using one of the other ICT tools? ________________________

Motivation

	Choose one of the options provided	very much	much	moderately	hardly	not at all	not applicable.
13.	To what extent were you motivated to share your knowledge within the group?	5 □	4 □	3 □	2 □	1 □	0 □
14.	To what extent did you got time to spend on the group?	5 □	4 □	3 □	2 □	1 □	0 □

15.	To what extent were you hindered by your primary tasks to share knowledge with your group?	5 □	4 □	3 □	2 □	1 □	0 □

Concerning content related features

			a day	a week	a month	a year	never
16.	Choose one of the options provided						
a.	How often did you use Stamtafel?	I use it more than once	5 □	4 □	3 □	2 □	1 □
b.	How often did you use Praktijklab?	I use it more than once	5 □	4 □	3 □	2 □	1 □
c.	How often did you use Cybrary?	I use it more than once	5 □	4 □	3 □	2 □	1 □
d.	How often did you use Opkamer?	I use it more than once	5 □	4 □	3 □	2 □	1 □
e.	How often did you use Buitenwereld?	I use it more than once	5 □	4 □	3 □	2 □	1 □
f.	How often did you use Domeinverkenning?	I use it more than once	5 □	4 □	3 □	2 □	1 □
g.	How often did you use Chat?	I use it more than once	5 □	4 □	3 □	2 □	1 □

		Stamtafel	Praktijklab	Cybrary	Opkamer	Buitenwereld	Domeinver-kenning
17.	Give an indication from 1-5 or 0						
a.	To what extent were you satisfied with the **quantity** of the content?						
b.	To what extent were you satisfied with the **quality** of the content?						
c.	To what extent was the content **up-to-date** in your opinion?						
d.	To what extent was the content **complete** in your opinion?						
e.	To what extent was the content **reliable** in your opinion?						
f.	To what extent was the content **conveniently arranged** in your opinion?						

Relative question

Choose one of the options provided	80-100%	60-80 %	40-60 %	20-40 %	0-20 %	not applicable
18. What percentage of the total relevant knowledge and information for your group was **online** available?	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐	0 ☐

Overall opinion

Choose one of the options provided	very much	much	moderately	hardly	no at all	no applicable
19. All in all, to what extent did the total ICT setting provide the knowledge and information you need?	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐	0 ☐
20. All in all, to what extent are you satisfied with the total ICT support?	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐	0 ☐

21. If, in your opinion improvements are needed, could you please mention the most important ones?

____

____

Personal data

22. Are you male (M) or female (F)? __________________
23. What is your age? __________________
24. How many years are you currently working for your organisation? __________________
25. How experienced are you with respect to the grouptask (in years)? __________________
26. How experienced are you in working with IT tools?

____

____

Appendix V Semi-structured interview as applied in the Online Community

Introduction: All information provided by the interviewee will be treated confidentially. The information will be used as input for my PhD research. As a researcher I am not employed or related in anyway to CPSquare.

Personal data

- Current job
- Education/Background
- Experiences with KM related activities
- Experiences with ICT tools/KM tools/Groupware tools
- Experiences with working in virtual groups

Goals and way of working

- What was your goal in participating in the online community?
- What was in your opinion the goal of the group? (Was there a groupgoal or only individual goals?)
- What was your preferred way of working in this group?
- How much time did you spend on working in this group? *(Hours per week)*
- How much time did you spend on using the platform CPSquare? *(Hours per week)*
- Were you motivated to share your knowledge within the group?
- Were any factors hindering you in sharing knowledge within the group?

Other

- Did you know other group members, before the group got started? How many?
- Did your organisation support your participation? How?

The CP Square platform

- What do you think of the platform?
- Which features did you like? Why? (Overzicht van de features laten zien, als men hier niet op komt.)
- Which features not? Why?
- How supportive was the platform in sharing knowledge and information?
- How supportive was the platform in finding knowledge and information?
- How supportive was the platform in adding knowledge and information?

Interaction with group members

- Did you use other media than the CP Square platform and telephone conferencing to interact with groupmembers? If yes, which one, how frequently and why?

Knowledge sharing

- Is knowledge sharing, in your opinion, an important goal for this group?
- In your opinion, to what extent was knowledge being shared in the group?
- What kind of knowledge or information were you looking for? Please mention as much 'kinds' as possible.
- What do you think of the following kinds of information/knowledge?
    - (Recognisable, important, relevant here, is supported by the platform CPSquare)
    - knowledge/information on the group topic
    - experiences from others
    - information on related projects
    - information on project management
    - knowing were to find experts, inside your organisation
    - knowing were to find experts, outside your organisation
    - background information of persons (groupmembers for example)
    - existence and purpose of the group
    - an overview of the topics the groups is working on
    - Is the platform supportive enough in interacting with groupmembers?

Characteristics of information

- What do you think are important characteristics of information?
- In what order would you line these characteristics?
    - quantity
    - quality
    - up-to-date
    - complete
    - trustworthy
    - correct
    - controllable
    - precise
    - conveniently arranged
    - fast insightful introduction to topic

Strengths and weaknesses

- What was a strength of this setting in working together?
- What was a weakness?
- What was a strength of the group?
- What was a weakness of the group?
- What was a strength of CP Square platform?
- What was a weakness of CP Square platform?

Improvements

- In general what could be an important improvement in your opinion?

Appendix VI E-MAGINE applied at !Effective

Evaluation Phase 1

Step 1 Inventory Meeting

Process

The first evaluation step, the Inventory Meeting, consisted of an interview with the contact person of !Effective. The interview was used to gain knowledge of the project teams working for !Effective and of the JIRA application and its functionalities. The meeting was further used to specify the evaluation objectives and plan the evaluation process.

Outcomes

JIRA as an issue management system appears to function relatively well. Project groups supported with this application have had successful outcomes.

However, !Effective the organisation is interested in evaluating its use and identifying improvements. The organisation is especially interested in the possible need for features that support knowledge sharing and interaction processes. The support of JIRA currently focuses mainly on organising software issues and not so much on supporting group interaction processes such as knowledge sharing and co-operation. However, this main support function of JIRA, organising software issues, enables users to interact and share knowledge through use of the tool. Project members use the tool for example to discuss software issues: how to solve them? Currently these types of interactions are more or less creative uses of the tool. The organisation is interested to find out whether it would be worth-while to extend JIRA in order to better support interaction and knowledge sharing processes.

!Effective and the evaluator agreed on an evaluation process as E-MAGINE prescribes it, with one of their recently finished project groups' use of JIRA as object of evaluation. The evaluation process would consist of an interview with the project leader, a survey sent out to the group members and a Focus Group with some group members. The selected project group will function as an example of how the collaborative platform is perceived and used in general at !Effective. It is assumed that improvements for this specific group hold for other project groups in the organisation as well.

Step 2 First Scan Interview

Process

The second step in the evaluation process consisted of an interview with the group leader of the selected project group. The objective of this interview was to gain more detailed knowledge of JIRA and the project group using it. The outcomes will be used to further direct the evaluation process.

Outcomes

The respondent had a good overview of all kind of project and team related issues and of the tool JIRA. In general the respondent was positive about the level of support by JIRA, even more, he was very enthusiastic. He only had a few complaints and suggestions for improvement. For example, he explained that remote access sometimes was a problem using JIRA and that all project groups at !Effetive he knew of had encountered this problem.

One of the issues that became clear from applying the First Scan was that the project group consisted of several subgroups. The respondent explained that all groups at !Effective mainly consisted of software engineers, software testers and software maintainers. Because of the different roles and activities applied in software development projects, the size of project groups fluctuates during the project: software engineers for example do not join from the start, they join after the information analysts have specified the criteria for the software programme. From that moment the software engineers have to be granted access to JIRA. As a consequence project groups changes have different characteristics during their existence. The evaluator decided to focus on the evaluation of the level of support of JIRA during the stage in which the number of group members is the largest. For, JIRA is applied most heavily in that stage.

Outcomes of the interview are described in the First Level Profile. It can be found as an Appendix to this document.

Step 3 Implications of the First Level Profile

In Step 3 implications of the First Level Profile are specified. The evaluation issues identified in Step 2 are basis for these implications. These issues will be specified as evaluation questions which will be assessed in the following evaluation steps. Each of the Evaluation Issues leads to one or more Evaluation Questions. Below the argumentation behind the specification of the questions is presented. Success Factors that are base for E-MAGINE are used to specify these questions.

Evaluation Issue 1

Issue 1. The group appears to have three different types of members with different tasks and roles, they form three subgroups.

Success Factor E and Success Factor F relate to this issue. Success Factor E states that: ‘Different group roles require a collaborative application that supports these roles and supports awareness of these roles’. And Success Factor F prescribes that: ‘Subgroups require a collaborative application that supports them’. According to the respondent the subgroups do not need different support from the tool. His opinion is in contrast with these Success Factors. In the Second Phase of evaluation it is relevant to assess whether the group members have the same opinion as the group leader, or see it differently. This leads to the following Evaluation Question:

Question 1: Do group members of different subgroups have different requirements for JIRA?

<u>*Evaluation Issue 2*</u>

Issue 2: The group leader was unsure how often group members used each of the tools available to them.

This unclearness results in Evaluation Question 2.

Question 2: What is the frequency of use of tools available?

<u>*Evaluation Issue 3*</u>

Issue 3: Remote access is limited from the customer's place; this functions as a hindrance for some group members.

Here Success Factor N of E-MAGINE is not met. Success Factor N states that: 'Group members who regularly work outside the company buildings require remote access'. The respondent explained that problems with remote access cannot be solved by !Effective. Mostly however, if necessary, it can be solved by the client organisation. If group members agree that this is a relevant issue, clients may be persuaded to help to overcome this hindrance. So it will be addressed in the Second Phase of evaluation.

Question 3: Does limited remote access function as a hindrance for group members?

<u>*Evaluation Issue 4*</u>

Issue 4: The quality of content in JIRA highly depends on how the group members use the tool, not on characteristics of the tool. As a consequence of different uses of group members, (other) group members encounter inconsistencies in using the system.

This evaluation issue indirectly resulted from the assessment of Success Factor TE-III, the usability requirement: 'Usability is the capability of the software product to be understood, learned, used and to be attractive to the user, when used under specified conditions'. When addressing usability items the respondent answered that JIRA sufficiently meets usability requirements. However, from discussing the aspect of consistency it became clear that although the application meets the usability requirements, users still encounter inconsistencies when using it (usability includes consistency in use.) Useful content for example can be found at different places in JIRA and it is not easy to gain a quick overview of task relevant information. The respondent argued that these inconsistencies are not the result from qualities of the software, but from the way users apply it. The respondent also suggested to train group members on how to use the tool in order to improve the quality of content. For the Second Phase of evaluation it is relevant to assess whether group members have the same opinion or whether they think improvements can be found in changes of the application.

Question 4: Is training in using JIRA needed to improve the quality of the content of JIRA or can improvements be found in changes of the application?

<u>*Evaluation issue 5*</u>

Issue 5: Most discussions and interactions are linked to the so-called software issues, this may result in issues with long cluttered discussion threads related to it.

JIRA appears to support all kind of interactions, but only in so-called threaded discussions. A relevant question for the Second Phase of Evaluation is: Do these long threads hinder clearness of the issues, or are they useful additions? Actually, evaluation issue 4 relates to this issue. For, these threaded discussions result in useful content being dispersed over different 'places' of the tool. A relevant other question is whether group members have the opinion that more sophisticated interaction support is needed.

Question 5: Do the threaded discussions in JIRA provide sufficiently useful interaction support or is more sophisticated interaction support needed?

<u>*Evaluation Issue 6*</u>

Issue 6: Online awareness might be an interesting optional feature.

A question in the Second Phase of Evaluation is whether group members agree with this suggestion.

Question 6: Is online awareness an interesting optional feature?

Evaluation Phase 2

Step 4 Application of Specific Evaluation Instruments

<u>*Process*</u>

In Phase 2, Step 4, in principle all kinds of group or technology factors might be assessed. The !Effective organisation was interested in improvements of JIRA, including improvements for its knowledge sharing support. This makes The Knowledge Sharing Support Instrument (KSSI) suitable for application in this study. The instrument assesses the quality of knowledge sharing support of a groupware tool.

In addition to the KSSI, the six Evaluation Questions resulting from the First Evaluation Phase should be assessed here. Some of the evaluation questions are covered by the items of the KSSI, or by combinations of these items. Other questions require adjustments of the KSSI. All adjustments are described below. The assessment of Evaluation Questions 3 and 6 is however postponed to the Focus Group (Step 6 of E-Magine). It is expected that a discussion in the Focus Group is more insightful than addressing these questions in a survey. Both questions relate to the fact that remote access is limited at the customer's place. From the First Scan Interview it appeared that not all group members are aware of this and that the quality of remote access also depends on the type of customer. This makes it a complex issue to address in a questionnaire.

E-MAGINE prescribes that the KSSI is adapted as a consequence of the outcomes of the First Evaluation Phase. First adaptations are made by selecting or adapting groups of items in the instrument. The KSSI for example assesses the quality of support for storing knowledge and information as well as the quality of support for interaction between group members. As JIRA is applied for both processes, both groups of items are applied at !Effective. The base version of the KSSI also contains 'motivation questions'. These are left out, as these only indirectly assess motivation by asking questions about time to work on the task and whether working on their primary task hindered cooperation in the team. At !Effective, project members work (almost) full time for the project, motivation is therefore less relevant for the frequency of use of JIRA. Further the question on project management is left out as only one group member is working as project manager. Finally, the questions on finding experts in and outside the organisation and on 'back-tracing who added what' are left out, as JIRA provides a closed working space in which it is clear who can has added what kind of information.

Second, adaptations are made in order to assess the evaluation questions. For Evaluation Question 1 an item is added to identify what role respondents have in the group, this enables the identification of requirements of subgroups. For Evaluation Question 2 no changes are necessary: an item addressing frequency of use is a standard option of the KSSI. Evaluation Questions 4 and 5 are indirectly assessed by the standard version of the KSSI. From the answers to items on the quality of the content and the quality of interaction support, answers to these Evaluation Questions will be derived.
An online survey was used to gain the KSSI data. In total 22 people, all member of the project group under evaluation, were invited to fill out the questionnaire. The invitation message explained the goal of the study. Respondents were further informed that answers to the survey would be treated confidentially: results would only be presented anonymously to !Effective.

In two weeks 12 respondents filled out the online questionnaire. Three other respondents asked for a 'paper version' of the survey, as they had no access to the Internet form their workstation. From the online respondents, 5 quitted at different places in the survey. This was interesting, why did respondents quit halfway the survey? Upon inquiry it appeared that group members perceived it hard to fill out the questions about knowledge sharing support; they did not consider JIRA to be a knowledge sharing tool. In their opinion the questionnaire, or at least some of it's items, was not suitable in this context.

A second invitation was sent to group members who did not complete the survey (including non-respondents). In this invitation it was explicitly stated that the research was initiated to evaluate JIRA and possibly define new functionalities for the application. This new round increased response rate to 55%. However, again 3 respondents quitted half-way through the survey. The set-up of the survey did not enable identification of these respondents. It is therefore unclear whether the same respondents quitted halfway or new respondents (former non-respondents).

<u>Outcomes</u>

The outcomes of the KSSI are discussed under Evaluation Step 5.

Step 5 Construction of the Final Profile

Process

The Final Profile has to provide information on the quality of knowledge sharing support of JIRA. In order to construct the Final Profile first the data of the KSSI were analysed and combined with the results from the First Scan. The analysis thus also needs to inform on the Evaluation Questions that were identified as relevant to assess in Step 4.

In the interpretation of the outcomes of the KSSI especially low and high mean scores and scores with a large variance are taken into consideration. This is also explained in the instructions of E-Magine. Low or high mean scores (with low variance) indicate high agreement in the group on aspects of the setting; these may indicate relevant potential improvements. Mean scores with high variance indicate high disagreement in the group on aspects of the setting; these scores are relevant to discuss in the Focus Group. The KSSI data will also be used to answer Evaluation Questions 1, 2, 4 and 5. If applicable, follow-up evaluation questions are specified as input for the Focus group.

Evaluation Question 1

1. Do group members of different subgroups have different requirements for the tool?

The First Scan revealed that the group consists of three subgroups. To answer the relating Evaluation Question the mean scores for the different subgroups need to be compared. The data of the KSSI were analysed to see whether these different groups had different requirements for the tool. From the 12 respondents, 7 represent the group of software engineers, 2 are information analyst, 3 are a project manager, one is architect and one is a tester. This makes it hard to derive conclusions for the subgroups they represent. However, some tendencies can be described when the data of these twelve respondents are divided into one group of software engineers (N=7) and one group ‘other’ (N=5). Where the ‘other’ respondents have in common that they all are from !Effective. The software engineers on the other hand all, but one, are from other organisations.

The mean scores of the two groups diverge more than one point on two items of the survey, e.g.: ‘To what extent does the tool support gaining knowledge on the purpose of the group’, and ‘To what extent is the tool helpful for new-comers in gaining an overview of activities in your group’. On the first item the mean scores of the software engineers of the other group differ significantly ($t(10) = 2.39$, $p > .95$). However, the mean scores on the importance of improvements on this aspect do not differ significantly ($t(10) = 0.27$, $p < .90$). The same holds for the second item. Where the groups significantly differ in their opinion on the extent of support of the groupware tool ($t(10) = 3.00$, $p > .95$), they do not significantly differ on the relating question about the necessity of improvements ($t(10) = 0.47$, $p < .90$). (See Table Appendix-I for an overview of these scores.)

Based on this analysis a first conclusion would be that these two subgroups do not have different requirements for JIRA. However, they differ in their opinion on the quality of support provided by JIRA for two knowledge sharing activities (gaining knowledge on the purpose of the group and JIRA being helpful for new-comers). The Focus Group now can be used to derive more details on these outcomes.

Table Appendix-1 The scores on four items of the KSSI

		Software engin. (N=7)		**'Other group' (N=5)**		**independent t-test**
		Mean	**sd**	**Mean**	**sd**	
12.	To what extent does the tool support gaining knowledge on the purpose of the group?	2.86	1.07	1.60	0.55	t(10) = 2.39*
13.	To what extent do you think the tool needs improvements in this respect?	2.57	1.13	2.80	1.79	t(10) = 0.27**
14.	To what extent is the tool helpful for new-comers in gaining an overview of activities in your group?	3.43	0.79	1.80	1.10	t(10) = 3.00*
15.	To what extent do you think the tool needs improvements in this respect?	2.71	0.49	2.40	1.67	t(10) = 0.47**

* p <.05 ** p<.01 ***p<.001

Input for Focus Group (1)

- What might be the reason for the different opinions of subgroups about the support of the tool in gaining knowledge on the purpose of the group?
- What might be the reason for the different opinions of subgroups about the importance of JIRA being helpful for new-comers?

Evaluation Question 2

2. What is the frequency of use of tools available?

One item of the KSSI assesses the frequency of use of several applications. Analysis of its outcomes did not lead to very surprising outcomes. E-mail and telephone are as often used as JIRA is: minimal 2-3 times a week, almost always daily. However, there is a large variance in the frequency of use of chat (M=3.00; s=2.00). As is stated in the introduction of this section a large variance in scores implies large differences between group members. Here, it indicates a different interaction style of group members. It is interesting to discuss in the Focus Group how chat is used and to what extent more group members would like to use chat. This should provide information than can be used to decide on improvements and new features.

However, two comments must be made:
As long as employees at the client's location do not have (easy) access to the Internet they are expelled from using chat. In that case, adding this feature might increase the dispersion between group members working at the customer's place and at !Effective. The discussion about the feature of online awareness relates to this chat functionality.

Input for Focus Group (2)
- Is chat an interesting feature for the groups using JIRA?
- Would it lead to a further dispersion between group members and is that acceptable for them?
- What is its relation to online awareness?

Evaluation Question 4

4. Is training in using JIRA needed to improve the quality of the content of JIRA?

Firstly, items on the quality of the content are analysed to answer this Evaluation Question.

In all, the mean scores on the 5 content items were reasonably high (3.42 - 4.08 on a 1-5 scale (not at all-very much)). However, several remarks were made suggesting that the quality of the content depends to a large extent on who adds the information. One respondent for example suggested that people need to be educated to improve their use of the system (resp. 1). Another one adds that comments often are "spur-of-the-moment replies that would benefit from some extra thinking before posting (resp. 2)". Two others also comment that the quality of the content depends on 'who entered it' (resp. 4) and on the 'writing skills of the poster' (resp. X). These remarks were in line with the outcome of the First Phase of evaluation. Apparently not only the group leader, but also (some) group members think the quality of the content can be increased when group members would apply another strategy in using the system. One way to achieve this is to instruct group members. The Focus Group session will be used to further address this issue.

Input for Focus Group (4):
- Is training in using JIRA a suitable way to improve the quality of its content?

Evaluation Question 5

5. Do the threaded discussions in JIRA provide sufficiently useful interaction support?

From the First Scan it appears that JIRA is used to ask questions to group members, after which long threaded discussion may follow. The KSSI is applied to find out how many group members use these threaded discussion to ask questions and how they like it.

The KSSI first addresses the question 'To what extent does JIRA support asking questions to group members?' Answers to this item are very diverse; they range from 1-5 (M=2.4; s=1.4). The same holds for the answers to the next three related questions: 'To what extent do you think JIRA needs improvements in this respect?'; 'How often do you use JIRA to ask questions to group members?' and 'How long does it (generally) take to receive an answer?' From the answers to these questions it appears that group members hardly use JIRA to ask questions (M=4,2 i.e., somewhere between monthly (4) and never (5)) and that they share the opinion that the tool is not supportive for asking questions (M=2.4; s=1.4). The mean score on the related 'improvement question' is also low (M=2,3 ; s=1,15). Apparently group members do not think improvements are needed.

However, it also appears that the question was not specific enough. One respondent commented: "Features like asking questions through JIRA are as yet undiscovered by me. (Resp. X)" The respondent is right, a specific feature is not available. Line of argument behind the items is that the tool is applied to ask questions *although* it is not so suitable doing that. Actually, the intention was to assess the extent of 'adapted tool use'. Analysis of their outcomes should have indicated how many group members apply JIRA in this way, although it is not specifically designed for it. This unclearness may have contributed as well to the large diversity in answers. Group members may have interpreted the items differently.

In all, from the answers to the items on 'asking questions using JIRA' it does not become clear whether the resulting long threads hinder working with issues. However, these threaded discussions are part of the content of JIRA. And from the items relating to the content of JIRA it appeared that some group members have the opinion that content could be more carefully added. Therefore it was decided to link the discussion in the Focus Group on this issue, interaction support, to Evaluation Question 6, which addresses the quality of content.

In all, Evaluation Question 5 not really can be answered by the KSSI. Improvements in interaction support do not seem to be necessary, however, group members complain about other group members inaccurately adding data.

Input for Focus Group (5)

- Ask for specification; how is JIRA used to ask questions?
- are threads under issues used to ask questions?
- Should JIRA be improved and made more suitable for interaction and asking questions, why and why not?
- If yes, what are possible solutions for interaction support?

Other results of the survey: Scores on 'improvement questions'

An interesting result from the KSSI survey concerns the scores on the seven 'improvement' questions'. The survey assesses for several aspects of JIRA 'To what extent does JIRA need improvements in this respect'? High scores on these questions suggest specific improvements for the tool. Two of these seven questions share the highest sore, a mean score of almost 3. These questions relate to the 'support of finding information' (M=2.9; s=0.8) and to 'finding information on related projects' (M=2.9; s=2.1). A mean score of 2.9 on a 5-point scale is not very high, suggesting improvements are not so much considered necessary. However, the variance in the scores on the last question is large (s=2.1). This implies that opinions highly differ and a closer look indeed reveals that scores range from 1-5. This is enough reason to discuss this issue during the Focus Group session.

Input for Focus Group (7)

- Is it useful to improve 'finding information on related projects' via JIRA?

Other results of the survey: Directions for improvements suggested in comments

The following lists provide an overview of comments (quotes) in the KSSI not discussed so far. The comments and answers to open questions are clustered into three categories: 1) Search and filter options, 2) Functionalities, and 3) Usability. Comments in the categories are listed in the Appendix. In each category a concluding remark is made that will be addressed in the Focus Group, these remarks are presented here as well:.

-

Search and filter options (including suggestions for related features)
- filtering could be made more intuitive (Resp.2)
- As stated before, filtering, grouping and searching functionality (Resp. 2)
- advanced search options (Resp. 3)
- The search option did not work well (Resp. 8)
- Using filters in JIRA takes a lot of time, especially with large databases. I mostly export unfiltered overviews to Excel, and use Excel filters. JIRA could improve a lot in filtering functions. (Resp. 9)

Input for Focus Group (8):
- What search and filter options would be advisable for the tool JIRA?

Functionalities
- Each issue is/can be commented with user experiences, thoughts, changes, etc. It should be possible to make comments mandatory when making changes to an issue. (Resp. 1)
- Improved 'creating issues' process with checks on content. (Resp. 1)
- Statistical analysis of the issue process (Resp. 1)
- search and filter attributes should be expanded (Resp. 3)
- expanded workflow (Resp. 3)
- integration with planning tools (Resp. 3)
- ability to change comments once entered (Resp. 4)
- Better Relationship between projects (Resp. 5)
- Better overview of the groups (incl. background information) (Resp. 5)
-

Input for Focus Group (9):
- The functionalities suggested will all be discussed in the Focus Group.

Usability
- Comments cannot be modified once entered (Resp. 4)
- Overviews with complete contents and comments are very hard to generate, and take a considerable amount of time. A total of 30 issues is generated in this way, when all you see is the first 20. Generating again on the next page results in doubling 10 issues. This is time consuming, generating reports in this way is a must when there’s no Internet connection available. (Resp. 9)
- Usability of JIRA could improve. (Resp. 9)
- We have had a lot of problems with JIRA. Mostly these problems resulted in generating wrong percentages in the general overview, and the right ones in the filtered overviews, but at some time we have lost a couple of days’ input, due to a database crash. Maybe this is not the result of using JIRA, but it sure cost a lot of time and confusion. (Resp. 9)

Input for Focus Group (10):
- The usability issues specified will all be discussed in the Focus Group

Other results of the survey: Are group members enthusiastic about JIRA?

For the evaluation of JIRA, the answer on item 27 of the KSSI is the most relevant: *'In all, to what extent are you satisfied with JIRA?'* The mean on this item is relatively high and variance is low (M=3.58; s=0.27) indicating that respondents are 'moderately' to 'much' satisfied with JIRA and that they highly agree on this total evaluating score.

Phase 2 – Step 6

The last step in the evaluation process is a Focus Group session with some group members. The intention of this Focus Group is to verify the results of the earlier applied evaluation instruments, to discuss possible contradicting requirements and to identify and prioritise improvements.

Evaluation issue 1

The three different group roles are confirmed in the group. The employee responsible for maintaining the application adds that the role of 'maintenance' might be added to the list of three roles. As a maintainer he has different aims as well.

It appeared that JIRA provides a feature that can be used to share information on the group topic. However this feature was never used. It appeared that not all group members were aware of this feature. In addition, some group members had been working for confidential projects, where this type of information could not be shared. These seemed to be the reason for different opinions in the group about usefulness of finding information on the group. The feature might be used in the future for those groups not working on confidential projects.

Evaluation issue 2

It appeared that group members thought chat might be nice as new feature. However, they also expected that if chat was implemented, too much information only would be shared in a small sub group of the project group.

Evaluation issue 3:

In the meeting it is confirmed that some of the group members working outside !Effective, do not have always access to the project environment. Most group members present do not see why this is a problem. However, these members usually work at the office of !Effective, and not at the customer's place, where this problem mostly occurs. As a consequence they do not experience related problems themselves.

The evaluator explained that differences in access to the application might have a so-called ingroup-outgroup effect. It appeared that not all group members had realised this. Group members present agree that if possible this problem should be solved. This implies that the customer needs to be informed and sometimes to be convinced to cooperate. Based on their experiences group members thought the problem was not only technical. For, they knew of cases, where colleagues could not be granted access, while access for software maintainers could be organised in a later phase.

<u>Evaluation issue 4</u>

The question about the quality of content confirmed that this quality indeed depends to a large extent depends on how the group members provide input. In the group discussion three possible solutions for this problem were identified.

1) Building in software checks for input. For example a form with obligatory fields. Problem with this solution is that such forms are hard to standardise, relevant fields highly depend on the type of project.
2) Change procedure for adding content. For example by making one delegate of each sub group responsible for adding content. Fro example, one of the tester adds test to JIRA and other tester are not provided with writing rights. It is however not a very practical way of working.
3) Training group members However, when the project starts it is not clear who is going to collaborate. Additionally, groups size increases rapidly during the project. To overcome these problems online training might be a solution. At least, it should be something more attractive than the currently available manual. This manual is hardly used by group members.

<u>Evaluation issue 5</u>

Group members present acknowledged that indeed JIRA is applied to ask questions to group members. And indeed, mostly the discussion threads related to the issues are applied for this aim. In some cases this results in long threads, where sometimes even the project leader interferes and stops the discussion.

It further appeared that group members present apply different manners to ask questions to other group members. Some frequently apply the telephone, others apply JIRA. From the discussion a distinction between two types of questions appears relevant: 1) Asking a question to a specific group member or 2) asking a question to a random group member. In the first case the most applicable manner is chosen, depending on the relation between the two group members at hand. Group members present agree that a feature supporting 'asking a question to the group' would be convenient for the last type of questions.

In the discussion of this evaluation issue group members present become more convinced that being online and having continuous access to the application makes a difference. For, at the moment someone is not online, he can not be reached by other group members using JIRA.

<u>Evaluation issue 6</u>

The discussion on evaluation issues 6 was combined with the discussion on evaluation issue 3.

<u>Other evaluation issues</u>

The other evaluation issues where discussed as well. This resulted in a few useful comments.
- The reporting feature (that can generate a project status) of JIRA could be improved.
- Creating issues might be improved by software checks for input. Another option may be allowing making chances after an issue is submitted.

What problems in using JIRA were missed?

A last question of the evaluator was whether group members had missed some evaluation issues.

1) Stability

   The group leader mentioned the issue of stability of the system into the group discussion. We had discussed this issue in the First Scan interview as well. However, I had understood it was not a problem anymore. Group members agreed that most stability problems were solved.

2) Compatibility

   Other group members brought forward that JIRA is not always compatible to other software formats (such as 'pdf' or 'xml'). However, not all group members acknowledged this problem. It may be relevant to identify how many group members have experienced this compatibility problem.

3) Releases

   One group member asks whether JIRA can be completed by adding release numbers to data. This would be very useful for the personal planning of software maintainers. .

First Level Profile of !Effective

In this section the First Level Profile of the project team of !Effective is presented. This First Level Profile is generated based on the First Scan interview with the group leader of the project team evaluated at !Effective.

About THE GROUP - Input Characteristics

I-III Related to the task

The main group task is software development. JIRA has been used since spring 2003 to support this task. Concerning this task three group roles can be discerned, e.g.: software engineer, software tester, and software maintainer. The group task, software development, is a critical process for !Effective, the organisation the group is working for. Software development is the core business of this organisation. For group members who are software engineers this is their main task and often the only task they are involved in. For group members who are software maintainers this is not always the case.

<u>*Evaluation Issue 1*</u>

The group appears to have three different types of members with different tasks, they form three subgroups. (This finding relates to Success Factor E and F.)

I-I Related to the group members

The constellation of the group is changing during its existence: Software engineers are involved after software architects have finished the design. The group is very diverse in age and experience. However, all of its members have much experience with IT tools.

About THE COLLABORATIVE TOOL - Process support

1. Which of the following ICT tools/features are available to communicate and share knowledge within the group?
   For those available, how often are they used in general?

		not available	daily	weekly	monthly	annually	never
A	E-mail	0 □	5 x	4 □	3 □	2 □	1 □
B	Telephone	0 □	5 x	4 □	3 □	2 □	1 □
C	Fax	0 □	5 □	4 □	3 □	2 x	1 □
D	Video Conferencing	0 □	5 □	4 □	3 □	2 □	1 x
E	Chat/Short Message	0 □	5 □	4 □	3 □	2 □	1 □

F	Company Intranet	0 □	5 □	4 □	3 □	2 □	1 □
G	Discussion list	0 □	5 □	4 □	3 □	2 □	1 x
H	Bulletin board	0 □	5 □	4 □	3 □	2 □	1 x
I	Group Calendar	0 □	5 □	4 x	3 □	2 □	1 □
J	Shared document database	0 □	5 □	4 □	3 □	2 □	1 □
K	Yellow Pages (List of people and their expertise)	0 □	5 □	4 □	3 □	2 □	1 x
L	Groupware to jointly work on documents (Co-editing)	0 □	5 □	4 x	3 □	2 □	1 □
M	Shared project planning tool	0 □	5 □	4 □	3 □	2 □	1 x
N	Shared white-board / application sharing system	0 □	5 □	4 □	3 □	2 □	1 x
O	Group decision support system	0 □	5 □	4 □	3 □	2 □	1 x
P	Other, please specify	-	5 x	4 □	3 □	2 □	1 □
	JIRA, constantly used. Notification, frequently used.						

Evaluation Issue 2

The group leader was unsure how often group members used each of the tools available to them.

I-IIa Increase number of accounts

It is possible to increase the number of accounts, however only the administrator can do this. The procedure works sufficiently.

I-IIa Standards

The standards that have to be met are met.

I-IIa Costs

The project leader did not know much about costs. It became clear however that in general it is cheaper to buy something new than to develop it in the company.

I-IIa Compatibility

Members of software maintenance, mostly working at the customer's place, have to go to a central computer to gain access. Sometimes an exception can be made but in general they do not have access to the internet from their workstation. To some extent – moderately – this is a problem. So, remote access to JIRA is limited.

Evaluation Issue 3

Remote access is limited from the customer's place; this functions as a hindrance for some group members. (Relates to Success Factor N.)

I-IIa Security

Security is taken care of. In case the firewall 'breaks down' remote access is immediately excluded.

I-IIa Privacy

Privacy is not so relevant for JIRA.

I-IIb Functionality

In first instance the robustness of JIRA was a large problem: the system often broke down. These problems are solved now.

I-IIb Technical efficacy

From inside !Effective JIRA is easily accessible and in general the tool provides the features expected.

I-IIb Usability

People using JIRA are experienced in using ICT. Usability issues form no hindrance for using the system. In training sessions more attention is needed for explaining *how* the tool should be used to support the process of software development. Therefore the tool itself cannot be judged with respect to consistency, the level of consistency depends on the way people use the tool.
It is possible to mark issues in the tool in such a way that you will be informed when things with respect to these issues change.
The facilitator has more access rights than other members. He can for example prioritise an issue or delegate it to one of the project members.

Evaluation issue 4

The quality of content in JIRA highly depends on how the group members use the tool, not on characteristics of the tool. As a consequence of different uses of group members, (other) group members encounter inconsistencies in using the system.

I-IIb Awareness

The tool indirectly informs group members about the progress of the project. Every issue can lead to a threaded discussion. When an issue (e.g., a software bug) is not solved yet, its related discussion often shows why. However, these threads may become very long and as a consequence cluttered.

Evaluation issue 5

Most discussions and interactions are linked to the so-called issues, this may result in issues with long cluttered discussion threads related to it.

It is argued that it might be handy to see who is on-line. It makes you aware of whether group members can see your 'problem'.

The systems shows what everyone is working on (or at least is supposed to be working on) by showing who is responsible for what issue and informing whether certain issues have been solved. JIRA shows updates and changes using graphics.

Evaluation issue 6

Online awareness might be an interesting optional feature.

Match TOOL - GROUP - CONTEXT

C-G Related to context in general

According to the respondent the tool provides very much what is needed to support the group in accomplishing its task.

Support of Outcomes

The tool supports building trust and a solid common ground for it supports interaction processes such as giving feedback and asking questions – in threaded discussions related to so-called ‘issues’ – if something is not clear.

The tool supports cost savings, for it supports arranging good and workable agreements. It prevents forgetting issues, provides clearness within the project group, as well as towards the customer. In that way it prevents frustrations.

About THE GROUP – part 2 -

I-IV Related to physical distribution

The group is nationally dispersed: most group members work at the office of !Effective,others at the customers place. Group members working at !Effective meet regularly, often daily. Further two-weekly face-to-face meetings are organised. Frequent interactions are often bound to the three subgroups that exist within the project (software engineers, software maintainers and software testers).

I-V Related to group structure

The group has been set up by management. The project manager decides who can join the project group. Most group members are from !Effective, some from Ordina, others from the customer and a few are free-lancers. The administrator has to organise access to JIRA for these group members. The group is mixed with respect to experience in software development. Everyone is about equally active in participating.

6.	Does the group have a formal facilitator/co-ordinator?	yes 2 x	no 1 □

	If **yes**, to what extent is the co-ordinator active in the following activities?	very much	much	mode-rately	hardly	not at all
a.	Organising meetings -	5 □	4 x	3 □	2 □	1 □
b.	Stimulating members to participate in the group - - -	5 □	4 x	3 □	2 □	1 □
c.	Sharing his/her own expertise within the group - - - -	5 x	4 □	3 □	2 □	1 □
d.	Connecting the group members with each other - - -	5 □	4 x	3 □	2 □	1 □
e.	Making external contacts - - - - - - - - - - - - - - - - - -	5 □	4 x	3 □	2 □	1 □
f.	Promoting the group towards management - - - - - - -	5 □	4 x	3 □	2 □	1 □
	Is the tool supportive in the following activities?					
a.	Organising meetings -	5 □	4 x	3 □	2 □	1 □
b.	Stimulating members to participate in the group - - -	Not applicable				
c.	Sharing his/her own expertise within the group - - - -	5 □	4 x	3 □	2 □	1 □
d.	Connecting the group members with each other - - -	5 □	4 □	3 x	2 □	1 □
e.	Making external contacts - - - - - - - - - - - - - - - - - -	5 □	4 □	3 x	2 □	1 □
f.	Promoting the group towards management - - - - - - -	5 □	4 □	3 x	2 □	1 □

The tool made clear that there were 1200 issues that had to be worked on and solved. This seemed much more than ever before in other projects. However, no-one before had tracked in so much detail all the work that had to be done (and in the end, thus, has been done.) Some features can only be used by the project manager, this holds for example for prioritising a certain issue.

The group has different subgroups, these do not need different support from the tool. Except that one part of the group focuses more on uploading issues and the other part more on reading these issues in order to know what they have to do.

I-VI Related to group culture

According to the respondent the groups operate in an open 'knowledge-sharing' culture. People are generally enthusiastic and motivated to participate and willing to share information and knowledge.

Lifecycle

The group existed almost one year from March 2003 till January 2004. The group has been dissolved, the issues will be removed from the tool and it only will be used to keep track of bugs and upgrades.

Processes

P-IV Related to social interaction

In total three face-to-face meetings were organised.

P-G Processes in general

1. Which of the following activities happen at the group (you can tick as many as appropriate)?

	often/regularly	seldom	not
a) Meetings -	3 x	2 □	1 □
b) Talks about experiences -	3 x	2 □	1 □
c) Presentations by members - - - - -- - - - - - - - - - - - - - - - -	3 x	2 □	1 □
d) Presentations by non-members - - - - - - - - - - - - - - - - -	3 □	2 x	1 □
e) Workshops or brainstorming - - - - - - - - - - - - - - - - - - -	3 x	2 □	1 □
f) Excursions -	3 □	2 □	1 x
g) Writing publications -	3 □	2 □	1 x
h) Doing concrete projects -	3 x	2 □	1 □
i) Preparing for new projects for customers - - - - - - - - - - -	3 □	2 x	1 □

Outcomes

O-I + O-II + O-III; Related to Outcomes on individual, group and organisational level

1. What objectives has the group to meet to be successful?
   The group has to develop a software product within the boundaries of budget and time.

2. Does the group meet these objectives in your opinion?
   Very much. The group was very successful, especially compared to former projects.

3. To what extent do you think the group has contributed to:

		very much	much	moderately	hardly	not at all
a.	the development of new ideas to the organisation - - - - - - - It resulted in new technical ideas as well as ideas for improving the collaboration with the customer.	5 □	4 □	3 □	2 □	1 □
b.	developing standards, new methods or 'best practices' for the company- Working so conscientiously resulted in a large added value.	5 □	4 □	3 □	2 □	1 □
c.	the documentation of new information for the company, such as knowledge systems, manuals, training instructions or requirements for new products Almost everything is documented conform the project management system that is applied in !Effective Prins II. The architect has the task of remembering more technical aspects.	5 □	4 □	3 □	2 □	1 □

Other

1. In your opinion what are the strong points of the group?
   Group members were very enthusiastic, it was a good mix of different types of people (concerning knowledge level, experience with software development, age, background and preferred way of working.)

2. In your opinion what are the weak points of the group?
   A somewhat more light-hearted working atmosphere might improve it. Especially when the group has its largest size. And the involvement of 'late groupmembers' might be increased.

Concluding

JIRA is a supportive tool for software development; it relatively well supports the main task of this dispersed group. The group leader is very enthusiastic about the quality of support of JIRA. It will be interesting to determine whether group members agree with him. In addition to the six specific Evaluation Issues that were a direct outcome of this First Scan, two other elements seem especially interesting in this respect.

Especially evaluation issues 4 and 5 address interesting aspects of the application. These both relate to aspects of the quality of content in JIRA, such as its clearness, completeness and organisation. According to the respondent this quality highly depends on the way the group members use the tool. Do group members agree in this respect? Or can improvements also be found in changes in the tool? As the content is central in the collaboration process, the quality of the content is very important the group. The respondent further claims that JIRA is used to ask questions to each other, although the tool is not very does not explicitly support interaction. Do group members indeed use the tool to interact, ask questions etcetera and are they interested in the implementation of more sophisticated interaction support?

Evaluation issue 1

The group appears to have three different types of members with different tasks and roles, they form three subgroups. (This finding relates to Success Factor E and F.)

Evaluation issue 2

The group leader was unsure how often group members used each of the tools available to them.

Evaluation issue 3

Remote access is limited from the customer's place; this functions as a hindrance for some group members. (Relates to Success Factor N.)

Evaluation issue 4

The quality of content in JIRA highly depends on how the group members use the tool, not on characteristics of the tool. As a consequence of different uses of group members, (other) group members encounter inconsistencies in using the system.

Evaluation issue 5

Most discussions and interactions are linked to the so-called issues, this may result in issues with long cluttered discussion threads related to it.

Evaluation issue 6

Online awareness might be an interesting optional feature.

KSSI as applied at Effective

Delft University of Technology are currently conducting a research project into how people use ICT tools to collaborate and share knowledge within organisations. Because !Effective is interested in the level of support the tool JIRA supplies, this organisation is participating in this study. Please fill out this questionnaire to help us gain more information on the support of JIRA for software development processes.

The survey will be treated entirely confidential and its results will anonymously be presented to !Effective. The results might help to further increase the quality of support of JIRA.

If you have any problems completing this questionnaire please contact Mirjam Huis in ‘t Veld who will be happy to help you.

1. How often do you use the following tools?

	daily	2-3 times a week	weekly	monthly	never	not available
JIRA	1 □	2 □	3 □	4 □	5 □	6 □
Intranet –Line of competence-	1 □	2 □	3 □	4 □	5 □	6 □
E-mail	1 □	2 □	3 □	4 □	5 □	6 □
Telephone	1 □	2 □	3 □	4 □	5 □	6 □

Further questions all concern JIRA, the tool that is used to support software product development within !Effective. If you are not using JIRA at this moment please refer to the last project you were involved in. With ‘group’ we mean the project group of this software development project.

	not at all	hardly	moderately	much	very much
2. To what extent does JIRA support finding information on the topic your group is working on?	1 □	2 □	3 □	4 □	5 □
3. To what extent does JIRA need improvements in this respect?	1 □	2 □	3 □	4 □	5 □

	N o-one				Everyone
4. How many groupmembers add information to JIRA?	1 □	2 □	3 □	4 □	5 □

		not at all	hardly	mode-rately	much	very much
5.	To what extent does JIRA support finding experiences of other people?	1 □	2 □	3 □	4 □	5 □
6.	To what extent does JIRA need improvements in this respect?	1 □	2 □	3 □	4 □	5 □

		no-one				everyone
7.	How many group members add their experiences to JIRA?	1 □	2 □	3 □	4 □	5 □

		not at all	hardly	mode-rately	much	very much
8.	To what extent does JIRA support finding information on related projects?	1 □	2 □	3 □	4 □	5 □
9.	To what extent does JIRA need improvements in this respect?	1 □	2 □	3 □	4 □	5 □
10.	To what extent does JIRA support finding 'background information' from persons in your group (such as their expertise)?	1 □	2 □	3 □	4 □	5 □
11.	To what extent does JIRA need improvements in this respect?	1 □	2 □	3 □	4 □	5 □
12.	To what extent does the tool support gaining knowledge on the purpose of the group?	1 □	2 □	3 □	4 □	5 □
13.	To what extent does JIRA need improvements in this respect?	1 □	2 □	3 □	4 □	5 □
14.	To what extent is the tool helpful for new-comers in gaining an overview of activities in your group?	1 □	2 □	3 □	4 □	5 □
15.	To what extent does JIRA need improvements in this respect?	1 □	2 □	3 □	4 □	5 □
16.	To what extent does JIRA support asking questions to your group members?	1 □	2 □	3 □	4 □	5 □
17.	To what extent does JIRA need improvements in this respect?	1 □	2 □	3 □	4 □	5 □

		daily	2-3 times a week	weekly	monthly	never
18.	How often do you use JIRA to ask questions to group members?	1 □	2 □	3 □	4 □	5 □

		one day	one week	less than a day	more than one month	not applicable
19.	How long does it (generally) take before you receive an answer?	1 □	2 □	3 □	4 □	6 □

JIRA contains ‘content’ such as issues and related information. The following five questions relate to this content.

		not at all	hardly	moderately	much	very much
20.	Are you satisfied with the **quality** of the content? If not , please comment	1 □	2 □	3 □	4 □	5 □
21.	Are you satisfied with the **clearness** of the content? If not , please comment	1 □	2 □	3 □	4 □	5 □
22.	Are you satisfied with the **organisation** of the content? If not , please comment	1 □	2 □	3 □	4 □	5 □
23.	Are you satisfied with the content’s **relevance** for your tasks? If not , please comment	1 □	2 □	3 □	4 □	5 □
24.	Are you satisfied with the content’s **completeness**?	1 □	2 □	3 □	4 □	5 □

		0-20 %	20 – 40 %	40-60 %	60-80 %	80-100%
25.	What percentage of the total relevant knowledge and information for your group is available in JIRA?	1 □	2 □	3 □	4 □	5 □

		not at all	hardly	moderatel y	much	very much
26.	All in all, to what extent does JIRA provide the knowledge and information you need?	1 □	2 □	3 □	4 □	5 □
27.	All in all, to what extent are you satisfied with JIRA?	1 □	2 □	3 □	4 □	5 □

28. If, in your opinion improvements are needed, could you specify the most important ones?

____

____

The final seven questions concern personal information. From these questions providing your name is optional. However, as explained before, we guarantee that your information will be anonymously applied.

29. What is your name? _________________________

30. Are you male or female? 1 □ male 2 □ female

31. What is your age?

20-29	30-39	40-49	50-59	>=60
1 □	2 □	3 □	4 □	5 □

32. What organisation are you working for? ______________________________

33. How many years have you been working for this organisation? ______________________________

34. How experienced are you with respect to software development (experience in years)? ______________________________

35. What was your role within the software development project?

software engineer	tester/test coordinator	architect	information analyst	project manager	other, please specify beneath
1 □	2 □	3 □	4 □	5 □	6 □

Appendix VII E-MAGINE: An Evaluation Method to Assess Groupware In Use

Instructions and instruments

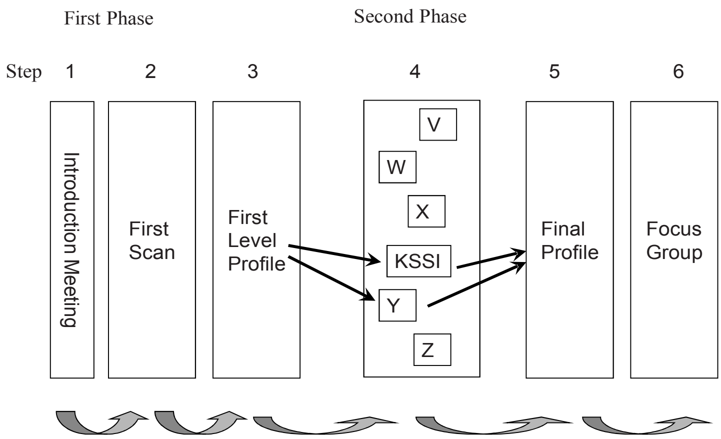


Figure VII-1 The E-MAGINE evaluation process

Table VII-1 Steps in E-MAGINE

		What	Whom	Result
Phase 1	**Step 1**	Inventory Meeting	Client and Evaluator	Evaluation plan
	Step 2	First Scan Interview	Evaluator and Group leader	First Level Profile
	Step 3	Implications of First Level Profile	Evaluator and Group leader/Client	Choice of Evaluation Instruments
Phase 2	**Step 4**	Application of Specific Evaluation instruments	Evaluator and Group members	Evaluation data
	Step 5	Data analysis and Interpretation	Evaluator	Final Profile
	Step 6	Focus Group	Evaluator, Group members, and Client	Finished Evaluation

Evaluator / Interviewer

E-MAGINE suggests the evaluator to be someone who has background knowledge of group dynamics, groupware applications and usability evaluation. The evaluator should further be capable to execute interviews and Focus Groups. More specifically, the interviewer applying the First Scan should know of the Success Factors underlying the First Scan (addition, based on findings in Chapter 9).

Evaluation Steps – Phase 1

Step 1 Inventory Meeting

The evaluation process starts with an Inventory Meeting of the evaluator and someone from the client organisation in order to specify the evaluation goal and to gain agreement on the evaluation steps. The meeting further should provide some first insights into the groupware application and the group supported with it. The Inventory Meeting results in an Evaluation Plan, describing the Evaluation Steps and the respondents that can be approached.

The Inventory Meeting should also entail a specification of how the client perceives successful use of the application. Is high frequency of use a criterion, or are other criteria relevant? (*addition, based on observations in Chapter 6*).

In case the organisation demands evaluation of a groupware application that is used by many groups, the Inventory Meeting should also be used to decide on a selection procedure for selecting representative group. The suggested selection procedure is as follows: First, identification of groups in the organisation that are provided with the groupware application. Second, the generation of rough descriptions of these groups on aspects such as tasks, size, structure and use of the groupware application. Third, a selection of one or more groups based on the outcomes of this scan. This selection should represent (groups of) all the groups identified. The evaluation outcomes subsequently have to be interpreted, in line with this selection processes (addition, based on findings in Chapter 9).

Step 2 First Scan Interview

Next step in the E-MAGINE evaluation process is a First Scan Interview with the group leader of the group under evaluation. The main purposes of the First Scan are to:

1) identify whether the groupware application is used, what functionalities of the application are used, to what extent, and by whom;
2) assess Factors that facilitate the use of the groupware application;
3) describe the context-of-use of the groupware application;
4) direct the evaluation process in the Second Phase of E-MAGINE.

For the First Scan Interview, the 'First Scan' is developed, a questionnaire structurally addressing relevant aspects of the setting. A basis version of this Scan is provided with E-MAGINE. The interviewer should use this questionnaire as basis for the interview. He should also provide the respondent with a copy of the questionnaire, this version enables the respondent to keep track of the questions and to scan optional answers. The interview should start with a short introduction of the goal of the interview and a short explanation of the entire evaluation process E-MAGINE entails. The First Scan Interview is expected to last around 1.5 hours.

Based on the First Scan interview a First Level Profile of the group and the groupware application is generated. This Profile describes the main characteristics of the group and the application and the way and extent of usage of the application. The First Level Profile consists of the filled in questions of the First Scan completed with comments from the interviewer, including a short summary of the interview. In addition it describes the so-called ‘Evaluation Issues’ identified in the setting. Evaluation Issues are aspects of the setting which might be relevant for its success, but which state is unclear. An evaluation issue is specified in one of the following three manners:

5) It is a question of the First Scan that could not be answered by the first respondent (group leader)
   The First Scan filters the presence of factors that hinder the use of a groupware application and in that way hinder the groupware application in being useful. In case the First Scan cannot reveal whether specific factors are present, their assessment is continued in the Second phase of evaluation.
6) It is a lacking Success Factor in the setting
   In case the First Scan reveals that a Success Factor is lacking, it is assessed whether this is a problem for group members in the Second Phase of evaluation.
7) It is a direction for improvement suggested in the interview (by the first respondent (group leader) or the evaluator).
   This suggestion may have come up during the First Scan interview or in the analysis of the questionnaire.

Whether the Evaluation Issues identified indeed are relevant, and to what extent, needs further assessment. The First Level Profile, including the Evaluation Issues, is basis for Evaluation Step 3.

If the group under evaluation is very fluid (with respect to type of members or size for example) and has many changing characteristics during its existence, it may be hard for the respondent to answer some items about the group. In that case instruct the respondent to apply the group as a whole including all its stages where possible (e.g. a question about the life cycle of the group). And instruct to apply the stage in which the number of group members is the largest if the former is not applicable (e.g. a question about the number of active group members). For, a groupware application is applied most heavily in that stage. The changing group characteristics will lead to specific requirements for the groupware application (addition, based on Chapter 9).

Step 3 Specification of the Implications of the First Level Profile

In Step 3 the implications of the First Level Profile are specified. Each Evaluation Issue will be specified into one or more Evaluation Questions that can be assessed in the Second Phase of evaluation. These Evaluation Questions should inform whether the Evaluation Issues identified, indeed are an issue in the setting. Two examples of the specification of an evaluation Question are provided here:

Evaluation Issue:	Feature X might be an interesting new feature.
Evaluation Question:	Is feature X an interesting optional feature?

Evaluation Issue:	The group consists of different subgroups.
Evaluation Question:	Do the different subgroups require different type of support? (Relates to a Success Factor.)

Another implication that needs to be specified relates to the objectives of the group. These need to be related to the personalisation and codification approach (or a combination of both). Specifying this, informs the type of questions that will be asked in the KSSI *(instruction derived in Chapter 8)*.

N.B. In order to be able to specify the Evaluation Questions, the evaluator needs to be familiar with the theory of the Success Factors underlying the First Scan (addition, based on Chapter 9).

Evaluation Steps – Phase 2

Step 4 Application of specific evaluation instruments

In the Second Phase of evaluation, in principle all kinds of group or technology factors might be assessed. However, the First Phase directs what factors will be assessed in this Phase. In step 4 relevant evaluation instruments are selected and applied. The Evaluation Questions are basis for this selection. When Evaluation Questions are more suitable for assessment in a Focus Group, their assessment is postponed to step 6. This may hold for example for questions that do not seem to be suitable for assessment using a questionnaire.

The Knowledge Sharing Support Inventory (KSSI) is one of the optional instruments that can be applied in this Phase. A basis version of this instrument is provided with these instructions.

Application of the KSSI

The KSSI evaluates the quality of knowledge sharing support of a groupware application. It is a questionnaire that may be applied as an online survey or as a 'paper and pencil' version. The KSSI may be used in (project)team or community settings. Not all questions are suitable for both types of settings this is indicated in the instructions by the instrument. Changes to the KSSI further depend on outcomes of the First Scan: on the evaluation outcomes and a few other results. This is also specified in the instructions. It is therefore important to scan the instrument and its instructions carefully and apply changes necessary before applying it.

In this stage of its development the KSSI should be analysed the item by item, as the items cannot be combined as informing on certain constructs. In the interpretation of the outcomes of the KSSI especially low and high mean scores and scores with a large variance are interesting. Low or high mean scores (with low variance) indicate high agreement in the group on aspects of the setting; these may indicate relevant potential improvements. Mean scores with high variance indicate high disagreement in the group on aspects of the setting, these scores are relevant to discuss in the Focus Group.

In case group members (unintentionally) have applied the groupware application to support functions that are not the main focus of the application; assessment of these types of use is relevant, but not straightforward. It is therefore suggested to investigate in advance more details on the types of uses of the groupware application, including the type and frequency of more creative uses. Another suggestion is to test the KSSI with one of the group members (and not only with group management). Lastly, more instructional information should be provided with the items assessing creative uses of the groupware application.(addition, based on Chapter 9).

Step 5 Final Profile

In Step 5 the Final Profile for the setting under evaluation is constructed based on the outcomes of steps 1 to 4. Not only the outcomes of the specific evaluation instruments are presented in the Final Profile, but also (first) answers to the evaluation questions specified in Step 3 (at least the questions that were assessed in evaluation Step 4). The Final Profile is input for the Focus Group session in Step 6.

Step 6 Focus Group

The last step in the evaluation process is a Focus Group session with some group members. The intention of this Focus Group is 1) to verify the results of the earlier applied evaluation instruments, 2) to discuss possible contradicting requirements and 3) to identify and prioritise improvements. It is important that the Focus Group consists of different representatives of groups of users and other stakeholders of the groupware application. This enables creating compliance for the evaluation outcomes. *It is important to create a balanced representation of subgroups, otherwise perspectives of 'over-presented' subgroups might dominate the discussion (addition based on Chapter 9).*

The Final Profile, including the Evaluation Issues identified, is input for the Focus Group. The agenda of the meeting mainly consists of the following items:

1) An introduction of the contact person of the organisation
   Reasons to start this evaluation process
2) Introduction of the evaluator
   Goal and process of evaluation
   Objective of this meeting (Focus Group meeting)
3) Summary of evaluation results (so far)
4) Group discussion about Successful use of the application and about each Evaluation Issue:
   a) What can be considered 'successful use' of the application at hand? (*addition, based on observations in Chapter 6*).
   b) Do group members present acknowledge issues identified?
   c) Do group members present agree with possible solutions?
   d) What (other) solutions might be applied?
   e) What (evaluation) issues were missed?
5) Conclusion and wrap up
   Share how the evaluation outcomes will be communicated to group members.

First Scan

In this First Scan (collaborative) 'application' can be replaced by the name of the group-ware tool that is evaluated.

In this questionnaire the following scale is used in a large number of questions (unless mentioned otherwise) 5 = very much; 4 = much; 3 = moderately; 2 = hardly; 1 = not at all.

About THE GROUP - Input Characteristics

Task

1. Pleas describe the group task(s)
Is this task central to the user's job?
Is use of the platform part of this task (work process)/does the group depend on the application in achieving its goals?
How does knowledge sharing relate to this task?
____
____

		very much	much	mode-rately	hardly	not at all
2.	Does performing this task involve much stress?	5 □	4 □	3 □	2 □	1□
3.	Is there much 'at stake' in performing this task?	5 □	4 □	3 □	2 □	1 □

4.	Is the group task the only task group members are involved in?	yes □	no □	
	If **not,** is the group task directly related to other tasks group members have?	yes □	no □	don't know □
5.	Is group participation a rating factor in performance interviews?	yes □	no □	don't know □

Group members

6.	a) What is the group size?	________________		
	b) Is this a steady number?	yes □	no □	
	c) If not how are the fluctuations?	yes □	no □	
7.	Are group members also a member of other (overlapping) groups, facilitated with other, but similar, collaborative applications?	yes □	no □	don't know □

8. What can you say about the following characteristics in general?
   - age of members ___________________
   - experience of members with the grouptask

   ____

   - experience of members with IT tools

   ____

   - other typical characteristics of the members

   ____

About THE COLLABORATIVE TOOL - Process support

9. Which of the following ICT tools/features are available to communicate and share knowledge within the group? For those available, how often are they used in general?

		Available					
		not available	daily	weekly	monthly	annually	never
a)	E-mail	0 ☐	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐
b)	Telephone	0 ☐	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐
c)	Fax	0 ☐	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐
d)	Video Conferencing	0 ☐	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐
e)	Chat/Short Message	0 ☐	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐
f)	Company Intranet	0 ☐	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐
g)	Discussion list	0 ☐	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐
h)	Bulletin board	0 ☐	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐
i)	Group Calendar	0 ☐	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐
j)	Shared document database	0 ☐	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐
k)	Yellow Pages (List of people and their expertise)	0 ☐	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐
l)	Groupware to jointly work on documents (Co-editing)	0 ☐	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐
m)	Shared project planning tool	0 ☐	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐
n)	Shared white-board/ application sharing system	0 ☐	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐
o)	Group decision support system	0 ☐	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐
p)	Other, please specify	-	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐

____

____

Functionality

		very much	much	mode-rately	hardly	not at all
10.	Does the collaborative tool provide what is needed to support the group (in accomplishing its task)?	5 □	4 □	3 □	2 □	1 □
11.	a) Is it possible to have remote access to the collaborative tool?	yes □		no □		
	b) If not, to what extent is it a problem?	5 □	4 □	3 □	2 □	1 □
12.	a) Is it possible to increase the number of accounts of the collaborative tool easily?	5 □	4 □	3 □	2 □	1 □
	b) Is the procedure to increase this number working sufficiently?	5 □	4 □	3 □	2 □	1 □

Reliability

13.	Does the application run smoothly?	5 □	4 □	3 □	2 □	1 □

Usability and Usefulness

		very much	much	mode-rately	hardly	not at all
14.	Do group members perceive the application as useful?	5 □	4 □	3 □	2 □	1 □
15.	Do members always have easy access to the collaborative application?	5 □	4 □	3 □	2 □	1 □
16.	Is it easy for new users to work with the collaborative application?	5 □	4 □	3 □	2 □	1 □
17.	Is it necessary to instruct new users of the collaborative application?	5 □	4 □	3 □	2 □	1 □
18.	Is it necessary to re-instruct the users of the collaborative application?	5 □	4 □	3 □	2 □	1 □
19.	a) Is the collaborative application consistent in use?	yes □		no □		
	b) If **not**, to what extent is it a problem?	5□	4 □	3 □	2 □	1 □
20.	Does the application supply the features expected?	5 □	4 □	3 □	2 □	1 □

21.	a) Is it possible to adjust the application to personal preferences?	yes □ no □
	b) If **not**, to what extent is it a problem?	5 □ 4 □ 3 □ 2 □ 1 □
	c) Is it possible to adjust the application to group preferences?	yes □ no □
	d) If **not**, to what extent is it a problem?	5 □ 4 □ 3 □ 2 □ 1 □

Efficiency

22.	Does the application run fast enough?	5 □ 4 □ 3 □ 2 □ 1 □

Compatibility and standards

23.	a) Is it possible to use the collaborative tool on all the operating systems in the company (companies)?	yes □ no □
		very much / much / mode-rately / hardly / not at all
	b) If not, to what extent is it a problem?	5 □ 4 □ 3 □ 2 □ 1 □
24.	a) Is the collaborative tool compatible with other applications group members use?	yes □ no □ I don't know □
	b) If not, to what extent is it a problem?	5 □ 4 □ 3 □ 2 □ 1 □
25.	a) Is it necessary for the collaborative tool to meet certain standards (such as ISO-norms)?	yes □ no □
	b) If **so**, to what extent does the tool meet these standards?	5 □ 4 □ 3 □ 2 □ 1 □
	c) Could you mention the standards that are relevant but not met yet?	

____

____

Costs

26.	What are the estimated costs to buy licenses and install the collaborative tool?	____________________
27.	How long will it take before the tool is implemented (in months approximately)?	____________________
28.	Is the required infrastructure available for the implementation of the collaborative tool?	yes □ no □
	If **not,** what are the estimated costs for the needed infrastructure (new or upgrade)?	__________________

29. What are the estimated costs for additional training and instruction of the prospective users of the collaborative tool? ____________________

30. What are the estimated costs for maintenance of the collaborative tool? ____________________

Awareness

31. a) Does the application show what other group members are currently involved in? yes □ no □

	very much	much	mode-rately	hardly	not at all
b) If **not**, to what extent is it a problem?	5 □	4 □	3 □	2 □	1 □

32. a) Does the application show whether other group members are on-line? yes □ no □
    b) If **not**, to what extent do you think this is a problem? 5 □ 4 □ 3 □ 2 □ 1 □

33. a) Does the application show what everyone's task and progress is? yes □ no □
    b) If **not**, to what extent do you think this is a problem? 5 □ 4 □ 3 □ 2 □ 1 □

34. a) Does the application provide information on why someone did what (s)he did? yes □ no □
    b) If **not**, to what extent do you think this is a problem? 5 □ 4 □ 3 □ 2 □ 1 □

35. a) Does the application show updates and changes since the last time you have logged in? yes □ No □
    b) If **not**, to what extent is it a problem? 5 □ 4 □ 3 □ 2 □ 1 □

Security and Privacy

36. a) Are security issues important for the collaborative tool? 5 □ 4 □ 3 □ 2 □ 1 □
    b) Do you think it is sufficiently ensured? 5 □ 4 □ 3 □ 2 □ 1 □

37. Do security issues at this moment inhibit smooth and fast use? 5 □ 4 □ 3 □ 2 □ 1 □

38. a) Is ensuring privacy important for the collaborative application? 5 □ 4 □ 3 □ 2 □ 1 □
    b) Do you think it is sufficiently ensured? 5 □ 4 □ 3 □ 2 □ 1 □

Adequate Introduction, Adaptation and Development

39. Pleas describe how the application was implemented and introduced to the group?
Was usage of the application pushed by the organisation?
Did group members have time to learn to work with it?
Was a meeting organised where group members could attain hands-on experience with the application?
Was use of the application motivated by the group leader (facilitator)?
How is the tool introduced to new group members?

____

____

Support of Outcomes

	very much	much	mode-rately	hardly	not at all
40. To what extent do you think **the application** supported members of the group:					
a) in building trust? -	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐
b) in building a solid common ground? - - - - - - - - - - - -	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐
c) in feeling a sense of belonging to the group? - - - - - - -	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐
41. To what extent do you think the tool has contributed to cost savings for the company? - - - - - - - - - - - - - - - - - -	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐

Support of the application

	very much	much	mode-rately	hardly	not at all
42. What tasks and activities should be supported with the application?	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐
43. Does the application provide what is needed to support the group in accomplishing its task?	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐

44. What other groups does the application has to support? Are these groups similar?

____

45. Are other applications available to the group which provide similar support? Are these frequently used?

____

About THE GROUP – part 2 –

Physical distribution

		within same building	within same city	within same country	internationally distributed
46.	What is the geographical distribution of the members?	4 □	3 □	2 □	1 □

If **internationally distributed**, please mention the different countries and different time zones.

____

47.	a) Do individual members of the group work at (physically) different places (Two days at the customers and three days at the companies for example)?	yes □	no □
	b) If **so**, is access provided from these places?	yes □	no □

		weekly	monthly	quarterly	twice a year	annually	never
48.	Does the group (as a whole) have face-to-face meetings?	5 □	4 □	3 □	2 □	1 □	0 □
49.	Do individual members see each other face-to-face (outside the joint meetings)?	5 □	4 □	3 □	2 □	1 □	0 □
50.	Do members have contact (telephone, e-mail etc.) with other members of the group outside of the joint meetings?	5 □	4 □	3 □	2 □	1 □	0 □

Group structure

		set up by mgmt	both	personal initiative
51.	Has the group been set up by management, or did it originate through the personal initiative of some employees?	□	□	□

52. a) Are all the members of the group from the same organisation? Yes □ no □

b) If **not**, to what extent do you experience problems in connecting members in using the same tool? (Because of firewalls of the different organisations for example.) 5 □ 4 □ 3 □ 2 □ 1 □

53. a) Is the group open to anyone who is interested in participating? yes □ no □

b) If **not,** please specify for whom membership is open:

____

54. a) What is the composition of the group; are members experts in relation to the group task or not?

only experts	only juniors	mixed	other
4 □	3 □	2 □	1 □

b) If **mixed**, to what extent is it a problem to motivate experts to participate?

very much	much	mode-rately	hardly	not at all
5 □	4 □	3 □	2 □	1 □

55. a) Which of the following applies:

A) most members participate actively

B) there is an active core group and many less participating members

mainly A	mainly B
2 □	1 □

b) If **B**, to what extent is it a problem? 5 □ 4 □ 3 □ 2 □ 1 □

56. a) Does the group have a formal facilitator/co-ordinator? yes □ no □

b) If **yes**, to what extent is the co-ordinator active in the following activities?

	very much	much	mode-rately	hardly	not at all
a. Organising meetings -	5 □	4 □	3 □	2 □	1 □
b. Stimulating members to participate in the group - - - -	5 □	4 □	3 □	2 □	1 □
c. Sharing his/her own expertise within the group - - - - - -	5 □	4 □	3 □	2 □	1 □
d. Connecting the group members with each other- - - - -	5 □	4 □	3 □	2 □	1 □
e. Making external contacts - - - - - - - - - - - - - - - - - - -	5 □	4 □	3 □	2 □	1 □
g. Promoting the group towards management - - -- - - - -	5 □	4 □	3 □	2 □	1 □
h. Other (please specify) - - - - - - - - - - - - - - - - - - -- - -	________________________				

____

57. a) Are special roles defined in the group? yes □ no □

b) If **so**, do these roles need different and specific support from the collaborative tool? yes □ no □

c) If **so**, does the application provide this support? yes □ no □

d) If **not**, please specify these roles and type of support needed:

____

58. a) Does the group have sub-groups that work independently of the main group? yes □ no □

b) If **so**, do these sub-groups need different and specific support from the collaborative tool? yes □ no □

c) If **so**, does the application provide this support? yes □ no □

d) If **not**, please specify the sub-groups and type of support needed: yes □ no □

____

59. a) Does the organisation allocate a certain number of hours for the members to participate in the group? yes □ no □ not appl. □

	very much	much	mode-rately	hardly	not at all
b) If **not**, to what extent does this hinder participation of members?	5 □	4 □	3 □	2 □	1 □

60. a) Does the organisation facilitate participation of the members in the group? (Such as providing budget.) yes □ no □

b) If **so**, please specify:

____

Group culture

61. To what extent do you think members are

	very much	much	mode-rately	hardly	not at all
a) willing to share their knowledge with other members -	5 □	4 □	3 □	2 □	1 □
b) generally enthusiastic and motivated to participate -	5 □	4 □	3 □	2 □	1 □
62. To what extent does the group operate in an open 'knowledge-sharing culture'?	5 □	4 □	3 □	2 □	1 □

Lifecycle

63. How long has the group been in operation (approximately in months)? ______________________

64. How many months is the group planned to last from now? ______________________

Processes

Social interaction

		often/ regularly	seldom	not
65.	Does the group have social events (such as informal dinners)?	3 □	2 □	1 □

Processes in general

66. Which of the following activities happen at the group (you can tick as many as appropriate)?	often/ regularly	seldom	not
a) Meetings -	3 □	2 □	1 □
b) Talks about experiences -	3 □	2 □	1 □
c) Presentations by members - - - - - - - - - - - - - - - - - - -	3 □	2 □	1 □
d) Presentations by non-members - - - - - - - - - - - - - - - -	3 □	2 □	1 □
e) Workshops or brainstorming - - - - - - - - - - - - - - - - -	3 □	2 □	1 □
f) Excursions -	3 □	2 □	1 □
g) Writing publications -	3 □	2 □	1 □
h) Doing concrete projects -	3 □	2 □	1 □
i) Preparing for new projects for customers - - - - - - - - -	3 □	2 □	1 □
j) Other, please specify -	3 □	2 □	1 □

____

Outcomes

Outcomes on individual, group and organisational level

67. What objectives has the group to meet to be successful?

____

____

____

68. Does the group meet these objectives in your opinion?

____

____

____

69. To what extent do you think the group has contributed to

	very much	much	mode-rately	hardly	not at all
a. the development of new ideas to the organisation - - - - -	5 □	4 □	3 □	2 □	1 □
b. cost savings for the organisation? - - - - -- - - - - -- - - - -- -	5 □	4 □	3 □	2 □	1 □
c. developing standards, new methods or 'best practices' for the company- -	5 □	4 □	3 □	2 □	1 □
d. the documentation of new information for the company, such as knowledge systems, manuals, training instructions or requirements for new products - - - - - - - - - - - - - - - - - -	5 □	4 □	3 □	2 □	1 □

Other

70. In your opinion what are the strong points of the group?

____

____

____

71. In your opinion what are the weak points of the group?

____

____

____

Knowledge Sharing Support Inventory (KSSI)

Below the KSSI instrument is presented. If applicable, items are preceded with instructional information for the evaluator applying the KSSI. This information is printed in *italic* and should be left out when the questionnaire is shown to respondents.

When using this questionnaire replace 'the collaborative application' by the name of the application that is evaluated.

In the analysis of the data low or high mean scores may indicate the presence evaluation issues. This is indicated in the instructional information provided with the items. In addition large variance in scores may indicate evaluation issues, in that case group members differ largely in their opinion.

Introduction (example): The Knowledge Sharing Support Inventory (KSSI) assesses whether 'the collaborative application' (which) you have access to is supporting you in sharing knowledge with your group. Does the ICT setting support you in finding, storing and exchanging knowledge and information with your colleagues?

Finding knowledge and information

The list of tools that should be addressed here results from the First Scan interview. Evaluation issues may be identified if mean scores are high.

1. How often do you use the following tools?

	daily	2-3 times a week	weekly	monthly	never	not available
Collaborative application	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐
E-mail	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐
Telephone	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐

The following items address to what extent the application supports the codification approach. Several types of information may be addressed. The items generally assess three aspects of knowledge and information: 1) the level of support provided by the application; 2) the need for improvements and 3) the number of group members adding this type of information. Evaluation issues may be identified if mean scores on 1 are low, on 2 are high or on 3 are low.

		not at all	hardly	moderately	much	very much
2a.	To what extent does the collaborative application support finding information on the topic your group is working on?	1 □	2 □	3 □	4 □	5 □
2b.	To what extent does the collaborative application need improvements in this respect?	1 □	2 □	3 □	4 □	5 □

		n o-one				everyone
3.	How many groupmembers add information to the collaborative application?	1 □	2 □	3 □	4 □	5 □

		not at all	hardly	mode-rately	much	very much
4a.	To what extent does the collaborative application support finding experiences of other people?	1 □	2 □	3 □	4 □	5 □
4b.	To what extent does the collaborative application need improvements in this respect?	1 □	2 □	3 □	4 □	5 □

		no-one				everyone
4c.	How many group members add their experiences to the collaborative application?	1 □	2 □	3 □	4 □	5 □

		not at all	hardly	mode-rately	much	very much
5a.	To what extent does the collaborative application support finding information on related projects?	1 □	2 □	3 □	4 □	5 □
5b.	To what extent does the collaborative application need improvements in this respect?	1 □	2 □	3 □	4 □	5 □

6.a	To what extent did the tool support you in finding experts **outside** your organisation?	1 □	2 □	3 □	4 □	5 □
6.b	To what extent do you think the tool needs improvements in this respect?	1 □	2 □	3 □	4 □	5 □
7a.	To what extent does the collaborative application support finding ‘background information’ from persons in your group (such as their expertise)?	1 □	2 □	3 □	4 □	5 □
7b	To what extent does the collaborative application need improvements in this respect?	1 □	2 □	3 □	4 □	5 □
8a.	To what extent does the collaborative application support ‘back-tracing’ who added information?	1 □	2 □	3 □	4 □	5 □
8b	To what extent does the collaborative application need improvements in this respect?	1 □	2 □	3 □	4 □	5 □

Visibility of the groups

The following items address to what extent the application supports visibility of the group to group members and new-comers. Visibility of group aspects such as purpose of the group may contribute to group identity. Items address two aspects 1) level of support and 2) need for improvements. Evaluation issues may be identified if mean scores on 1 are low or on 2 are high.

		not at all	hardly	mode-rately	much	very much
9a.	To what extent does the tool support gaining knowledge on the purpose of the group?	1 □	2 □	3 □	4 □	5 □
9b.	To what extent does the collaborative application need improvements in this respect?	1 □	2 □	3 □	4 □	5 □
10a.	To what extent is the tool helpful for new-comers in gaining an overview of activities in your group?	1 □	2 □	3 □	4 □	5 □
10b.	To what extent does the collaborative application need improvements in this respect?	1 □	2 □	3 □	4 □	5 □

Interaction with other group members

The following items address the personalisation approach. Apply these questions only if the application is used to support interaction between group members. In case assessment of need for interaction support is advisable, items need to be adapted. Items address four aspects 1) level of support; 2) need for improvement; 3) frequency of use and 4)time it takes to receive an answer. Evaluation issues may be identified if mean scores on 1 are low, on 2 are high, on 3 are low or on 4 are high.

11a.	To what extent does the collaborative application support asking questions to your group members?	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
11b.	To what extent does the collaborative application need improvements in this respect?	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
		daily	2-3 times a week	weekly	monthly	never
11c.	How often do you use the collaborative application to ask questions to group members?	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
		one day	one week	less than a day	more than one month	not applicable
11d.	How long does it (generally) take before you receive an answer?	1 ☐	2 ☐	3 ☐	4 ☐	6 ☐

Motivation

Questions relating motivation are more relevant in case group member participate on a voluntary basis. Or when group members have (competing) task or applications available. In case the groupware application is applied to support an individuals main task and no alternatives are available, these questions may be left out. Evaluation issues may be identified if mean score on these items are low.

	Choose one of the options provided	very much	much	moderately	hardly	not at all	not applicable
12.	To what extent were you motivated to share your thoughts, ideas, and knowledge within the group?	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐	6 ☐
13.	To what extent did you got time to spend on the group?	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐	6 ☐
14.	To what extent were you hindered by your primary tasks to share knowledge with your group?	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐	6 ☐

Concerning content related features

Apply these questions only if the application is used to store knowledge and information for the group. Evaluation issues may be identified if mean scores on these items are low.

The collaborative application contains 'content' such as <*specify here*>. The following five questions relate to this content.

		Not at all	hardly	moderately	much	very much
15a.	Are you satisfied with the **quality** of the content? If not , please comment	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
15b.	Are you satisfied with the **clearness** of the content? If not , please comment	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
15c.	Are you satisfied with the **organisation** of the content? If not , please comment	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
15d.	Are you satisfied with the content's **relevance** for your tasks? If not , please comment	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
15e.	Are you satisfied with the content's **completeness**? If not , please comment	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐

Concerning training *(new)*

If group members consequently use the application the quality of content may be improved. Therefore one item addresses this aspect. Evaluation issues may be identified if (the) mean score(s) on this item are high.

		Not at all	*hardly*	*moderately*	*much*	*very much*
new	*Do you expect that training users in using the application will increase the quality of content?* *If not , please comment*	*1 ☐*	*2 ☐*	*3 ☐*	*4 ☐*	*5 ☐*

Overall opinion

The items below assess the overall opinion of the user, evaluation issues may be identified if mean scores are low.

		0-20 %	20 – 40 %	40-60 %	60-80 %	80-100%
16.	What percentage of the total relevant knowledge and information for your group is available in the collaborative application?	1 □	2 □	3 □	4 □	5 □
		not at all	hardly	moderately	much	very much
17.	All in all, to what extent does 'the collaborative application' provide the knowledge and information you need?	1 □	2 □	3 □	4 □	5 □
18.	All in all, to what extent are you satisfied with 'the collaborative application'?	1 □	2 □	3 □	4 □	5 □

18. If, in your opinion improvements are needed, could you specify the most important ones?

____

____

Personal Information

The items below assess user characteristics. The information generated by these items may be used to identify relevant subgroups or other relevant user characteristics such as low experience with the group task .

The final seven questions concern personal information. From these questions providing your name is optional. However, as explained before, we guarantee that your information will be anonymously applied.

19.	What is your name?	________________________					
20.	Are you male or female?	1 □ male	2 □ female				
		20-29	30-39	40-49	50-59	>=60	
21.	What is your age?	1 □	2 □	3 □	4 □	5 □	
22.	What organisation are you working for?	____________________________					
23.	How many years have you been working for this organisation?	____________________________					
24	How experienced are you with respect to the group task (experience in years)?	____________________________					
	This question is only relevant if group roles are present in the group. Specify the roles identified as optional answers to this question.	Role 1	Role 2	Role 3	Etc.		
25	What was your role within the group?	1 □	2 □	3 □	4 □	5 □	6 □

Summary

This thesis describes the development of an evaluation method that supports dispersed knowledge groups in the assessment of the usefulness of a groupware application for sharing knowledge. The approach aims to enable dispersed knowledge groups to evaluate their current use of a groupware application. The name of the approach is derived from the acronym for 'Evaluation Method to Assess Groupware In Use': E-MAGINE.

The development of a new groupware evaluation method is relevant for two reasons. First, there is a need for groupware evaluation methods that are more practical in terms of time and costs. Second, existing groupware evaluation methods focus too much on evaluating the groupware system itself; their results are less useful once the groupware tool is implemented and used in an organisational setting. An evaluation approach should be able to handle the multitude and complexity of factors that may influence the successful use of groupware systems. Due to the important role of the context in which groupware applications are used, an application cannot be evaluated in isolation.

This research project aims to contribute to the scientific body of knowledge on software evaluation approaches; especially on the question how contextual factors can be integrated into these approaches. This entails an integration of disciplines, such as usability engineering, human-computer interaction, and social and organisational psychology.

The focus on dispersed knowledge sharing groups in this thesis is inspired by their relevant role in knowledge sharing processes in organisations. Distributed work has become more and more common in today's business models and many organisations depend on dispersed groups in order to be successful. Dispersed groups form essential elements in the knowledge strategy of organisations and are important for organisational innovation.

All evaluation processes have common features: these all have a purpose, and in all cases there is an object being evaluated and a process through which one or more attributes of this object are judged and are assigned a value. The same holds for E-MAGINE; in order to generate a complete evaluation approach all three components need to be defined or designed. The initial design requirements for E-MAGINE are:

1) concentrate on the support of dispersed knowledge groups (*object* of evaluation);
2) concentrate on groupware in use (*object* of evaluation);
3) follow a socio-technical approach (*process* of evaluation);
4) be practical (cost-effective) (*process* of evaluation).

Input from practice and theory were generated in an iterative way during three different phases. The research project comprises 7 case studies in total (see Figure Summary-I below for an overview). These case studies concerned actual groups in a dispersed setting which were facilitated by a groupware application and whose main goals was knowledge sharing. Besides these commonalities, the groups under study operated within different contexts. As the evaluation approach aims to support diverse dispersed knowledge groups, input from diverse groups is necessary. The literature study focused on a review of topics related to dispersed knowledge groups, such as group dynamics, knowledge management, groupware, and technology adoption processes. In addition, literature on software evaluation methods was reviewed.

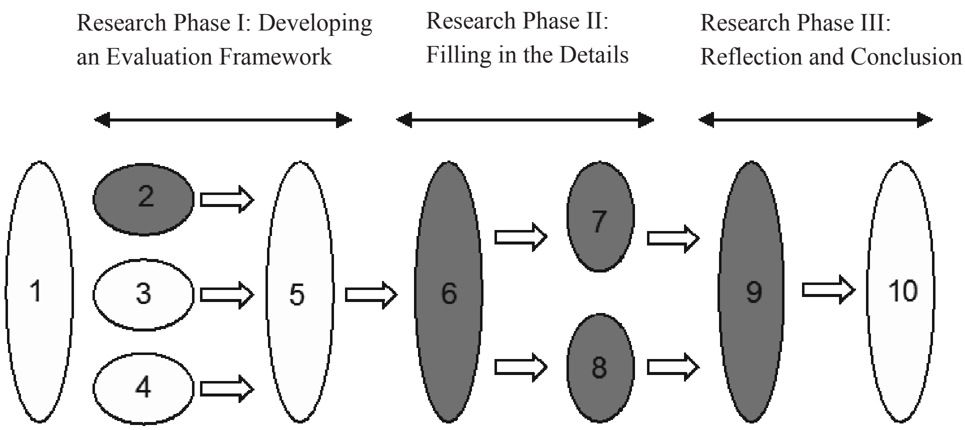


Figure Summary-I Outline of this thesis; grey ovals depict chapters that present case studies

The objective of the First Phase of research was to 1) gain insight into the object of evaluation i.e. dispersed knowledge groups, 2) to specify design requirements and 3) to create a first outline of the evaluation approach. This phase started with 3 explorative case studies in order to identify reasons for successful and non-successful use of groupware in dispersed knowledge sharing groups (case studies 1 to 3, presented in Chapter 2). It appeared that the use of groupware in the groups under study was limited. The cases showed a number of pitfalls for successful groupware use in the following three categories:

1) factors related to the application;
2) factors related to the group and its context and
3) factors related to the fit between application and task.

Some factors hinder the use of the application; other factors hinder successful use. An evaluation method that focuses on the identification of the usefulness of a groupware application needs to take these findings into account.

Several other implications for the development of E-MAGINE were specified in the subsequent review of literature presented in Chapter 3. Firstly, the DGIn-model was identified as a useful framework. The model not only structurally describes dispersed knowledge groups, but also incorporates group dynamic theories as well as theories on (individual) technology use and technology acceptance. Secondly, new relevant factors for the success of dispersed (knowledge) groups were identified. Thirdly, more insight was gained into groups as knowledge carriers in organisations. Fourthly, several categorisations of groupware systems were introduced. Finally, insight was gained into theories on technology acceptance, technology use and related challenges. The overview led to the conclusion that ‘use’ and ‘task-technology-fit’ are both input factors for performance. The challenge for E-MAGINE is to come up with more insightful and qualitative evaluation metrics and to specify and evaluate the quality of fit.

The subsequent chapter, Chapter 4, focuses on the process of evaluation: what evaluation steps should be taken in order to answer the evaluation question of E-MAGINE? In this chapter a number of useful suggestions for the evaluation process were identified on the basis of a literature review. Based on these steps an updated list of requirements for E-MAGINE was specified.

Chapter 5 is the final chapter of the First Research Phase and presents an evaluation framework on the basis of the inputs from the previous chapters. The framework consists of two phases to fulfil the design requirements. A main evaluation instrument is specified for each phase: the First Scan and the Knowledge Sharing Support Inventory (KSSI), respectively. Further, methodological requirements for the evaluation method were specified and a categorisation for Success Factors was derived (see Figure Summary-II for an overview of the framework).

Research Phase Two starts with two extensive case studies (case studies 4 and 5) in Chapter 6 that focused on the identification of Success Factors. The development of the First Scan is presented in Chapter 7. This research step includes application of the First Scan in a case study (case study 6). Chapter 8 presents the development of the Knowledge Sharing Support Inventory (KSSI). A first version of this instrument is applied in the context of case study 6.

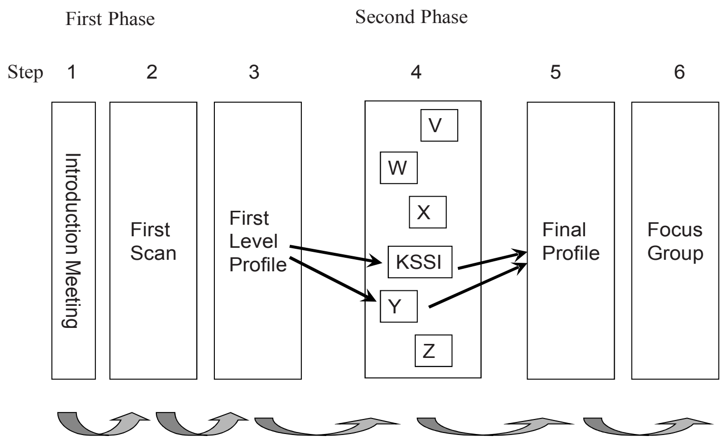


Figure Summary-II The E-MAGINE evaluation process

The Third and final Research Phase features the application of the full evaluation approach in a test case study (case study 7). Each step of the case study was applied and the results of this case study led to a number of reflections on the process and usefulness of the outcomes by the researcher. These are further discussed and result in the final version of E-MAGINE.

The research project has resulted in a new groupware evaluation approach including two new evaluation instruments: the First Scan and the Knowledge Sharing Support Inventory (KSSI). Based on application of the approach it is concluded that E-MAGINE in its current form allows for the evaluation of groupware applications for dispersed knowledge sharing groups. E-MAGINE provides a step-wise approach that incorporates a large range of relevant factors in the evaluation process. This is achieved by first applying a scan (the First Scan) and subsequently focusing on notable results. Results of the scan may for example indicate that the KSSI is suitable for a more specific assessment. In this manner E-MAGINE distinguishes itself from other existing evaluation methods in (a) its broad focus, (b) extensive conceptual basis, (c) its modularity, and (d) its practicality and cost-effectiveness.

In developing this evaluation method, more insight was generated into success factors for groupware support in dispersed knowledge groups. The thesis provides a valuable overview for researchers, managers and members that are involved in such groups. The underlying framework adds to literature on task-technology fit (TTF), because it also specifies 'matching' success factors. These are Success factors that match group characteristics to functionalities of the groupware technology. However, the framework is not rigid in this respect; it includes and specifies the relevance of introduction and adaptation processes.

Moreover, more insight was generated into the challenges of evaluating groupware - developed to support knowledge sharing - in use, especially in cases of participative evaluation. It appeared that users may have problems in making a distinction between features of the technology and the content of the system, including contributions of other users. The same holds for being critical in evaluating an application, if users have ‘nice experiences’ participating in the group, they tend to be less critical and vice versa. Evaluation methods that apply participative evaluation of groupware in use have to deal with these challenges; E-MAGINE provides first suggestions.

Samenvatting

Dit proefschrift beschrijft de ontwikkeling van een evaluatiemethode die geografisch verspreid werkende groepen ondersteunt in de evaluatie van het nut van een 'groupware' applicatie voor het delen van kennis.[4] De methode focust op de evaluatie van groupware *in gebruik*, dus de actuele ondersteuning en het actuele gebruik van de groupware applicatie. De naam van de evaluatiemethode is afgeleid van het acroniem voor 'Evaluatie Methode voor de Assessment van Groupware In gebruik: E-MAGINE.

De ontwikkeling van deze evaluatiemethode is om twee redenen relevant. Ten eerste is er een gebrek aan praktisch toepasbare en kosteneffectieve groupware evaluatiemethoden. Ten tweede focussen huidige evaluatiemethoden te veel op de groupware applicatie alleen ofwel de applicatie in isolement. Resultaten van dergelijke evaluatiestudies zijn minder goed bruikbaar op het moment dat de applicatie wordt geïmplementeerd en gebruikt in organisationele settings. Succesvol gebruik van een groupware applicatie wordt door veel factoren beïnvloed, een evaluatiemethode moet in staat zijn om met die veelheid van factoren om te gaan. Omdat de context waarin een groupware applicatie gebruikt wordt een zo belangrijke rol speelt, kan een applicatie niet in isolement worden geëvalueerd.

Dit onderzoeksproject heeft als doel bij te dragen aan de wetenschappelijk kennis over software-evaluatiemethoden; meer in het bijzonder is het doel bij te dragen aan een antwoord op de vraag hoe contextuele factoren in deze evaluatiemethoden kunnen worden geïntegreerd. Dit vereist een integratie van onderzoeksdisciplines, zoals software engineering, mens-computer interactie, en sociale en organisatiepsychologie.

De focus op verspreid werkende groepen in dit proefschrift is geïnspireerd door hun belangrijke rol in kennisprocessen in organisaties. Geografisch verspreid samenwerken komt steeds meer voor in organisaties; een toenemend aantal organisaties leggen (cruciale) taken bij verspreid werkende groepen neer. Ze vertrouwen op deze groepen om succesvol te kunnen opereren. Verspreid werkende groepen vormen essentiële elementen in hun strategie voor het delen van kennis en ze zijn belangrijk voor de ontwikkeling van innovaties. In dit proefschrift verwijzen we naar deze groepen als verspreide kennisgroepen.

---

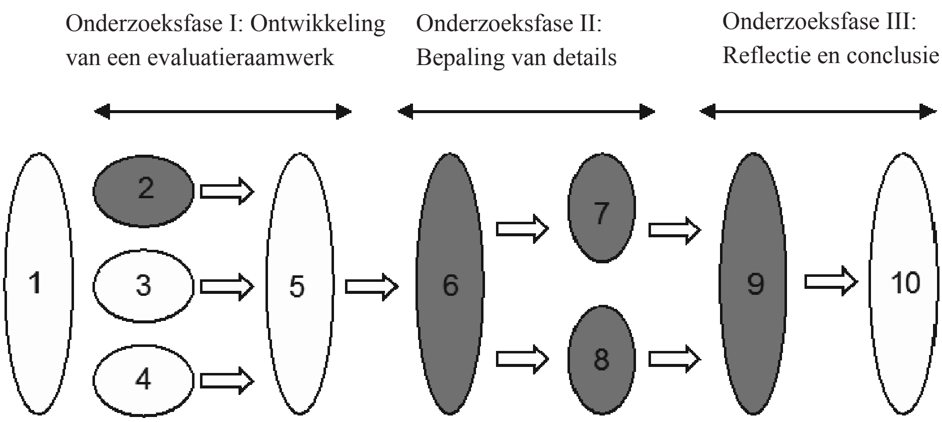
[4] Groupware verwijst naar 'informatietechnologie ontwikkeld voor (de ondersteuning van) groepen'. In dit proefschrift wordt de term gebruikt om te verwijzen naar 'informatietechnologie ontwikkeld voor *verspreid* werkende groepen'. In deze samenvatting wordt de term onvertaald aangehouden.

Alle evaluatiemethoden hebben drie eigenschappen: ze hebben een evaluatiedoel, een evaluatieobject en een proces waarin één of meer attributen van het object worden beoordeeld en een waarde krijgen toegekend. Dit geldt ook voor E-MAGINE; om tot een complete evaluatiemethode te komen moeten deze drie eigenschappen worden gedefinieerd of ontworpen.

Initiële ontwerpcriteria voor E-MAGINE zijn:

1) focus op de ondersteuning voor verspreide groepen (*object* van evaluatie)
2) focus op groupware in gebruik (*object* van evaluatie)
3) pas een socio-technische benadering toe (*proces* van evaluatie)
4) wees praktisch (kosten-effectief) (*proces* van evaluatie)

Dit onderzoek bestaat uit drie onderzoeksfasen waarin op een iteratieve manier input van praktijk en theorie wordt verwerkt om E-MAGINE te ontwerpen. Het onderzoeksproject omvat een totaal van 7 casussen. (Zie Figuur Samenvatting-I voor een overzicht). De casussen betreffen verspreide kennisgroepen die worden gefaciliteerd door een groupware applicatie. Voor elk van de groepen is kennisdelen een hoofdproces. Naast deze gedeelde eigenschappen kent elk van de groepen unieke aspecten en opereren ze in verschillende contexten. Omdat de evaluatiemethode ontwikkeld wordt om diverse groepen te ondersteunen, is deze diversiteit als input voor E-MAGINE noodzakelijk.



Figuur Samenvatting-I Opzet van dit proefschrift; de grijze ovalen geven hoofdstukken weer waarin casussen worden behandeld.

De literatuurstudie gepresenteerd in dit proefschrift behandelt verschillende onderwerpen gerelateerd aan verspreide kennisgroepen, zoals groepsdynamica, kennismanagement, groupware en technologiegebruik en -adoptie. Bovendien wordt een overzicht gegeven van literatuur over software evaluatie.

Het doel van Onderzoeksfase I is 1) inzicht krijgen in het object van evaluatie, te weten groupware en verspreide kennisgroepen, 2) het specificeren van de ontwerpcriteria voor de evaluatiemethode en 3) het ontwerpen van een eerste raamwerk voor de evaluatiemethode. De fase begint met 3 exploratieve casussen waarin factoren voor succesvol en niet succesvol gebruik van groupware in verspreide kennisgroepen werden gezocht. Uit deze casussen blijkt dat het gebruik van groupware in sommige groepen beperkt is. De studies onthullen een aantal valkuilen voor het gebruik van groupware die verdeeld kunnen worden in drie categorieën:

1) factoren gerelateerd aan de applicatie;
2) factoren gerelateerd aan de groep en zijn context en
3) factoren gerelateerd aan de combinatie tussen de applicatie en de taak van de groep.

Sommige factoren hinderen het gebruik van de applicatie, andere factoren hinderen *succesvol* gebruik. Een evaluatiemethode die focust op de identificatie van het nut van een groupware applicatie moet deze bevindingen meenemen. Deze bevindingen zullen dan ook input vormen voor het ontwerp van E-MAGINE.

Een aantal andere implicaties voor de ontwikkeling van E-MAGINE worden gespecificeerd in het daaropvolgende gepresenteerde overzicht van de literatuur. Ten eerste wordt het DGIn-model geïdentificeerd als een bruikbaar raamwerk. Het model geeft niet alleen een structurele beschrijving van verspreid werkende groepen, maar incorporeert ook theorieën uit onder meer de groepsdynamica, en theorieën over (individueel) technologiegebruik en -acceptatie. Ten tweede worden nieuwe relevante factoren voor het succes van verspreide (kennis)groepen geïdentificeerd. Ten derde wordt meer inzicht verkregen in groepen als kennisdragers in organisaties. Ten vierde worden diverse categorisaties van groupware applicaties geïntroduceerd. Tenslotte wordt inzicht verkregen in technologiegebruik en -acceptatie en de daaraan gerelateerde uitdagingen. Op basis van dit overzicht wordt de conclusie getrokken dat ‘gebruik’; en ‘taak-technologie-combinatie’ beide input factoren zijn voor prestatie. De uitdaging voor E-MAGINE is om te komen tot meer inzichtelijke en kwalitatieve evaluatie indicatoren en om ‘kwaliteit van combinatie’ te specificeren en evalueren.

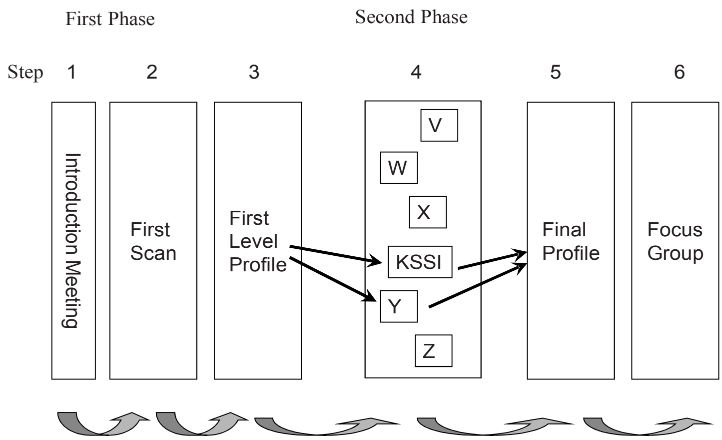
Het volgende hoofdstuk, hoofdstuk 4, richt zich op het proces van evaluatie: welke stappen moeten worden genomen zodat de evaluatievraag van E-MAGINE goed beantwoord wordt? In dit hoofdstuk wordt een aantal nuttige suggesties geïdentificeerd op basis van literatuur. Gebruikmakend van deze bevindingen wordt een nieuwe lijst van ontwerpcriteria voor E-MAGINE gepresenteerd.

Hoofdstuk 5 is het afsluitende hoofdstuk van de Eerste Onderzoeksfase en presenteert een evaluatieraamwerk op basis van de resultaten van de voorgaande hoofdstukken. Om aan de ontwerpcriteria te kunnen voldoen, wordt een raamwerk ontworpen dat uit twee fasen bestaat. Voor elk van deze twee fasen wordt een kern evaluatie-instrument gespecificeerd, respectievelijk de ‘First Scan’ en de ‘Knowledge Sharing Support Inventory’ (KSSI). Verder worden in dit hoofdstuk methodische eisen voor de evaluatiemethode gespecificeerd en wordt een categorisatie voor Succes Factoren afgeleid (Zie Samenvatting-II voor een overzicht van het raamwerk voor E-MAGINE).

Onderzoeksfase II begint met twee uitgebreide case studies (casus 4 en 5) in Hoofdstuk 6. Deze case studies zijn gericht op de identificatie van succes factoren voor groupware in gebruik door kennisgroepen. In hoofdstuk 7 wordt vervolgens de ontwikkeling van de First Scan gepresenteerd. In deze onderzoeksstap wordt de eerste versie van de First Scan ook toegepast in een casus (casus 6). Hoofdstuk 8 presenteert de ontwikkeling van de KSSI, van dit instrument wordt ook een eerste versie toegepast in casus 6.

Onderzoeksfase III behelst de toepassing van de gehele evaluatiemethode in een test casus (casus 7). Elk van de voorgeschreven stappen van de evaluatiemethode wordt toegepast in de casus, waarna op elk van de stappen wordt gereflecteerd door de onderzoeker, zowel op het proces als op de uitkomst. Waar dit relevant lijkt, wordt E-MAGINE aangepast.

Het onderzoeksproject resulteert in een nieuwe groupware evaluatiemethode, inclusief twee nieuwe evaluatieinstrumenten: De First Scan en de Knowledge Sharing Support Inventory (KSSI). Op basis van de toepassing van de methode kan worden geconcludeerd dat E-MAGINE geschikt is om groupware in gebruik door verspreide kennisgroepen te evalueren. E-MAGINE biedt een gefaseerde en modulaire methode waarin een breed scala van relevante factoren wordt meegenomen in het evaluatieproces. Dit wordt bereikt door eerst een scan toe te passen (de First Scan) om vervolgens te focussen op de belangrijkste bevindingen. Het resultaat van de scan kan bijvoorbeeld indiceren dat de KSSI passend is voor een meer specifieke evaluatie. E-MAGINE onderscheidt zichzelf van bestaande evaluatiemethoden door a) haar brede focus, b) haar uitgebreide conceptuele basis, c) haar modulaire opbouw en d) haar praktische en kosteneffectieve eigenschappen.



Figuur Samenvatting-II Het E-MAGINE evaluatieproces

In de ontwikkeling van de evaluatiemethode is meer inzicht verkregen in succesfactoren voor de ondersteuning van groupware in verspreide kennisgroepen. Het proefschrift heeft een waardevol overzicht gegenereerd voor onderzoekers, managers en leden van deze groepen. Het onderliggende raamwerk draagt bij aan het onderzoek naar Taak-Technologie-Combinatie omdat het 'Kwaliteit van Combinatie' specificeert in Succes Factoren. Deze Succes Factoren verbinden groepseigenschappen met functionaliteiten van de technologie. Tegelijkertijd is het raamwerk niet rigide, het specificeert ook de relevantie van introductie- en adaptieprocessen. Bovendien is meer inzicht verkregen in de uitdagingen die gerelateerd zijn aan het evalueren van groupware – ontwikkeld om kennisdelen te ondersteunen – in gebruik, in het bijzonder in het geval van participatieve evaluatie. Het bleek dat gebruikers het moeilijk vinden om onderscheid te maken tussen de functionaliteiten en inhoud van dergelijke systemen. Iets vergelijkbaars geldt voor het kritisch zijn naar een applicatie, wanneer gebruikers positieve ervaringen hebben voor wat betreft hun deelname aan de groep dan lijken ze minder kritisch ten opzichte van de ondersteunende groupware applicatie en vice versa. Participatieve groupware evaluatiemethoden moeten hier mee om kunnen gaan, E-MAGINE biedt hiervoor handvatten.

Acknowledgements - Dankwoord

En dat was het dan, alsnog, toch nog. De eindstreep gehaald na een bijzonder traject. Gemengde gevoelens: het is een vreemde gewaarwording dat het boek ook 'af' kan zijn in plaats van 'bijna-af'. Maar, ik ben ook blij dat het af is en trots op mijn boek.

Om de doctorstitel te behalen moet je veel van jezelf geven, maar zeker ook veel van anderen krijgen. Dat geldt ook voor mij. Ik heb in de afgelopen jaren veel gegeven en gekregen en ben voor het laatste velen dankbaar. Ik heb gekregen van mensen die mij al na stonden en gekregen van mensen die ik in de afgelopen jaren heb mogen ontmoeten en leren kennen. Ik wil een ieder die een bijdrage heeft geleverd aan de totstandkoming van dit proefschrift hartelijk danken. Ik denk aan familie, vrienden, collega's en respondenten uit de casussen. Een aantal mensen wil ik in het bijzonder noemen.

Als eerste Erik, mijn promotor. Het is een tijd geleden, maar ik kan me onze eerste ontmoeting nog goed herinneren, dit was nog voor mijn afstuderen. Als lid van de studievereniging van cognitiewetenschap bracht ik tezamen met andere studenten een bezoek aan jouw sectie in Delft, niet wetende dat ik later ook bij die sectie zou gaan horen. Ik ging niet voor niets mee met deze trip van Nijmegen naar Delft, ik was toen al gefascineerd door onderwerpen die in jouw sectie onderzocht werden. Mijn afstudeeronderzoek met de titel 'Gaze in Dyadic Communication' raakte dan ook aan die onderzoeksthema's. De ontwikkelingen in dit vakgebied zijn snel gegaan, maar jouw fascinatie voor ICT-gebruik door mensen in organisaties is dezelfde gebleven. Vooral daarom waren onze gesprekken nooit saai. Dank voor je enthousiasme, je steun en de mooie ontmoetingen. En dank vooral ook voor je geduld, aanmoedigingen en vertrouwen. Na jouw emeritaat ben ik ook enkele keren bij jou thuis geweest, daarom wil ik Eefje ook noemen. Dank aan jullie beiden voor een altijd even gastvrije ontvangst.

Robert, als co-promotor heb jij ook een belangrijk aandeel gehad in dit proefschrift. Jouw enthousiasme en positiviteit is aanstekelijk en gaf mij vertrouwen. Je zorgvuldige commentaar was elke keer opbouwend en praktisch. Je was niet vanaf het begin betrokken bij mijn promotietraject en toch heb je, sinds je aan boord bent, altijd volle betrokkenheid getoond. Je bleek ook een mobiele kenniswerker ten top: altijd bereikbaar en voor wat betreft locatie en tijd zeer flexibel inzetbaar. Dank voor een heel prettige samenwerking.

In Delft hoorde ik bij de sectie Arbeids- en Organisatiepsychologie (AOP), later Organisational Behavior and Innovation (OBI). Een prettige omgeving om in te werken, voor het overgrote deel door de collega's. Marleen, mijn eerste oriëntatie op mijn 'nieuwe' onderzoeksveld deed ik onder meer onder jouw supervisie, ik vond het een spannende en geweldige tijd. Jan, Linda en Maura, een deel van het onderzoek deed ik met jullie. Het was fijn met jullie over onze observaties te sparren en zo kennis te delen over processen van kennisdelen die we meenden te hebben geobserveerd. Helen, je was altijd de spil van de sectie en later, toen ik op afstand zat, was je altijd bereid om mijn link te zijn naar de TU. Dank voor je bijdrage op allerlei manieren.

Het was heerlijk om ook bij een groepje 'gelijkgestemden' te horen, de zogenaamde peergroup. Alexander, Heleen, Leon, Linda, Maura, Ruben en Sonja bedankt voor de interessante meetings, discussies en jullie feedback op stukken tekst of 'oefenpresentaties'. Ik hoop dat mijn promotie een leuke gelegenheid mag zijn om weer eens bij te praten.

Mijn onderzoek viel binnen het onderzoekscentrum 'BETADE'; ook in deze setting had ik vele gesprekken en discussies die mij vormden als wetenschapper. Daarnaast kwam ik in contact met de KLO-peergroup, bestaande uit AIO's van verschillende universiteiten. De meetings met deze collega's hebben mij geholpen grip te krijgen op het concept 'kennis'.

Ik heb ook veel gekregen van de respondenten in elk van de cases: (kennis)managers, leiders van communities of teams, ondersteuners van deze groepen of groepsleden; iedereen verleende enthousiast zijn of haar medewerking. Bovendien heb ik bij een groot aantal communities mogen aanschuiven, fysiek of virtueel. Deze 'kijkjes in de keuken' vond ik altijd enorm interessant.

In de laatste fase van de promotie was ik de respondent: in gesprekken met een aantal commissieleden werd ik geïnterviewd over mijn proefschrift en het onderhavige werk. Ik heb deze gesprekken als zeer boeiend ervaren en wil betreffende commissieleden daarvoor bedanken. Aan alle commissieleden wil ik mijn dank uitspreken voor de getoonde interesse in mijn werk.

Bij TNO kwam ik in een nieuwe werkkring, met nieuwe collega's en nieuwe kamergenoten. Ook hier voelde ik me al snel thuis. IV-, HiC- en HOI-collega's bedankt daarvoor. In het bijzonder wil ik Peter, Wilfried en José, mijn (oud-)kamergenoten bedanken. Bedankt voor een luisterend oor op vele momenten, voor het delen van luchtige en meer gewichtige zaken. Als het nieuwe werken zich zodanig evolueert dat je geen kamergenoten meer hebt, dan zie ik er van af ;-).

Jeannette, je hebt een groot deel van de teksten in dit proefschrift geredigeerd (t.w. (eerste versies) van H. 1-6 en 9, de vragenlijsten, de summary, de stellingen en het CV). Dit pakte je gedegen en nauwgezet aan. Als gevolg hebben je commentaren ook wel tot discussies over de opzet en inhoud van het proefschrift geleid. Uit deze discussies bleek altijd je frisse blik, met veel gevoel voor de leek als lezer. Dank daarvoor.

Joke, dank voor je creatieve inbreng en je gave om mij niet alleen analytisch, maar ook beeldend te laten beschouwen. Ik wil Hilde en jou ook bedanken voor een fijn weekend in de laatste weken voor mijn deadline waarin ik ook promotieperikelen van me af kon praten.

Maura en Marieke, mijn paranimfen, wat ben ik trots dat jullie er vandaag zijn in deze rol. Maura, omdat we inderdaad de kleinste peergroup vormden. Delen van wat we deelden, noem ik hierboven. Maar vooral dankzij onze gedeelde tijd op die kamer is mijn tijd in Delft heel bijzonder voor mij. Marieke, omdat jij mijn peer was al voordat ik van het bestaan van het concept wist. We waren elkaars peers in alles wat het studentenleven betreft - behalve dan de inhoud van onze studies - door huisgenoten te zijn in Nijmegen.

Een promovendus mag maar twee paranimfen kiezen, maar er zijn er meer die mij als vriend of vriendin tot steun waren in de afgelopen periode. Gelukkig mogen meer mensen worden uitgenodigd om het behaalde resultaat mee te vieren; mijn manier van dankzeggen.

Papa en mama, twee mensen die mij door en door kennen. Als geen ander weten jullie hoe veel verleidingen tot afleiding er waren op de weg naar dit eindpunt. Jullie aanmoediging tot persoonlijke groei en ontwikkeling is voortdurend en daar hoorde de aanmoediging tot afronding van dit proefschrift bij. Inclusief ondersteuning op allerlei manieren. Er waren ook onvrijwillige, langdurige onderbrekingen voor wat betreft het werken aan dit proefschrift. Ook toen, of juist toen, waren jullie tot volle steun voor mij en ons gezin. Jullie huis is nog steeds een thuis voor mij en nu ook voor onze kinderen. Dat is mooi om te zien. Ik hoop dat jullie ten volle meegenieten met het behalen van dit resultaat.

Daniëlle en Robert, dat andere (t)huis, daar horen jullie ook bij. En ik weet dat dat andersom ook zo is. Dat te weten steunt, bij alledaagse en bij ingrijpende dingen.

Henk en Betty, ook jullie steun aan mij en aan ons gezin is onvoorwaardelijk en voortdurend. Jullie hebben mij opgenomen in de familie en genieten van ons gezin. Ik kan me niet meer of beter wensen.

Thijmen en Lucas, wat geweldig dat jullie er zijn. Ik heb (letterlijk) aan den lijve ondervonden dat het moederschap niet alleen over geplaveide paden gaat, maar ik geniet en zie uit naar wat komen gaat: we gaan het samen beleven.

Michiel, het voelt heel gewoon om samen te zijn, maar ik weet heel goed dat dat nou juist bijzonder is. Ik koester ‘ons’. Dank je voor heel veel, inclusief de vele laatste zetjes.

Mirjam,
Bilthoven 25 juli 2011

Curriculum Vitae

Mirjam Huis in ‘t Veld (Almelo, 1975) attended pre-university education at the Pius X College in Almelo. She subsequently started studying Psychology at Radboud University Nijmegen. Two years later she switched to the Master’s programme in Cognitive Sciences at the same university, where she earned her master’s degree in 1999. From 2000 until 2004 she worked as a PhD student at Delft University of Technology, in the Faculty of Technology, Policy and Management. There she conducted the main part of the research reported in this dissertation. Since late 2004 she has worked as a researcher and project leader at the Netherlands Organisation for Applied Scientific Research TNO .She has worked on projects on virtual and multidisciplinary teams, crisis teams and crisis management, on self-organising groups in crisis settings and on crowd management.