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Raija Halonen

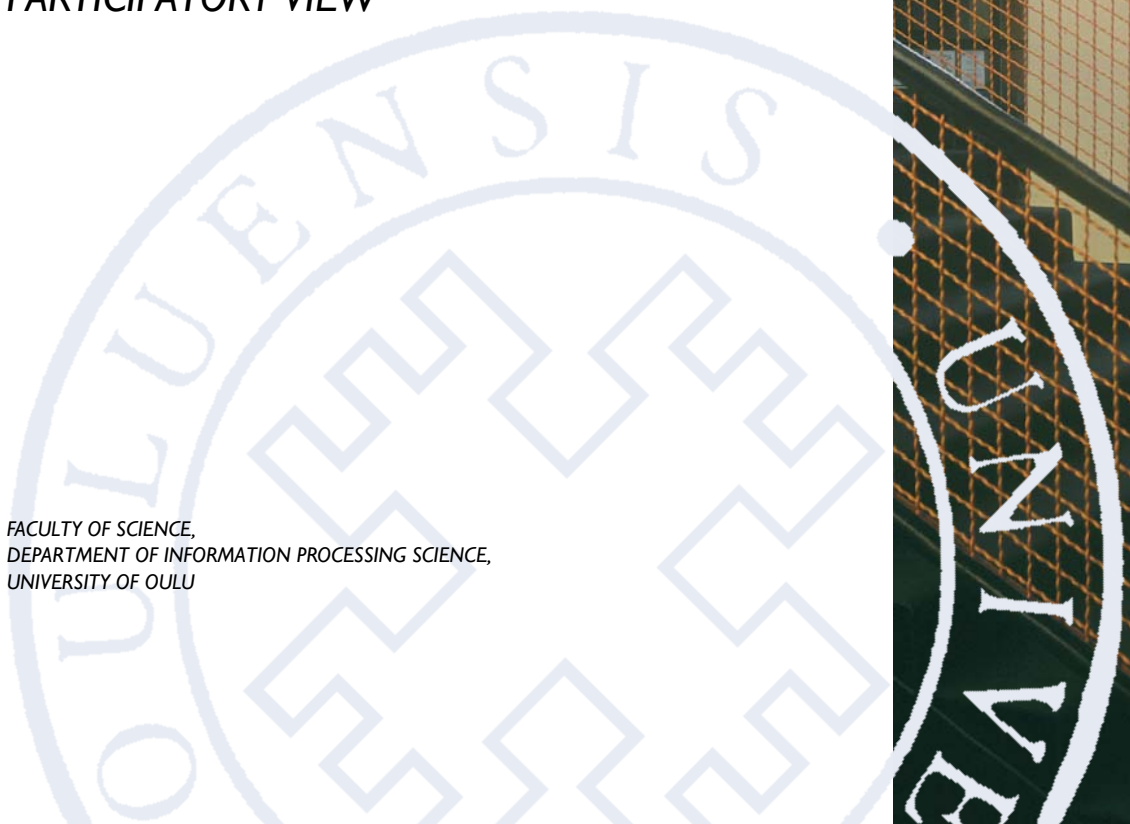
CHALLENGES IN
AN INTER-ORGANISATIONAL
INFORMATION SYSTEM
IMPLEMENTATION

PARTICIPATORY VIEW

FACULTY OF SCIENCE,
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RAIJA HALONEN

**CHALLENGES IN AN INTER-
ORGANISATIONAL INFORMATION
SYSTEM IMPLEMENTATION**

Participatory view

Academic dissertation to be presented, with the assent of
the Faculty of Science of the University of Oulu, for public
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Abstract

A trivial information system consists of three components: a user, a container for the information and a tool to manage the information. The focus of this research is more complicated with several users and organisations, with several databases in those organisations and with an inter-organisational information system. In inter-organisational information systems information flows across boundaries and the boundaries as well as information itself must be carefully taken into account. This research takes seriously the users who represent different professions and who were more or less involved in the information system implementations. In a distributed project, also the container is under special attention. That is discussed in the dissertation, as well.

The approach in the research is mainly interpretative and subjective. The empirical material comes from several cases but three of them acted as a background for the main case that was conducted in an academic environment. The case appeared to be versatile due to its many stakeholders and it offered several topics to be explored.

The goal of the research was introduced in a meeting to the attendees: "*The aim of the thesis is to describe how a joint information system of different universities was finally implemented or why it wasn't.*" This introduction predicted challenges that were to be overcome during the subsequent years.

In addition to the versatile case, also the information system implementation offered fruitful viewpoints for the research. Inter-organisational information system projects are described in literature to some extent. This case contributes the research with the many organisations and users that were involved in the development project. Furthermore, the information system was planned to be built on ready-made specifications and it increased the challenges to succeed. This led to the lesson that a new model to be used in information system developments is needed because existing models do not support this kind of development process. The research supports the concept that action research and design science complement each other especially in development projects when the output is an information system that has been implemented in collaboration with several users and stakeholders.

The results of this thesis emphasise the need to manage potential competition between participating organisations, lack of interaction between parties and security and user authentication. Proper project management is needed with active and confidential terms between all project members. In addition, flexible working routines are found workable.

Keywords: action research, inter-organisational information system implementation, multi-organisational involvement, user participation

Preface

This thesis is an intermediate stopping point that acts as evidence of my ability to perform research and to report of it.

The grounds for the thesis lay in my workplaces where I got my inspiration to continue my academic studies. I'm deeply grateful for the experience I got there and the possibilities that they gave me. It is amazing how life conducts us. If we only let it do that.

This doctoral thesis was not possible without contribution by several people. I'm greatly thankful to my supervisors Professor Ari Heiskanen and Professor Veikko Seppänen for their constructive attitude towards my research. Professor Ari Heiskanen is also noted for letting me in the main case that proved to be a real treasure chest. I want to thank my colleagues Riitta Hekkala and Kai Lindberg who were more or less involved in the same case as I was. They understood when I had to talk about the research settings. In addition, I want to express my gratitude to many other people who were available and who contributed the output of my dissertation. I list here only some of them: Ilkka Bordi, Anneli Lappalainen, Julian Lindberg, Maikki Naarala, Päivi Pakkanen and Margareta Soismaa.

In the thesis I used pseudonyms because of the personal and subjective approach in the research. In this way I also provide possibilities for future research where the same research material and settings can be used. Due to the diversified research context, the use of pseudonyms is justified, thus leaving the field open for other researchers.

KAUTE säätiö (Kaupallisten ja teknillisten tieteiden tukisäätiö) supported my research and I am grateful to it. Furthermore, I was privileged to participate in the INFWEST program that is partly funded by the European Social Fund. I cannot mention all the recognised scientists that I have met there and with whom I have been able to discuss. I am thankful to all of them. However, I want to name Professors Bo Dahlbom, Roberto Evaristo, Juhani Iivari, Pertti Järvinen, Kalle Lyytinen, Michael Myers, Mike Newman, Ulrike Schultze and Geoff Walsham who encouraged me to carry on. In addition, Pertti Järvinen and Roberto Evaristo acted as external reviewers of my thesis. I am grateful for their persistent and generous comments that also opened new viewpoints in my research.

Furthermore, I thank Professor Harri Oinas-Kukkonen and Professor Mikko Siponen and other staff in the department who took their time to discuss my research. Finally, I

must not forget KISS seminars that enabled relaxed possibilities to write, sometimes until midnight.

In addition to academic society, I want to express warm thanks to my friends who understood my limited social life. It would be nice to continue our friendship.

Most significant thanks belong to my family – my husband Veikko and our daughters Mari and Liisa. I understand that from time to time they were not as enthusiastic about my academic research as I was. However, countless are the moments when Veikko and I had rewarding discussions about research, science, information systems and what ever.

This is a good place to thank my parents Eeva and Arvo who were available when our daughters needed a safe place to stay during this research. You are special.

List of original publications

- I Halonen R (2004) Resisting technical change – three case studies. *International Journal of Innovation and Technology Management* 1(3): 1-15.
- II Halonen R & Heiskanen A (2005) Configuring Co-operation: A Reflective Learning History. *Reflective Practice* 6(3): 379-391.
- III Halonen R (2004) Many faces of collaboration in an information system project. In: Sobolewski M & Cha J (Eds) *Concurrent Engineering: The Worldwide Engineering Grid*. Beijing: Tsinghua University Press and Springer-Verlag: 449-454.
- IV Halonen R (2005) Building a Joint Information System. In: Kamel S & Irani Z (Eds) *Electronic proceedings of the European and Mediterranean Conference on Information Systems, 7-8 June 2005, Cairo, Egypt*.
- V Halonen R (2005) Supporting decision-making in managing student mobility. In: Wei C-P & Yen B (Eds) *IT & Value Creation. Electronic proceedings of the Ninth Pacific Asia Conference on Information Systems July 7-10, 2005, Bangkok, Thailand*: 1603-1609.
- VI Halonen R & Paavilainen J (2005) Hierarchical Model of Problems in Implementing Information Systems. In: Wei C-P & Yen B (Eds) *IT & Value Creation. Electronic proceedings of the Ninth Pacific Asia Conference on Information Systems July 7-10, 2005, Bangkok, Thailand*: 350-362.
- VII Halonen R (2006) Building user authentication in an inter-organisational information system. *Journal of Information Systems Security* 2(3): 49-68.

Contents

Abstract	
Preface	
List of original publications	
Contents	
1 Introduction	11
1.1 Motivation	11
1.2 Research area	14
1.3 Main concepts	17
1.4 Life-cycle of the main case	18
1.5 Outline of the thesis	20
2 Issues in implementing information systems	22
2.1 Information systems	22
2.2 Organisational change	25
2.3 Role of culture in implementations	26
2.4 Users in implementations	29
2.5 Trust in collaboration	31
2.6 Other challenges in information system projects	34
2.7 Inter-organisational information systems	38
2.8 Theoretical preface for action-related research	47
2.9 Case study and action-related research methods	49
3 Empirical context	56
3.1 Research objectives	57
3.2 Positioning the researcher	57
3.3 Use of research methods	59
3.4 Original publications	63
3.4.1 Earlier experience	63
3.4.2 Research from the main case	64
3.5 Personal notes	66
4 Analysing the empirical material	70
4.1 Analysis of the research material	70
4.2 Scientific contributions	74

4.2.1 Similar challenges in differing environments.....	74
4.2.2 Experience and learning in information system acquisitions	75
4.2.3 Collaboration between partners	76
4.2.4 Heading towards a joint information system	77
4.2.5 Role of decision-making.....	77
4.2.6 Evaluating risks	78
4.2.7 Building security in inter-organisational information systems	78
4.3 Practical contributions	79
4.3.1 Differing information system implementations.....	79
4.3.2 Information system management insights: Case MoSu.....	81
4.4 Analysis of the results.....	91
5 Extended discussion	97
5.1 Responses to research questions.....	97
5.2 Contemplation	98
5.3 Implications for science.....	106
5.4 Limitations.....	111
5.5 Future research	111
6 Conclusions	113
6.1 Final account	113
6.2 Additional remarks	114
6.3 Concise “lessons learnt”	116

References

Original publications

1 Introduction

The aim of this chapter is two-fold: firstly, it should motivate the reader to continue with his or her reading until the main message of the thesis has become evident, and secondly, this chapter aims to describe briefly what is to come when the reader continues reading.

The first section explains the motives and the fundamental reasons that led to this topic. The next section describes the research area, starting with generic notes about information systems and their implementation focusing on inter-organisational information systems, and finally concentrating on the targets of this research. Inter-organisational information systems and especially their implementations with several stakeholders have so far got only minor attention in the information systems' research. Therefore, the subject is worth studying. The role of the researcher is briefly explained at the end of this section. The main concepts are explained after that, highlighting only the most important issues in this thesis. The next section briefly introduces the life-cycle of the main case in this thesis. However, the main case is described in detail in Section 4.3.2. Finally the outline of the thesis is introduced. The approach in the thesis is subjective, and limited to the viewpoint of the researcher who worked as an active project manager and a facilitator in all but one of the cases.

1.1 Motivation

“A man, a pen and a calendar.” This formulation was introduced to me as an example of an information system in the early 1990's, and I was impressed. The example concretised the simplest information system that consisted of three particles: a database (the calendar), a tool that was used for inserting data into the database (the pen) and a user that used the database (the man). Later I was able to use the same example when giving presentations about information systems. The example was useful even when elucidating the operations necessary when replacing an old information system with a new one. It was amazing how the same example served when illustrating the tasks that have to be catered for before the old information system is ready to be totally abandoned.

The wonder of information systems continued when I was able to visit the patient information archives of the Northern Ostrobothnia Hospital District. The archives were

situated in a cellar, with walls covered with shelves full of files in a strict order. Each of the cardboard files had a simple calendar on its spine: day, month, and year marked with a coloured tape – red for women and blue for men. This system produced three horizontal broken lines on the walls – one line for the day of birth, a second line for the month of birth and the third line for the year of birth (Figure 1).

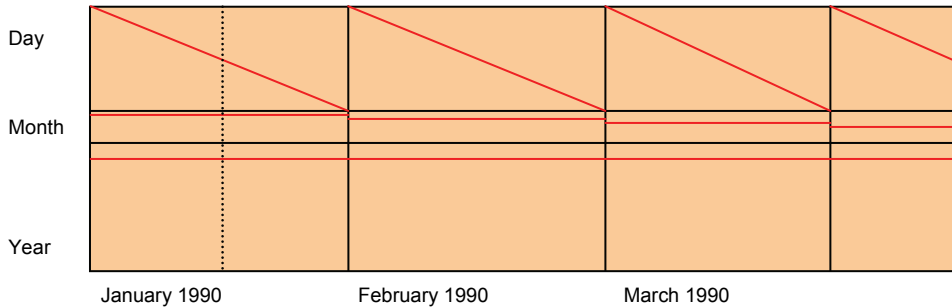


Fig. 1. Condensed illustration of a piece of wall covered with cardboard patient files, from the 1990's.

By using this simple information system the personnel in the hospital were able to find the correct patient file in the huge archives when the gender and date of birth of the patient were known. For example, the file of a girl who was born on January 15 1990 would be located in the middle of the first section (dotted vertical line in Fig. 1). The information system was undergoing change because the files were to be microfilmed and a computerised information system was under planning at that time.

However, these two examples of different information systems made such an impact on me that I became interested in information systems. My working life gave me more opportunities to work with information systems, designing, testing, and finally implementing them. My first information system implementation project was conducted in the mid-1990's (Halonen 2003a). The information system was coded with Access and replaced piles of paper sheets and paper files, reminding me of the impressive patient information archives. Despite the small size of the project, it taught me a lot about implementation projects, users and design (Halonen 2004a). The project taught me the importance of understanding the context in which the information system is to be implemented. In addition, I learnt that there is always some kind of hierarchy in the organisation and this must be taken into account in the work practices. The most important lesson learnt was the considerable impact of users, especially if they do not want to accept the information system, causing great resistance to change and thus influencing the output of the implementation.

My first hands-on experience came from a small project, comprised of only a handful of workers who were to be the users of the information system. Despite the small size of the project, it taught me a lot about designing information systems and about the importance of users. The second lesson came from an information system project where several hospitals were planning a common information system to replace their legacy systems. The experience consisted of running the pilot project, in which two departments

in a small hospital were to use two applications of that information system. In addition, before the information system was ready to be piloted, several actions had to be carried out to enable its use. For example, where the new database was to be constructed using information retrieved from the legacy system, the transfer of information between the new system and the legacy system had to be managed. The project was much larger than the first one, giving more opportunities to learn. This lesson also showed the importance of noticing resistance to change and the importance of reacting to it (Halonen 2004b, publication I). During this time I became inspired in the study of information systems and enrolled in the university to get a degree in information system sciences.

My third experience was again different from the previous one. This example included the first step towards implementing a global enterprise resource planning system to be used in a large information technology organisation. I was able to follow the implementation project and to get information about its progress from the project manager who was responsible for running this implementation project. This project was a big one, and its importance was emphasised every now and then in the organisation. Because of its diversified nature, the project was divided into several sub-projects, and it seemed to me that every one of them was challenging. This versatile implementation project taught me not only the importance of careful planning and timing but also the problem of information that was only limitedly delivered due to its confidential nature. In addition, it also increased my interest in information system projects.

And then, a new project was suggested to me by my supervisor. The universities in Finland needed an information system to support the management of student mobility that meant that students were allowed to perform courses in other universities as a part of their academic degrees. These studies had to be paid to the giving universities and so far no standardised records were available to support the invoicing. Student mobility was expected to increase and a project was needed to implement this information system. There had already previously been a project owned by other stakeholders, and student mobility was specified and specifications for the information system had been created in that project. However, there had not been sufficient resources to implement the information system. This was the situation with specifications made by other actors when I was introduced as a project manager to the officials in the student affairs offices, and the implementation project was to be established.

The background, with other actors and a large number of participating organisations, created challenges for the new information system that was to be designed, coded and piloted during the project. The output would be a joint information system that would include all student mobility between the universities. At that stage, no ideas about the final architecture or any database were available. The most impressive driver was the high-felt need expressed only by the universities to get an information system to support their efforts with student mobility. The universities are traditionally highly autonomous and independent and they have built their own ways of managing their functions. Building a joint information system for several organisations is a challenge in itself. Furthermore, stepping in as a newcomer to a project with previous actors and expectations gives a project special characteristics, adding difficulties and challenges in the management of the project. This project is described in detail later in this thesis because the main research material was collected during my work in the project.

Furthermore, with this background and experience I was prepared to run the project as the project manager and to collect research material for my academic thesis. When doing so, I was aware of the following management challenges in implementing information systems and when influencing organisational change (Laudon & Laudon 1998b):

1. Organisational inertia, meaning that if there is no compulsion it is difficult to focus organisational attention and resources on developing new systems because organisations are so resistant to change.
2. Dealing with the complexity of large-scale system projects that affect several organisational units and that have big information requirements, especially when the development lasts years.
3. Estimating the time and cost required to implement a successful large information system.

The research area is briefly described in the following section, setting it in the right context of implementing information systems and concentrating especially on inter-organisational issues.

1.2 Research area

Information technology has become an inevitable part of our society. Information technology entails changes in organisations that make them more dependent than in the past on the knowledge, learning and decision-making of individual employees (Laudon & Laudon 1998a). Technology enables interaction between people and organisations without the need for physical attendance. This interaction is enabled with inter-organisational information systems (Johnston & Vitale 1988). The common intention of traditional inter-organisational information systems has been to support companies' value chains in order to enable them better to compete in the market. However, in recent years inter-organisational information systems have increasingly tended to support partnering among organisations (Hong 2002). This tendency leads to the goal of this research.

The aim of this thesis is two-fold:

first - to explore what kind of challenges are found when several distinct organisations, including the participating organisations, are involved in developing an inter-organisational information system, especially in the context of academia, and

second - to explore how the inter-organisational information system in that context is implemented.

The approach is that of an insider who is involved in the development work. There is not much literature about information system acquisitions made by several users representing different organisations (Dahlbom, oral communication June 11, 2005). This research narrows this gap in information system research.

The research is qualitative and the cases are unique, the main material coming from one case about implementing an inter-organisational information system. However, the

main case includes several characteristics found in the other three cases. Action research and related methods are used, in addition to case study following notes by Mathiassen (2002), who studied how computer-based information systems are developed in practice. In Mathiassen's case there was an aim of improving practices in each of the participating organisations, which is similar to this present research. Mathiassen notes that collaborative practice faces a combination of practice-driven and research-driven goals, again like the situation in this research.

The researcher gathered study material from the cases and she was involved in the implementation projects except in one case. The role of the researcher is explained in detail in the original publications that are attached at the end of this thesis. Furthermore, her position in this thesis is expressed later when introducing the empirical context.

Organisations are constantly developing technological tools to be used when they are seeking solutions to manage knowledge (Schultze & Boland Jr. 2000). Networked inter-organisational information systems implement reciprocal interdependencies between organisations (Hong 2002). There is a great deal of literature that discusses research about implementing information systems in distributed organisations (*e.g.* Munkvold 1999, Kotlarsky & Oshri 2005). Moreover, managing interpersonal co-operation in information system implementations is a challenge (Barki & Hartwick 2001), and transforming conflicts to benefit group outcomes increases this challenge (DeChurch & Marks 2001). However, organisations should link with each other to perform effectively in present-day environments (Daniel & White 2005). Nevertheless, so far there is not much literature about implementing inter-organisational information systems, especially in the context of the organisations themselves being involved in the development work (Lyytinen, oral communication June 21, 2005).

The fact that the failure rate of information system projects is generally known to be high (Laudon & Laudon 1998b, Schmidt *et al.* 2001) gives us good reasons to carry out this research. Furthermore, because less than 10 percent of implementation failures stem from technical problems, and most of them occur for human and organisational reasons, including users' misunderstanding of the technology (Griffith & Northcraft 1996), this research is ever more justified. Lyytinen and Lehtinen (1987) suggest that sense-making should be oriented towards recognising the diversity of information systems development, which is a political and symbolic process. Following them, this process brings along a distribution of language and a co-ordination of conflicting interests.

All the same, it is not always self-explanatory whether an information system project is success or failure. Sauer (1993) argues that an information system development project is a failure when the management terminates it. Larsen and Myers (1999) discuss the question of what if an information system turns out to be a failure even if it was at first evaluated to be successful. Halonen (2003a) reported a project as a failure, but a later consideration evaluated it more positively (Halonen 2004a). Newman and Sabherwal (1989) suspect their model that an assessment of success changes over time, also depending on the win or lose side of the evaluator. Smithson and Hirschheim (1998) ponder the level that should be used when evaluating the outcome of an information system project.

There are different measures to evaluate the success of an information system. Lucas *et al.* (1990) list the following examples of success measures:

1. The use of the system measured by intended or actual use
2. User satisfaction with the system or with outcomes of using the system
3. Favourable attitudes toward the system on the part of users
4. The degree to which a system accomplishes its original objectives
5. Payoff to the organisation.

Furthermore, lack of co-operation and the opportunistic behaviour of partners have been reported to be causes for the relatively high rate of failures in alliances (Das & Teng 1998). However, it is reasonable to assume that similar issues related to collaboration matter regardless of the rate of commerciality of the participating organisations. Relation-specific assets, knowledge-sharing routines, complementary resources and effective governance build inter-organisational competitive advantage, describe Dyer and Singh (1998). Håkansson (1992) has studied collaboration between commercial partners. He has found that local or regional networks seem to be important when there is no ongoing commercial exchange to provide a basis for collaboration. In addition, another important factor that determines a company's choice of collaborative partner is the relative importance of the partners to one another. Kotlarsky and Oshri (2005) study the contribution of social ties and knowledge-sharing to successful collaboration in distributed information system development teams. Collaboration on multiparty information systems development projects was studied by Levina (2005). Levina followed two information system development teams as a non-participatory observer, which differs from the setting in this thesis.

Furthermore, this research concentrates on the issues that emerge when acquiring a joint information system, having no commercial agreements or official contracts - except between the vendors and the customer - to support the collaboration between the partners that are involved in the development work. This situation is possible when there is perceived trust between the partners and persons who are involved in the development work.

The research area consists of universities with their special characteristics as independent organisations and departments, people working there, with their own objectives, and other organisations that were involved in the implementation project. In our research we had several universities involved from the very beginning. Universities are essentially different from business organisations in their decision-making processes (Heiskanen 1994). In addition, the new information system was designed to be grounded on previously made decisions that were made by other stakeholders. Furthermore, we wanted to find out the lessons that were learnt during the implementation project. The goal was to find out how a joint information system is implemented in the context of several universities participating, having their own procedures and ways of managing the use of the information system to be developed. The approach from the beginning was that of an insider who looks at the situation from inside the project when participating in the implementation.

The researcher was acting as a project manager from the beginning of the project and her first task was to get acquainted with the previously created specifications. At the same time, the acquisition process was started with the vendors. However, the project manager was not responsible for carrying out the acquisition because she had no experience in that field. Despite this, she was involved in the acquisition and informed about its progress.

The information system project offered an opportunity to learn, for both the project manager and the other participants in the project groups. The position of the researcher is described in detail later in this thesis.

This research area contains some main concepts that are expressed in the next section. We highlight the concepts of information system, inter-organisational information system, distributed project, customer and end users, trust and culture, and eGovernment.

1.3 Main concepts

“Information system” as a concept has many descriptions and meanings. Hevner *et al.* (2004) point out that information systems and the organisations that they support are complex, artificial and purposefully designed. In this thesis, “information system” is taken as a unity that consists of a database, users, data collection devices, data sharing devices, the interpretation of information, organisational structures and processes. In addition to the individual end users, there are organisations that are seen in this study as a customer in relation to the vendors that produced the information system. Compared to customers, end users are seen in this paper as human beings who use the information system. In our main case, the procurement contracts are made between independent organisations, *e.g.* vendors and a customer. However, the customer organisations consist of the people working in them, using the information system under discussion and allowing information flow across organisational borders (Johnston & Vitale 1988). We discuss this kind of information system as an inter-organisational system

Besides being an inter-organisational system, our information system is an output of a distributed project (Evaristo 2003). A characterising feature of a distributed project is that it is carried out in a situation where actors are located at shorter or longer distances from each other. In our project there are several universities involved, situated in several cities and locations. In addition, there are participating departments in universities that again are distributedly located. Furthermore, there are vendors involved, coming again from distant locations.

Because of the nature of a distributed project and its several actors, the role of trust is emphasised in this study. Most trust theorists agree that trust is fundamentally a psychological state (Kramer 1999). Furthermore, trust can be viewed from a rational or social perspective (Jarvenpaa *et al.* 1998). Trust is based on the assumption that others will behave as expected. One of the reasons people do not trust each other is a lack of knowledge about the rationale for past or present behaviour and intentions (Evaristo 2003). Trust has different forms in organisations, and there are several antecedent conditions that produce these forms.

Furthermore, due to the many stakeholders in the development project, the concept of culture is noted in this thesis. “Culture” expresses the feeling of a pervasive way of life or set of norms (Handy 1999). Organisations have differing cultures that are affected by the events of the past and by the climate of the present, by the technology of the type of work, by their aims and the kind of people that work in them (Handy 1999). Culture can be seen as one of the trust determinants (Evaristo 2003).

Implementing an information system is seen in this research as the whole process from choosing vendors, through requirements analysis and so on, to the realisation of the information system. The approach differs from the concept introduced by Iivari (1991) when he defined implementing as “organisational implementation” that did not include planning or design. This research follows the definition by Laudon and Laudon (1998b, 513) when they state: “Implementation refers to all organizational activities working toward the adoption, management, and routinization of an innovation.” Laudon and Laudon suggest that managing an implementation necessitates the consideration of the following aspects:

1. controlling risk factors
2. overcoming user resistance
3. designing for the organisation
4. allowing the human factor
5. sociotechnical design.

Because the researcher acted as a project manager and because she collected research material from the implementation to be published, the management aspects were to be emphasised in the project in order to get a successful output.

Furthermore, implementing an information system is always an instance of organisational change (Davis & Olson 1985). In our case we had two vendors involved and their role is described in more detail later on. In addition to people working in the organisations, there are end users that use the system without being employees in the organisations. In our case these end users are students that study in the universities.

We use the concept of eGovernment when discussing actions that are performed using an electronic device and the World Wide Web (WWW). Wikipedia (2007) defines eGovernment as “the delivery of public services, where there is an online or Internet based aspect to the delivery of the services”. By using information and communication technologies and eGovernment it is possible to re-locate government services from government offices to locations closer to the people who use the service (Gichoya 2005). That means that no paper forms are needed when, for example, applying for rights to study or when managing student mobility.

1.4 Life-cycle of the main case

This section gives the reader the chance to understand the diversity and background of the main case of this thesis. In addition to this short description, the case is described in detail later in Section 4.3.2.

The fundamental background for the current information system project can be found in the increasing student mobility. This kind of student mobility has been possible for years, but until now the agreements between universities had been mutual. Because of the increasing student mobility, the process of that mobility was first described in 2002 by other actors. This description served as a good starting point when the current information project MoSu (an abbreviation for Mobility Support) was about to start its work in summer 2003.

Together with defining the process of student mobility, another effort was started. That effort included tasks to define and implement a pilot information system that would support and develop the management of student mobility. The output of this effort was a mass of documentation that included project memorandums and definitions for an information system. However, due to a lack of resources the information system was never implemented. Instead, the definitions were declared to act as a backbone when the current information system project was established. Despite the close relation to the current information system project, that effort is outside the scope of this thesis.

The first meeting to establish the current information system project was held in June 2003. The author of this thesis was introduced to the student affairs officials of three universities from the metropolitan area and other participants of the meeting, and her role as a project manager was cleared. In the same meeting the steering group and project group were also unofficially nominated and the first plans to establish the project were made. Moreover, the aim of this thesis was put in words in the meeting: *“The aim of Raija’s thesis is to describe how a joint information system of different universities was finally implemented (or why it wasn’t).”* (Memorandum June 16, 2003)

Table 1. Organisations related with MoSu.

Organisation	Nature of organisation
UA	University of Alfa that applied for the funding
UB	University of Bravo that was involved from the beginning
UC	University of Charlie that was involved from the beginning
UD	University of Delta that acted as a process university from the beginning and that joined the piloting after the three others
UE	University of Echo where project management was taken care in
UV	University of Victor, a consortium of universities
MinEdu	Ministry that funded the project
Sierra	Vendor
Tango	Vendor
StuRec	Consortium of the most used student registration systems

Table 1 summarises of the versatile group of organisations that were involved in the main case. The organisations are described in detail later in this dissertation.

The process of acquiring the vendors started in September 2003 and the contracts were finally signed in December 2004 (Halonen and Heiskanen 2005, publication II). However, the project already started progressing actively in 2004 before the contracts were officially signed. A surprise came up in the steering group when a competing information system project was introduced by an attendee at the meeting. This situation caused a lot of overlapping work and it consumed both mental and material resources.

Another task that demanded more resources than expected was setting up the functionality to cater for user authentication and to transfer secure information about students and their studies to be used in the application forms. This information was to reduce the need to fill in information that was available in the master systems of the universities. (Halonen 2006b, publication VII)

The piloting of MoSu was divided into two phases: the first functionalities supported the application phase, in which students applied for the right to study elsewhere and the student affairs officials supported or rejected the right. This phase started in spring 2005. The second phase included actions that supported reporting on student mobility, helping invoicing in particular. This phase was realised in spring 2006. In addition, in the first phase there were only three universities that piloted the information system. In the second phase two other universities participated in the piloting, giving experience about using the information system and also about the manoeuvres that were needed when extending the use of MoSu.

The life-cycle of the project ended in late 2006, when the project with its experiences was delivered to its new owners.

1.5 Outline of the thesis

This thesis consists of an introductory part with six chapters and seven distinct research papers that are attached at the end. Except for the first research paper, the research papers all discuss the same case. The researcher was involved in the principal case acting as a project manager and participating in every phase in the implementation process. The first paper includes three cases of various sizes and from differing business fields, and the role of the researcher varied between them. However, the basis of its presence in this thesis is justified because it describes the grounds for the experiences of the researcher. Our experiences make us what we are and we act following our experiences in whatever situation we meet in our life.

The first chapter presents the motivation for the research, describes briefly the research area and introduces the main concepts that are used in this thesis, thus giving an overview of the area. The chapter ends with this outline after the life-cycle of the main case is delineated. The second chapter presents prior literature in the field and highlights some main aspects that will be discussed in this thesis. That chapter builds the theory behind this research. The third chapter introduces the empirical context. Firstly, the research objectives are introduced. That is followed by a section where the researcher is positioned within the research. After that the research methods used are described and the original publications in the research path are then listed. The third chapter ends with personal notes that again help the reader to understand the research approach that is used in this dissertation. The fourth chapter is about analysing the empirical material. The research material is evaluated first, after which theoretical contributions and empirical contributions are expressed. The fourth chapter ends with analysis of the results. This is followed by an extended discussion in which a response to the research questions is given, followed by grounded contemplation. The chapter ends with proposals for future study. Before that, limitations are listed. Then come conclusions with additional remarks and they close the research (Figure 2).

Finally, the original publications are enclosed, enabling the reader to become fully acquainted with the original research that has been conducted and that makes up this academic dissertation.

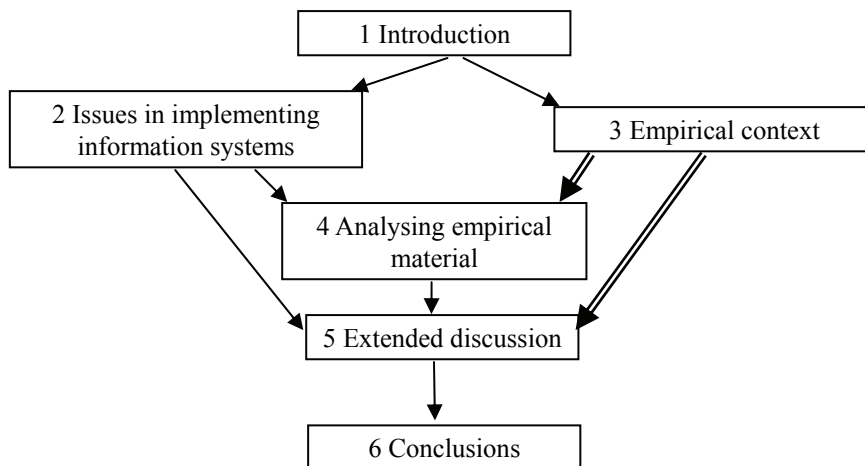


Fig. 2. The outline of the thesis.

The arrows in Figure 2 show the direction of influence in the research. The theory part (2) is seen in the background of both the analytical chapter (4) and the contemplative chapter (5) of the thesis. Likewise, the empirical part (3) is seen in the same chapters (4 and 5), but the approach differs from that of the theory part. The concluding part (6) is described apart due to its special nature.

The outline of the thesis associates with the motives described in Section 1.1. The background from her earlier information system projects guides the researcher when she dives into the main case that also summed several characteristics that were seen in the earlier cases.

2 Issues in implementing information systems

This chapter represents concepts that are connected with implementing information systems. The approach starts with general notes about information systems and their implementations and continues to inter-organisational information systems after that. Before going any further, the interpretative nature of the chosen literature should be recognised. Although the literature review aims to be objective, the literature is chosen in this research and read by the researcher. Therefore her experience influences every choice she has made when selecting literature, and her interpretation in relation to significant issues affects which notes she highlights in the review.

Oulu University Library and its catalogues, in addition to the “Nelli” portal (www.nelliportaali.fi) were used when searching for appropriate literature. Google Scholar (<http://scholar.google.fi>) was also used when performing searches. Its “Advanced Scholar Search” was used when looking for articles on specific concepts. Some visits to the National Library of Finland were made due to the perceived importance of certain literature that was not available in Oulu or electronically.

Firstly important concepts are presented, concentrating on such concepts that appear in information systems implementations and that have been proven to be important in previous information systems research. The starting point is organisational change, followed by the role of culture in implementations. Users in implementations are considered next, followed by some notes on trust in collaboration, and obstacles and challenges in information system projects. Finally inter-organisational information systems are discussed. The theoretical part ends with a review of research methods.

2.1 Information systems

An information system can be characterised as a set of interrelated components that collect, process, store and distribute information to support decision-making and control in an organisation (Laudon & Laudon 1998a). Formal information systems can be either computer based or manual. Manual systems use paper and pencil technology (*cf.* Halonen 2004a), while computer based systems depend on computer hardware and software technology to process and distribute information (Laudon & Laudon 1998a). Information

system development is described as an effort that requires the expertise, insights and skills of several individuals (Tiwana & McLean 2005). Information systems have a life cycle, like any new product, and traditionally it is represented as Lucas (1985) expressed it already twenty years ago:

Inception → Feasibility study → Systems analysis → Requirements analysis → Design → Specifications → Programming → Testing → Training → Conversion and installation → Operations

Twenty years later Huisman and Iivari (2006) defined a systems development process model as a representation of the sequences of stages through which a system evolves. They list a linear life cycle and a spiral model as examples of the process model. The most challenging task in the classic life cycle introduced by Lucas (1985) is 'Design', with a number of potential problems such as systems that do not meet their specifications, systems that are not used and systems that are strongly criticised by their users. 'Design' is also the phase in which the process that is to be supported by the information system should be identified thoroughly. There are several reasons to develop an information system and these reasons influence implementation (Lucas *et al.* 1990).

Information systems are implemented in organisations in order to improve the effectiveness and efficiency in those organisations (Hevner *et al.* 2004). On the other hand, opportunity, as well, has been recognised to be a reason for building something new (Järvinen 2007b). However, information systems are also seen as trouble-makers that tend to encourage the bureaucratisation, standardisation and mechanisation of information processes that do not meet the realities of organisational activity (Lyytinen 1986). Implementing information systems has been widely described in the literature (Lucas 1981, Lyytinen & Lehtinen 1987, Laudon & Laudon 1998b).

Information system development was studied by Iivari (1991) who analysed the paradigmatic hypotheses made by the seven major disciplines of information system development. The approach by Iivari is mainly theoretically oriented but it also emphasises the practical benefits of the viewpoint. Iivari introduces a framework that can be used as a tool when analysing the disciplines. The framework includes four main paradigmatic dimensions (ontology, epistemology, methodology and ethics) to be used. Iivari concludes that in case of human nature and research methods, a dominant approach is not possible to be identified.

Hirschheim *et al.* (1997) have explored further the approach to take when developing information systems. They compare five alternative approaches (Interactionist Approach, Speech Act Methodology, Soft Systems Methodology, Scandinavian Trade Unionist Approach and Professional Work Practice Approach). The authors conclude that the approaches are complementary, but they point out the main characteristics of the approaches. They remark that the strength of the trade unionist approach is its support for informal interaction and communication between professional information system developers and users. Furthermore, Iivari *et al.* (1998) have analysed these approaches concentrating on four basic questions: What is the assumed nature of an information system? What is human knowledge and how can it be obtained? What are the preferred research methods for continuing the improvement of each approach? What are the implied values of information system research? Laudon and Laudon (1998a, 9) contribute to these questions: "To understand information systems, one must understand the

problems they are designed to solve, their architectural and design elements, and the organizational processes that lead to these solutions. Today's managers must combine computer literacy with information systems literacy."

In contrast to the studies of Iivari, Hirschheim and Klein, Mathiassen approached the subject differently. He studied the development of computer-based information systems in practice (2002). His study of four software organisations and researchers from universities and technology institutes underlined the role of the local organisational environment. The mission of Mathiassen's study was industry-related, together with three research goals. These research goals were:

1. To develop understanding of systems development that is used when interpreting practice
2. To build new knowledge that can support practice, and
3. To learn what is needed when improving practice.

In addition, Mathiassen's study combined interpretative understandings of practice with normative propositions to support professional development. His study states how establishing properly functioning relations between research and practice is the main concern in collaborative practice research. Further, the lessons learnt are expressed as follows:

1. Collaborative practice should be organised to support versatility
2. Understanding and supporting practices are basic knowledge interests in studying systems development
3. Collaborative practice studies combine action research, experiments and practice studies
4. Extensive documentation is needed to ensure sufficient rigour when organising research initiatives.

Kotlarsky and Oshri (2005) have conducted an in-depth case study on geographically distributed information system projects. They state that ongoing innovations in information and communication technologies make it possible to co-operate in a distributed mode. The authors argue that there is a need to understand whether and how social aspects actually contribute to successful collaboration. They accept the observation that insufficient trust and poor social relationships may act as barriers to successful collaboration in globally distributed teams, and sufficient trust and well-established social relationships may act as enablers to collaborative work. Even though the cases were globally distributed, each case included just one organisation (LeCroy and SAP).

Besides enabling co-operation in a distributed mode, information and communication technologies enable the improvement of the efficiency and effectiveness of administration within government, and the re-location of government services to locations that are closer to the citizens (Gichoya 2005). Gichoya goes on to say that projects in which information and communication technologies are implemented are complex endeavours and more research is needed to identify challenges, good practice and solutions for successful implementations.

2.2 Organisational change

Organisational change is an essential issue in information system implementations, as shown in this section. The development and implementation of an information system are instances of organisational change (Davis & Olson 1985, Lyytinen 1987), and they often lead to changes in the work processes and structures of the personnel (Eason 1988, Sahay & Robey 1996). Organisations and information systems are closely related due to the growing interdependence between business strategy, rules and procedures, and information systems software, hardware, databases and telecommunications (Laudon & Laudon 1998a,b). A change in any of these components often necessitates changes in other components in the list.

Another view to organisational change comes from environmental turbulence where the expectations of customers, suppliers, competitors and governments change without prior notice or assessment (Salmela *et al.* 2000). To avoid failures in information system investments, Salmela *et al.* suggest that information system planners conduct environmental analysis and that they engage management support that would enable successful information system planning outcomes.

On one hand, communication technology has enabled many organisations to be organised in more adaptable ways by increasing the ability of the organisations to respond to changes in their environments and to take advantage of new possibilities (Laudon & Laudon 1998a,b). For example, networks of computers have enabled employees to work together as a team despite the distance between them. On the other hand, Lee *et al.* (2003) note that the importance of adopting and implementing relevant and appropriate information technology tools has often been underestimated as a way of bringing effective changes into an organisation. Lee *et al.* continue that despite the much advertised importance of information technology in increasing the competitiveness of an enterprise, the exploitation of the Internet is still far from satisfactory and is still limited to information searching and e-mailing.

Adding to organisational change, Bødker *et al.* (2004) explored information system implementation in distributed organisations. They implemented a context specific web-based information system and concluded that attempts to predict use patterns of open-ended virtual workspace technologies are mostly obsolete. They also accentuate that change management efforts are not useless and they developed their own change management approach with four implementation contexts: newly established organisational units; special interest groups; short term projects, and teams handling recurrent tasks.

Information systems development as social action was studied by Lyytinen (1986, 74), who gave the following definition: "Information systems development is a change process taken with respect to object systems (target) in a set of environments by a development group to achieve and/or to maintain some objectives". Furthermore, cultural and social background has its impact on changes in organisations and on the implementation of new technology (*e.g.* Walsham 1993). Viitanen and Piirainen (2003) describe how culture affects efforts towards organisational changes. Following their study in a hospital environment, efficiency and profitability is emphasised, leaving no place for organisational changes.

Pettigrew *et al.* (2001) argue that the study of change and development is one of the great themes in the social sciences. Pettigrew *et al.* go on to say that the field of organisational change is still lacking research that would help to understand the dynamics and effects of time, process, discontinuity and context. They also add that the most fundamental challenges in studying phenomena in organisational change are to our own scholarly routines.

Organisational change can be carried out in at least three different ways when implementing information systems: 1) letting users not notice the change, 2) users noticing the new information systems, and 3) both information system and process change, noticed by users (Markus 2004). Markus goes on to say that research has even introduced the concept of “technochange”, where major organisational changes enable opportunities for high risk and high reward.

Moving from printed media to electronic information forms and formats is a change that is widely predicted by authors and theorists (Lamb 1997). Contrary to those predictions, the volume and frequency of online use reported by many organisations remain below the levels that information providers and researchers have expected. Lamb argues that there is a wide gap between intentions to use online information resources and the prevailing situation in organisations. She continues that this gap is due to the inter-organisational network of firms and institutions, and that not all organisations in the network are independently motivated to gather data and use information resources.

The dynamics in the relationships between software developers and users were studied by Heiskanen *et al.* (2000). They enlarge the process model introduced by Newman and Robey (1992), where user-analyst relationships are expressed using a sequence of events which makes up system development. In the process model by Newman and Robey the encounters and events in information system development can be situated on three levels: rejection, equivocation and acceptance. The researchers believe that this process model raises the consciousness of both researchers and practitioners about systems development.

Heiskanen *et al.* (2000) have conducted their study in the academic world using reflective practice as their research method. They list encounters in the prevailing development project by beginning with hiring an analyst in the university and ending with signing contracts with an implementer, and they present the encounters in development trajectories. The authors argue that situating encounters and episodes on a timeline helps to understand development processes in complicated situations. In addition, their research shows how the dynamic relationships between software developers and users develop over time.

2.3 Role of culture in implementations

As well as organisational change, culture is also worth taking into account in information system implementations. This section highlights aspects related to culture in implementations. Culture as a concept conveys the feeling of a pervasive way of life or set of norms (Handy 1999). In organisations this means deep-set beliefs about the ways work should be organised, the way authority should be exercised, and the ways people

should be rewarded and controlled. Handy goes on to say that this culture often takes a visible form in the organisation's buildings, offices, shops or branches. Furthermore, the kinds of people the organisation employs, the length and height of their career aspirations, their status in society, degree of mobility, and level of education are reflections of the culture. Handy concludes that organisations with different cultures require different kinds of people and different ways of working. These organisations also appeal to different kinds of people. However, "cultures are founded and built over the years by the dominant groups in an organization". By saying this, Handy is referring to the slowly changing nature of culture.

Information system researchers have increasingly turned to issues of national, societal or ethnic culture instead of only organisational culture (Gallivan & Srite 2005). In their literature review Gallivan and Srite argue that culture should be defined in a more holistic way and its influence on individual's behaviour should be considered more properly. Culture in information systems research was also explored in a literature review by Leidner and Kayworth (2006) when they develop six themes of information technology culture research that emphasise culture's impact on information technology and information technology's impact on culture. Leidner and Kayworth suggest that information technology changes culture over time.

Academic organisations have their own cultural and national context, where science is practiced, organised and managed in specific, nationally-based institutions, with specific cultural and national characteristics (Hearn 2003). Moreover, in some academic fields – especially the humanities and the social sciences – the impact of such local contexts is perhaps more pronounced, Hearn writes. He argues that even with internationalisation, academics act day-to-day in a mainly local, national, organisational context. In his research on organisation violations in practice, Hearn points out that academic life is unavoidably class-, gender- and culture-specific. Furthermore, "academia and academic life frequently present themselves and are presented as neutral, intellectual activities". Hearn goes on to say that, although they are seats of science, universities are complex mixtures of classed, gendered and culture-bound practices, and of power and moral relations.

The organisational nature of universities can also be seen in implementation projects (Heiskanen *et al.* 2000, Kudrass 2006). Kudrass studied integrated information systems in universities and he listed requirements to be concerned especially when the information systems are located in the academic environment *e.g.* communication, self-service functionality, content management and publishing, information extraction from heterogeneous data sources, and data security and privacy.

The special nature of academic organisations can also be seen in the organisational form that they present (Mintzberg 1983). Mintzberg writes that organisations can be bureaucratic without being centralised. Universities represent professional bureaucracy, which is described as "stable operating work, leading to predetermined or predictable, in effect, standardised behaviour". This structural configuration is common in universities, general hospitals, school systems etc. All rely on the skills and knowledge of their operating professionals to function, Mintzberg notes. Mintzberg describes the characteristics of professional bureaucracy with co-ordination of the standardisation of skills and its associated design parameter, training and indoctrination. Furthermore, these characteristics give the specialists considerable control over their own work. Mintzberg

explains how control over the specialist's own work means that the professional works relatively independently of his colleagues. In addition to having control over their own work, the professionals in the organisation are empowered to influence their new colleagues. This is enabled by their attendance of expert committees that assess the applications of new candidates. Mintzberg describes this as "a rather administrative structure".

Besides the feature of relative high autonomy, universities can be characterised as highly decentralised (Mintzberg 1983). Mintzberg argues that the power of the individual professional in universities lies in the knowledge and competence of the individuals. This also enables the high autonomy of the individuals in the universities. The professionals can demand autonomy or leave the organisation, taking their knowledge and competence with them. This kind of professional bureaucracy has only little horizontal command power between different departments in the organisation.

Walsham (2002) adds to the concept of culture in developing information systems when he studies cross-cultural software production and use. He notes how the concept of culture refers to shared values and attitudes within a specific organisation or other form of social grouping. Walsham believes that culture is not static. On the contrary, there are dramatic changes in many societies in areas such as attitudes to gender, the environment, race, sex, family life and religion. He continues that in the context of globalisation, with increasing contact between different societies, it is increasingly difficult for any group to remain isolated and uninfluenced by other cultures. This difficulty leads Walsham to conclude that in the domain of cross-cultural work, people need theories that reflect change as well as stability and that are attuned to shifts in attitudes and action as well as their continuance.

Furthermore, Walsham notes that there is a need for information systems practitioners to be highly sensitive to cultural differences when working in a cross-cultural context. Following him, sensitivity to other cultures does not imply the need for practitioners to change their own attitudes and values to those of the other culture. Walsham states that understanding and empathy for the attitudes, norms and values of others is needed in the production of the information system as well. This offers the possibility of mutual respect between cross-cultural partners and the opportunity for a move toward a more negotiated culture of co-operation. Walsham's observations follow findings from the study of Kumar *et al.* (1998), who explored information system implementation in differing cultural environments. In their paper, the researchers emphasised the cultural context of an information system implementation.

Ciborra and Andreu (2001) believe that managing knowledge differs in diverse organisational contexts. Ciborra and Andreu introduce the concept of the 'learning ladder', meaning that two or more firms adopt a co-operative strategy and engage in some form of alliance. These firms share related knowledge management policies. The authors go on to say that in a learning community, learning takes place through the practice of membership and that it is hard to locate the know-how precisely. Pfeffer and Sutton (2000) place particular emphasis on the gap between having knowledge and acting on the situation. They pay attention to cases in which talking about problems did not lead to actions, but inhibited them. Mason (2002) continues this theme and emphasises the importance of noticing situations before any action can be performed.

2.4 Users in implementations

The role of user participation in information system developments and implementations has been under discussion for decades (Markus 1983, Davis & Olson 1985, Markus & Benjamin 1996, Sahay & Robey 1996, Kumar *et al.* 1998, Cairns & Beech 1999, Dewulf & van Meel 2002). User involvement is needed at the very beginning of an information system project in order to find out the requirements needed (Halonen 2003a, Jiang *et al.* 2002). Adding to that, Kujala (2007) completes that the most significant user involvement occurs at the beginning of product development, when the decisions about the product and its nature are on table. Kujala argues that the process of early user involvement needs to be simple enough to be practical in product development. Newman and Noble (1990) state in their case study that the contribution is not always evident and that the user participation is only weakly associated with the success of implementation. Kensing and Blomberg (1998) discuss the role of users when designing information systems. Furthermore, user participation varies, from providing designers with experience from their work to actively participating in designing the information system, analysing the needs and possibilities. The arguments behind user participation are diverse. Despite user participation is utilised in some information systems security methods, it can also be seen as a security threat and therefore user participation may be rejected in information systems projects (*cf.* Siponen 2005).

Management may support user participation because they believe that it reduces resistance to change or that it increases acceptance of change. In this sense user participation can be used as a manipulative tool (Mumford 2003), and it may turn out to be an obstacle rather than a strength. Palonen (2003) has studied shared knowledge and the web of relationships. She describes how transferring or sharing knowledge requires frequent interaction among the participants. Furthermore, she describes how collective performance ability depends on whether members of the community have relevant knowledge and whether this knowledge is adequately distributed. The users may even find decision-making difficult if the decisions influence other participants and their organisations (Halonen 2005b). A relationship between communities arises as a result of interaction between two companies, or a series of interactions during which the behaviour of both parties affects the sequence of events (Håkansson 1992). Håkansson goes on to say that the interaction is likely to be influenced not only by characteristics of the two parties as such, but also by the way these characteristics interact with one another.

Users need reasons to use new applications. Keefe (2003) writes about the importance of focusing on the user, who must not be forgotten in any phase of the system development. Systems that improve business processes and deliver information faster to users are not enough – the users using the new application must be motivated to do the tasks that are needed to get the information available. Without motivated users there is no traction to get the implementation project to succeed, Keefe believes. There are information systems that have failed because they did not meet user requirements (Halonen 2003a, Lorenzi & Riley 2003). The needs of the users and other stakeholders are often difficult to define and they change over time (Heiskanen 1994). Lorenzi and Riley also state that planning implementation projects beforehand makes commitment easier.

Engler (1996) gives a step-by-step approach for identifying the right user to represent all users in the implementation project: 1) identify the correct user, 2) involve the user early and often, 3) create and maintain a quality relationship, 4) make improvement easy. With these steps the designer should ensure that the user wants to progress the implementation, the feedback is continuous, the commitment lasts for the system's entire life cycle, and among other things, the designer could learn the user's language. Different backgrounds, interests and priorities of users and information systems specialists easily lead to a user-designer communications gap (Laudon & Laudon 1998b). Laudon and Laudon continue that communication problems between users and designers are recognised as a major reason why user requirements are not included in information systems and why users are cast out of the implementation process. On the other hand, users are the right people to describe the entire process that is to be supported by the information system that is developed for them (Halonen 2007).

The practitioner and researcher communities have for decades considered user participation in the development of information system to be critical to information system implementation (Barki & Hartwick 1994). Barki and Hartwick want to separate user participation, user involvement and user attitude, identify key dimensions for them and investigate their relationships. In their study they found that users do not participate more if they believe that a new system that is developed will be good, important or personally relevant. They also believe that users may be able to influence the design of a new system and satisfy their needs. The users may also understand the new system better. Participation in strategic change processes is often thought to have a lot of positive consequences for decision quality, effective responses to change and the success of strategic change implementation (Lines 2004). In his study on the influence of participation in strategic changes, Lines has found a strong positive relationship between participation and goal achievement and organisational commitment, and a strong negative relationship between participation and resistance. The goal of his research was to assess the outcomes of participation in strategic change in a major strategic reorientation of a national telecommunications firm. The outcome also suggests that the effects of participation are changed by the changes' compatibility with the organisational culture and the personal goals of change recipients.

Gefen and Ridings (2003) note that users and information technology developers typically belong to different organisational units, with different objectives and values. They continue that in many cases users are not or cannot be actively involved in developing or testing new information technology. They have examined information technology adoption focusing on users' acceptance of the information technology. Gefen and Ridings found that users' acceptance increased when the users believed that they shared values with the information technology developers. The authors suggest that information technology developers should strive to create a relationship with their users that will reduce any polarity between users and information technology developers. This suggestion was realised in our research from the beginning by the strong participation of the users in the project work.

Noble (1986) strongly states the role of users compared to the role of designers, saying: "It matters a great deal, in terms of what actually gets designed, whether or not the designers and users are the same people, whether or not they know each other, whether or not they view each other as equals, whether or not they have power over each

other, whether or not they are friends. On the whole, technical people come to share the perspective of those who wield power rather than those over whom the power is wielded, with managers rather than labour, with officers rather than soldiers.”

Syrjänen (2004) has described a development project where non-information technology professionals were driving an information system implementation. The developers consisted of dog breeders and they produced an information system to meet their needs, also shaping the use of information system technology and whole community. Furthermore, she describes how the nature of the system’s development has been guided by the practical needs and commitment of the participants instead of financial or business purposes. This non-information technology professionals context is also familiar in this current research that was carried out in the universities.

2.5 Trust in collaboration

This section considers trust as among the most important issues in information system implementations.

There is accumulating evidence that trust has a number of important benefits for organisations and their members (Kramer 1999). Kramer emphasises that trust entails a state of perceived vulnerability or risk that is derived from individuals’ uncertainty regarding the motives, intentions and prospective action of others on whom they depend. Decisions about trust are seen as similar to other forms of risky choice when individuals are presumed to be motivated to make rational and efficient choices, Kramer continues.

Trust and conflict are natural issues of any organisational arrangement and central to knowledge sharing (Panteli & Sockalingam 2005). Organisations are today often compelled to form alliances with other organisations to survive, and the basic structure for these inter-organisational arrangements is the increased access to a wider pool of resources, especially knowledge. Panteli and Sockalingam have studied virtual inter-organisational alliances, and they concentrate on the role of trust and conflict in their research. They summarise that familiarity with partners is a key prerequisite for trust development. Trust changes with time when people get to know each other and feel more comfortable with each other, developing improved awareness of others’ integrity and competence. Nonaka and Takeuchi (1995) note the importance of trust when sharing tacit knowledge. Tacit knowledge can usually be transmitted only slowly in face-to-face situations, in which trust and shared experience are perceived.

Furthermore, our research verifies Gustafsson’s (1996) observations, when he writes that trust is an important part of business as a facilitator of transactions. He has studied the importance of trust in international business. In his research on Finnish entrepreneurs, he noted that business was usually done on the basis of an oral agreement. This oral agreement was seen as the contract in itself and contained all necessary aspects of what should be achieved and how. Gustafsson concludes that trust is a central phenomenon both in trade as in social life in general. He notes that trust governs the activities of economic actors, even though it is often disregarded or ignored outright by economists. In addition, trust seems to vary a great deal between different cultures.

The role of trust has also been studied in online shopping (Gefen *et al.* 2003). In the study by Gefen *et al.*, the research focuses on commercial customer-e-vendor relations but it gives common information about perceived WWW-relations. Their research emphasises that consumer trust is as important as, for example, perceived usefulness and perceived ease of use. Furthermore, they report how the usefulness of a WWW site depends on both the effectiveness of its relevant technological properties, such as advanced search engines, and on the extent of the human service behind the information technology, which makes the non-technological aspects of the information technology effective. We believe that these research results can be transferred to refer to common eGovernment as in our case, and we equate consumers with users and e-vendor with e-service (meaning the new information system).

Karahannas and Jones (1999) have studied inter-organisational systems and trust in strategic alliances. They briefly review the literature on trust and its role in inter-organisational relationships. Furthermore, they consider the treatment of trust in the inter-organisational information system. According to their study, trust may play three interrelated roles in inter-organisational relationships: it may act as an obstacle to opportunistic behaviour, it may substitute for hierarchical governance and it may provide a competitive advantage. Even though the research of Karahannas and Jones concerned commercial companies and was based on information collected from business periodicals and newspapers, our research supports these roles. In our case there was no negative exploitation found between the parties. In addition, the hierarchy in the implementation project was low and this alliance enabled the successful outcome of the project.

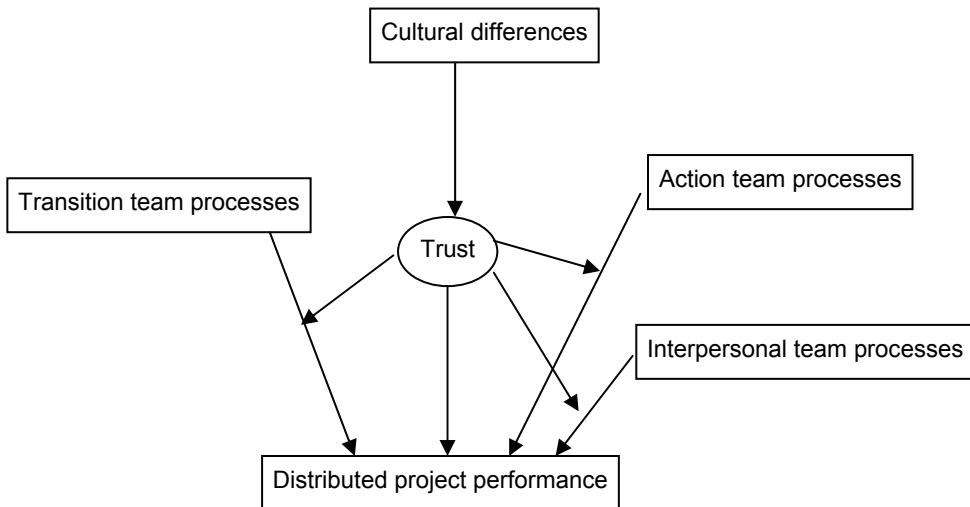


Fig. 3. The role of trust in managing distributed projects (Evaristo 2003).

The importance of trust is emphasised in the management of distributed projects (Evaristo 2003). Evaristo models the influence of trust in his research on the management of distributed projects as shown in Figure 3. In the figure the location of trust is central and it affects the relations between processes and project performance. In addition, in his model, cultural differences influence trust, being an antecedent of trust.

The model introduced by Evaristo emphasises cultural differences as a precursor of trust and points to the importance of managing these differences properly. He goes on to say that managing the cultural differences influences the way in which trust is generated and in this way it affects the performance of the project as a whole. Moreover, under low trust, co-operative goals are less likely to cause co-operative behaviour (Evaristo 2003). When there is no trust, co-operation is less likely to exist. Evaristo adds that the amount of trust may determine which goals will be given extra weight, in situations where there are both competitive and co-operative goals.

In his literature review Kramer (1999) has also considered the antecedent conditions that promote the emergence of trust, including the psychological, social and organisational factors that influence individuals' willingness to engage in trusting behaviour when interacting with them. One interesting finding is category-based trust, which refers to trust predicated on information regarding a trustee's membership in a social or organisational category and its influence on others' judgements about their trustworthiness. Another finding is role-based trust, which is a form of depersonalised trust because it is predicated on knowledge that a person occupies a particular role in the organisation rather than specific knowledge about the person's capabilities, motives and intentions.

Furthermore, trust is also connected with voluntary deference within hierarchical relationships in organisations (Kramer 1999). Prevailing trust affects people's willingness to comply with an organisation's directives and regulations and their willingness to voluntarily defer to organisational authorities. In case of conflict, trust is important because it influences the resolution of disputes.

The creation of trust is highly dependent on meeting the other trustees face-to-face (Jarvenpaa *et al.* 1998). In a virtual team where people never meet each other, it is supposed that trust is more strongly related to ability and integrity and less to benevolence. Jarvenpaa *et al.* continue by saying that trust on a collective level, *e.g.* in an organisational unit, is more complicated than dyadic trust because of the multiple trustees with different attributes. Furthermore, among strangers who do not share a common past and who are unfamiliar with each other's personalities, electronic communication can be expected to be impersonal and task-focused. To assess integrity and ability, people must make their assessments of others on the basis of history, *i.e.* other people's recent performance in the team. This assessment enables the emergence of trust among the team members.

In their research on trust in virtual teams, Jarvenpaa and Leidner (1999) noted that communication was active, empathetic and encouraging in teams with high levels of felt trust. Respectively, teams with low levels of felt trust communicated less and the communication was less empathetic. They also spent more time discussing other people's lacking contributions.

2.6 Other challenges in information system projects

In addition to the previously mentioned issues, this section raises some other challenges that deserve to be mentioned.

Lucas *et al.* (1990) listed examples of ways of measuring success in information systems. Evaluating success or failure is justified, because failure is more common in information technology projects than success (Furton 2003). Project failure rates can even exceed 80 percent. The failure can derive from resistance, or the new system can differ too much from the assumptions and requirements of the owner. Changes in project personnel and project objectives can be seen in the system development life cycle. The competence of the designer is difficult to evaluate. Incompetence can be found in the form of unprofessional work, unqualified personnel and improper processes.

The failure or success of a project is often a perception that is influenced by people having different backgrounds and experiences, thinks Rad (2003). He suggests tools that would allow project members to evaluate their project. The tools differ depending on the viewer: the customer side values the goals and objectives of the project, scope and quality aspects of the deliverables of the project and cost and schedule attributes of the project. The vendor side values the managerial success regardless of the phase and incremental changes to scope, schedule, and cost. The primary focus from the vendor's point of view is the final deliverable of the project.

Organisational conflict literature has identified three forms of conflict: relationship conflict (also called affective conflict), task conflict (also called cognitive conflict) and process conflict (Panteli & Sockalingam 2005). These forms refer to their appearance in the organisational setting. Relationship conflict reduces open communication and knowledge sharing. Panteli and Sockalingam say that well-managed process conflict provides the foundation for relationships and trust between partners to develop. However, in spite of the clear theoretical distinctions between the three common forms of conflict, Panteli and Sockalingam believe that there is a strong inter-relationship between each form. They conclude that if process conflict is effectively managed, the potential for relationship conflict can be minimised, which enables the benefits of high task conflict to be used for the mutual gain of the alliance and its partners.

There is no incentive to share knowledge, meaning that people are busy with their tasks even without the need to write their knowledge in any databases (Effron 2004). Furthermore, Effron knows of no major corporation that rewards employees' contribution to their knowledge database. He continues that information needs to be put into databases, and that it is difficult to remember to do it. This is also related to relinquishing knowledge and the power that it contains. The author goes on to say that learning to share knowledge requires one to overcome cultural obstacles. Lack of knowledge hinders the problem-solving process at the beginning, when clarification and description of the problem are important (Mumford 2003). Mumford continues: "Many routes to a solution can be blocked because of lack of knowledge or through political, security or financial constraints." On the other hand, it is a widespread norm for the employer to own products that have been produced or gained at work (Constant *et al.* 1994). Constant *et al.* add that these products cover ideas, processes, inventions, documents and software. According to

them, modern facilities, with emails and groupware, have increased the opportunities to share information in organisations.

Carlile (2004) approaches knowledge from its managerial view. He introduces a framework for managing knowledge across boundaries. Carlile notices the distinction between domain-specific knowledge and common knowledge and its importance at a boundary. He lists three different viewpoints of boundaries: an information processing approach, an interpretive approach and a political approach. These different viewpoints need to be integrated. In his framework, the capability to manage knowledge at a boundary can be described as a combination of capacity and ability. Carlile adds that actors tend to reuse knowledge even when new knowledge is available.

Besides the intentional problems of sharing knowledge, there are also unintentional problems caused by not knowing what people know. Nonaka and Takeuchi (1995) explain that most customers' needs are tacit, meaning that they cannot tell exactly or explicitly what they need or want. In her study on digitising information systems, Halonen (2007) emphasises the need to write the actions down in order to explicate the work process to the designers and to the users themselves. Nonaka and Takeuchi clarify this problem by giving an example: "Asked 'What do you need or want?', most customers tend to answer the question from their limited explicit knowledge of the available products or services they acquired in the past." According to Nonaka and Takeuchi, tacit knowledge is highly personal and hard to formalise, making it difficult to communicate or to share with others. Moreover, tacit knowledge is deeply grounded in an individual's action and experience, as well as in the ideals, values, or emotions of the individual.

More of the challenges of information technology are introduced in a study by Benamati and Lederer (2000), who concentrate on management problems in information technology changes. The authors warn that mistakes in implementing new information technology can be costly and that project managers cannot be experts on all emerging information technologies. Moreover, they propose nine categories that cover problems in managing information technology projects:

1. Vendor neglect: insufficient experience, knowledge or problem determination ability
2. Vendor oversell: premature marketing or the setting of unrealistic expectations
3. Acquisition dilemma: difficulty staying informed about or choosing new information technology
4. Support burden: lack of external expertise about, control over, or information system organisation structure to properly administer new information technology
5. Resistance: disagreement about use or reluctance to accept new information technology
6. Cascading needs: unanticipated need for or dependence on new information technology
7. New integration: incompatibility or need for interfaces between multiple information technologies
8. Errors: inadequate documentation of or shortcomings in new information technology
9. Training demands: long learning curves, diminished productivity and difficulty retaining staff experienced in new information technology.

Heiskanen (1994) reports on four intertwined issues that cause difficulties when evaluating information systems projects. First, the needs of the users and other stakeholders are difficult to define; second, it is difficult to choose variables that indicate success, failure, organisational impacts etc.; third, information system quality is not standardised; fourth, the evaluation is too often perceived to be a discrete event without connection to further development.

The challenges of information technology implementations have been studied by Munkvold (1999) in cases when organisations are distributed. The aim of his study was to increase the understanding of the form of the information technology implementation process and to understand how the process can be managed. Munkvold applied the perspective of the implementation team that was responsible for the activities in the implementation project. He identified several additional challenges compared to traditional intra-organisational implementations, such as top management support and participation, user involvement and participation, training, and the adaptation of existing practices. Furthermore, Munkvold introduces a revised model of the implementation process, which is derived from his case study of distributed organisations. He lists the main challenges as initiation of the implementation process, decentralised adoption, establishing connectivity, individual acceptance and establishing collaborative work practices. The cases in Munkvold's study consisted of four Lotus Notes implementations, one integrated communication system implementation and one implementation of a global area network. Even though the organisations were geographically distributed, all the cases consisted of a single organisation.

Risk factors in distributed projects were studied by Erickson and Evaristo (2006) who developed a conceptual view of key risk factors in information technology projects. They note the difficulties of monitoring distributed projects because different stakeholders are physically located in different places. Erickson and Evaristo list significant risk factors that were highlighted compared to the risk factors listed by Schmidt *et al.* (2001). Firstly, the Sponsorship/Ownership risk factor relates to commitment and ownership by the key set of stakeholders (the sponsor, the project owner, the client, the end-user and the functional area owners). The researchers note that, because of the distances, the project owner may not be able to communicate effectively with the responsible teams. Secondly, Relationship Management refers to the development and management of user relationships, which can be influenced by unclear roles and expectations among users and other stakeholders. Trust management is part of relationship management, Erickson and Evaristo argue, and it is an integral part of high-performing distributed projects. They go on to say that user involvement is more difficult in a distributed environment and thus the risk that relationship management may be faulty is increased in distributed projects. Erickson and Evaristo add that organisational distance increases the complexity of relationships and thus increases the risk of failure. They also note that different organisations develop their own corporate culture and approaches to development, thus increasing the possibility of misunderstandings and mistrust between the distributed sub-teams.

The third risk factor listed by Erickson and Evaristo is Project Management and Planning. They point out that in distributed projects the risk is multiplied compared to projects without distribution. Scheduling is presented next, and this refers to the timing of the tasks and resources required for the successful completion of the project. The authors

decided that even though scheduling is closely associated with the Project Management and Planning risk factor, they wanted to keep it separate due to its focus on the timing and availability of resources. However, the scheduling risk factor is significant for any kind of distributed or non-distributed project.

The risk factor list by Erickson and Evaristo continues with the Development Processes risk factor, which is connected with a lack of established processes, or the presence of inappropriate processes. Again, the effect is magnified in distributed projects. The last risk factor in their list is Personnel and Staffing, which refers to the presence of appropriate skills in development and process management, combined with issues related to staffing levels, changes in personnel and the unavailability of key personnel resources. Erickson and Evaristo conclude that lack of knowledge about risk factors may cause project managers to undervalue or ignore their potential effects and thus lead to large losses that could have been avoided.

Furthermore, because the history of implementing information systems is grey with more failures than successes, it is still reasonable to look for methods to evaluate and to research these failures in order to get information to be used in subsequent implementation projects. Lyytinen (1986, 71) wrote in his literature survey on information systems development, even 20 years ago: “Based on the results of the literature review we face a crucial question: how can it be so that the information system failure syndrome continues, although so many efforts have already been made to cure it?”

Researching accidents has a history of its own, and the domino model introduced by Heinrich in 1931 is good evidence of it (Figure 4). In Heinrich’s domino model there are five dominoes: firstly an ancestry or a social environment which leads to the fault of a person (second domino), and is a proximate reason for an unsafe act or a condition (third domino). This act or condition causes an accident (fourth domino), which leads to an injury or losses. This model is very influential because it shifts the emphasis from unsafe conditions to human error.

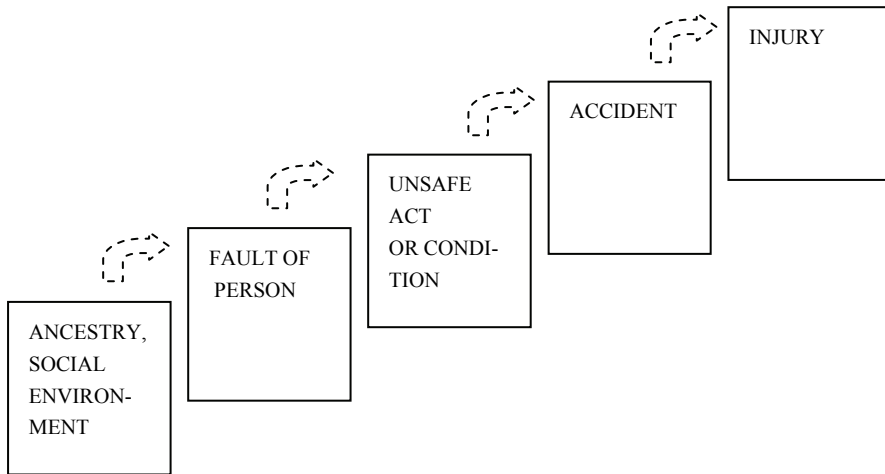


Fig. 4. Heinrich's dominoes (Leveson 2001, 5).

However, in Heinrich's (1931) domino model there is no mention of the possibility of several conditions for an accident. Accident models were developed during the years that followed, and Leveson (1995) reports a new concept of 'point of no return'. This point means that when the process has gone far enough there is no possibility of preventing the forthcoming accident. Despite the fact that accidents and failures in information system implementations differ from each other, there are similarities between them. We believe that there are methods in examining causes for accidents that can be used when evaluating the causes of failures in information system projects. All the same, any information technology project has to overcome many risks, as Furton (2003) reminds us. The most influential risk comes from the user's or customer's side – for instance, changes in priorities in the organisation.

2.7 Inter-organisational information systems

This section introduces inter-organisational information systems, with their special nature, and presents their background by bringing out some application area for them. An information system is an inter-organisational system if information flows across organisational borders (Johnston & Vitale 1988). Inter-organisational information systems allow the information or processing capabilities of one organisation to improve the performance of another organisation or to improve relationships among organisations (Laudon & Laudon 1998a).

Electronic data interchange (EDI) was one of the first realisations of the transfer of information between organisations using new technology (Iacovou *et al.* 1995). EDI is a co-operative inter-organisational system that allows trading partners to exchange data

electronically. The participating systems are separate computer applications and the data are structured. Pfeiffer (in Iacovou *et al.* 1995) defines four features that EDI must fulfil:

1. It must have at least two organisations in a business relationship as users.
2. Data processing tasks pertaining to a transaction in both organisations must be supported by independent application systems.
3. The integrity of the data exchange between the application systems of trading partners must be guaranteed by agreements concerning data coding and formatting rules.
4. Data exchange between the application systems must be accomplished via telecommunication links.

Iacovou *et al.* (1995) note that EDI differs from inter-organisational information systems, as it contains separate information systems, as opposed to a shared information system that is used by the participating organisations. The authors consider the reasons why not all organisations adopt EDI. The research material was collected from seven organisations that were suppliers to British Columbia. The researchers identified three factors that influence the EDI adoption practices of small firms: organisational readiness, external pressures to adopt, and perceived benefits. They conclude that both high organisational readiness and an awareness of the benefits are required for integrated EDI systems.

An interesting finding concerning EDI and inter-organisational information systems was reported by Zhu *et al.* (2006) who studied migration to open-standard inter-organisational systems. They introduce a trajectory that begins with paper-based systems, goes on to electronic data interchange and ends up in open-standard inter-organisational systems. Zhu *et al.* found that network effects and expected benefits are significant stimuli to the change. Among other things, they also found that adoption costs are a significant obstacle to proceed in the trajectory. Especially EDI users perceived costs as an important issue to be noticed.

Stewart (2003) has studied trust transfer on the WWW. She explains how the WWW allows organisations to associate themselves with one another. McKinney *et al.* (2002) have developed constructs for measuring WWW customer satisfaction during the information phase. They separated WWW site quality into information quality and system quality, and proposed nine key constructs for WWW customer satisfaction. They also posit that WWW customer satisfaction has two sources: satisfaction with the quality of a WWW site's information content, and satisfaction with the WWW site's system performance in delivering information. The authors conclude that when measuring web-customer satisfaction it is critical to identify the key constructs of WWW customer satisfaction and to develop validated instruments to measure them.

Moreover, according to the research of Gefen *et al.* (2003), creating the WWW site so that it looks and behaves in an anticipated manner should increase perceived ease of use. They note that consumers' prior knowledge of how to use the WWW will be directly applicable to the task of purchasing from the present e-vendor's WWW site. They continue that a WWW site is both an information technology and the channel between consumers and e-vendor. In this sense technology-based and trust-based antecedents should work together to influence the decision to partake in e-commerce with a particular e-vendor. Gefen *et al.* add that the more normal a task is, the more a person can extrapolate from existing cognitive maps, making the solution easier. In our case, the

process was changed as little as possible, and the users could easily understand how the process proceeded. The respondents in Gefen *et al.*'s study were graduate or undergraduate students and they can be compared with the end users in our case.

Håkansson (1992) studied the grounds for collaboration in commercial organisations. According to the study, the typical partner is near at hand, important in terms of volume, and well established as a partner. Furthermore, general social characteristics are more important than purely technological or knowledge attributes. In addition, the conclusion seems to be that companies enter into technological collaboration with units which they have come to know in other interactions, rather than interacting with units they would like to acquire as technological collaborative partners. A crucial and significant characteristic of the interaction consists of the personal contacts it involves. These make possible a freer and livelier exchange of ideas and suggestions than any written document can promote. Håkansson concludes that people on both sides can gradually build up confidence and trust in another, and in this way important social elements enter the interactions.

According to Håkansson's studies, an important characteristic of corporate collaborative relationship is the low level of formalisation. Very few of the collaborative relationships have any element of formal agreement, and even fewer are entirely based on such agreements. Both parties have had an opportunity to build up confidence in one another. This trust will presumably also mean that expectations on both sides are realistic, that is, they are on a scale with which the other partner is able to cope. Both parties know the other's strengths and weaknesses. The very fact that the parties have learned to cooperate with one another leads to the expectation of further collaboration. (Håkansson 1992).

Collaboration can be seen as a purposive relationship, having a need to solve a problem, create something or discover something (Schrage 1990). This relationship is limited by constraints like expertise, time, money, competition and conventional wisdom. In addition, Schrage believes that any technology that reshapes collaboration will reshape the fields in which collaboration is important. Loebbecke *et al.* (1999) have introduced a new concept of 'co-opetition' *i.e.* simultaneous co-operation and competition between firms. They point out the problem of how to manage inter-organisational knowledge sharing under co-opetition. The problem can be stated by questioning how much and what knowledge should be shared, when, with whom and under what conditions. Loebbecke *et al.* state that transferring management should consist of:

- close interaction in inter-organisational collaborative teams
- managing dual commitment by rotating members of inter-organisational teams
- structuring intraorganisational knowledge teams.

Collaboration in multiparty information systems development projects was studied by Levina (2005), where the target was to find out how people from diverse professions and organisational settings collaborate on information system development projects, and to describe how their diversity influences the systems that they are designing. The starting point for her study was the need to develop a deeper understanding of actual collaborative practices in multiparty information system development attempts. Levina explained how collaboration on multiparty information system development can be understood as a collective reflection-in-action cycle that changes and is changed by versatile

organisational and professional stakeholders. The research material was collected from two different cases in which the researcher was acting as an external observer.

Another view on collaborative development projects comes from Kumar and van Dissel (1996) who studied the possible risks of conflict in inter-organisational information system development. The authors notice that the level of structure in the relationship can influence the potential conflict. Furthermore, they continue that level and type of interdependence between the actors affects the structure of the relationship between the actors. Kumar and van Dissel generalise that structure can be interpreted as the ways in which inter-organisational work is divided among the partnering organisations by giving certain roles to them. Kumar and van Dissel note how researchers have developed several theoretical arguments to explain the formation and structure of organisational collaboration that is supported by inter-organisational information systems. They studied the elements of co-operative alliances in the development work, and summarise four main factors (environmental forces, motives of the co-operative parties, supportive role of information technology and enabling role of information technology) as shown in Figure 5.

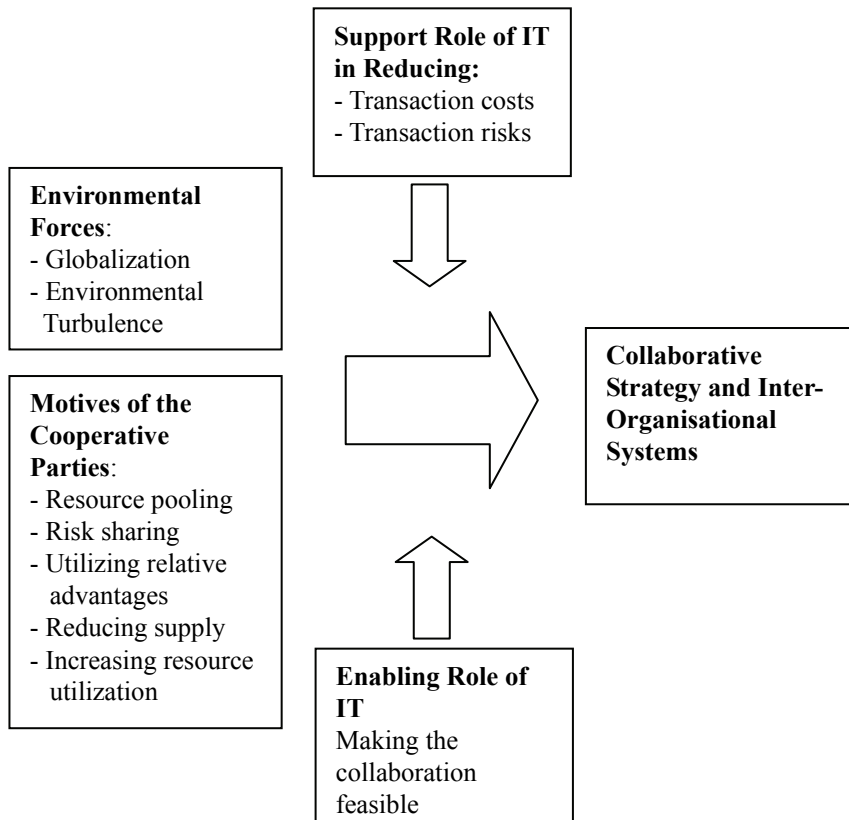


Fig. 5. Formation of co-operative alliance (Kumar & van Dissel 1996).

Successful inter-organisational systems have been studied by Markus (2005), who reviews conditions when promoting and inhibiting benefit realisation in inter-organisational information systems. Her research concentrates on commercial companies and she has chosen two notable examples for more detailed treatment. She states that many companies have already received significant benefits from investments in inter-organisational systems. Furthermore, in the enterprise sector an increasing number of organisations are striving for the goal of automating 100% of their most important inter-organisational transactions, which requires their partners to adopt inter-organisational systems as well.

Markus (2005) goes on to say that successful initiation of private infrastructures of inter-organisational systems requires careful attention to the needs of business partners. Following her, several studies on inter-organisational information system successes and ways to increase inter-organisational information system benefits have highlighted the importance of creating mutual benefits for participants. However, she also notes that win-win outcomes are rare.

Hong (2002) introduces a framework for inter-organisational systems with horizontal and vertical linkages. The horizontal linkage was formed via the interconnection of firms that performed common value activities. The vertical linkage was formed according to the different roles of participating organisations. With this framework, Hong focuses on the linkage of participants' roles, and points out that inter-organisational information systems should be examined in terms of how their participants' roles are linked (horizontally or vertically) and what key motivator drives the information system development (strategic or operational). Figure 6 shows the framework (Hong 2002).

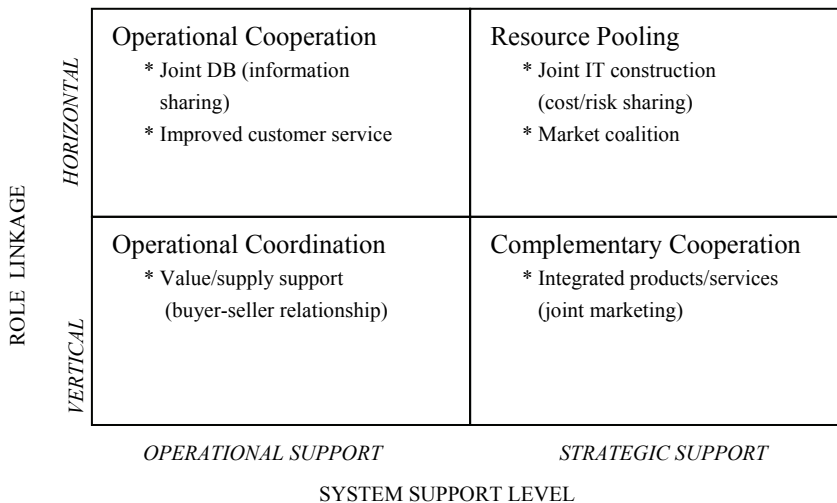


Fig. 6. A framework for inter-organisational systems (Hong 2002).

The system support level in Figure 6 consists of strategic support and operational support. By strategic support, Hong means either pooling or sharing resources. Operational support describes the primary purpose of the information system. The dimension of role linkage consists of a horizontal section, which shows the interconnections between firms, and a vertical section which reflects the different roles of participating organisations that co-operate. The framework classifies inter-organisational information systems into four categories: resource pooling, complementary co-operation, operational co-operation and operational co-ordination (Hong 2002).

The future of inter-organisational system linkages has been studied by Daniel and White (2005). The authors explored the expected future role and use of information systems that are supposed to support these linkages. The authors used a Delphi technique that enables the exploration of the expected future of novel and evolutionary phenomena. The technique takes account of the views of participants by means of controlled feedback. It appears that the role of participants is emphasised in the study. Daniel and White describe how 35 of the potential participants were contacted. These participants represented a mix of roles and geographical locations. The results are based on the feedback from the participants. However, Daniel and White do not describe the organisations and their relations with each other. This offers an opportunity for the research at hand to make up for this lack.

Lee *et al.* (2003) have studied commercial companies and their operations in organisations in different locations. Lee *et al.* describe the problems of transmitting and sharing large amounts of company data by using e-mails or faxes. The researchers propose that a collaborative platform can be used to provide an interactive platform for geographically dispersed users when they disseminate, share or retrieve enterprise knowledge in a networked environment. The collaborative platform allows users to revise documents and interact with other users in a distributed and co-operative environment. Furthermore, Lee *et al.* note that there is no need for the users to install any utility software at their ends because the access is based on browser/server and thin client technology. Lee *et al.* conclude that besides linking up dispersed and heterogeneous systems for retrieving, sharing and co-working with data and information, the collaborative platform enables the re-design of workflow among enterprise networks.

Already ten years ago, Kumar and van Dissel had introduced a typology for characterising inter-organisational information systems along the dimension of inter-organisational interdependency in interfirm relationships (1996). The authors refer to earlier research back to 1960's by Thompson (1967) who distinguished three different dependencies in organisational units. Using their typology, inter-organisational systems can be classified into three types: pooled information resource inter-organisational information systems, value/supply chain inter-organisational information systems, and networked inter-organisational information systems. Furthermore, a networked inter-organisational information system is likely to possess the characteristics of a value/supply chain and a pooled information resource inter-organisational information system, and a value/supply chain inter-organisational information system is likely to possess the characteristics of a pooled information resource inter-organisational information system. The authors define these three types as follows:

1. The pooled information resource inter-organisational information system is an inter-organisational sharing of common information system/information technology resources, *e.g.* common databases, communication networks and applications.
2. The value/supply-chain inter-organisational information system supports customer-supplier relationships and it occurs as a consequence of these relationships along the value/supply chain.
3. The networked inter-organisational information system operationalises and implements reciprocal interdependencies between organisations, *e.g.* joint marketing programs, where firms exchange information for mutual benefits.

According to the definitions by Kumar and van Dissel, the inter-organisational information system in our study conforms to all these types. The new information system is based on a joint database that is contributed to by every participating organisation. In turn, the organisations get information they need concerning the substance from that database. The information system supports the workflow related to the substance and it ties the organisations that are combined with the issue. Lastly, the information system enables interdependency between the organisations when they realise the aim of the information system.

Organisations seeking solutions for the management of knowledge are ever more developing technological tools to be used (Schultze & Boland Jr. 2000) in order to cope in the modern society. However, the complex, dynamic and internationally conscious world sets new challenges for organisational change (Pettigrew *et al.* 2001). Pettigrew *et al.* describe the challenges for future research as being due to difficulties with durable generalising across international, institutional and cultural borders. They conclude that there is still a need for research and they warn about being limited to our own scholarly routines. Co-operation is a challenge (Barki & Hartwick 2001, DeChurch & Marks 2001), and organisations should link with each other in order to perform effectively in present-day environments (Daniel & White 2005). In addition, the failure rate of information system projects is generally known to be high (Laudon & Laudon 1998b, Schmidt *et al.* 2001).

Local or regional networks seem to be important when there is no ongoing commercial exchange to provide a basis for collaboration (Håkansson 1992). Furthermore, lack of co-operation and the opportunistic behaviour of partners have been reported to be causes for the relatively high rate of failure of alliances (Das & Teng 1998). In addition, another important factor which determines a company's choice of collaborative partner is the relative importance of the partners to one another. Markus (2005) adds that catering for the needs of business partners is fundamental in order to achieve successful inter-organisational systems. Kotlarsky and Oshri (2005) study the contribution of social ties and knowledge sharing to successful collaboration in distributed information system development teams. Collaboration on a multiparty information systems development project was studied by Levina (2005). The researcher followed two information system development teams as a non-participant observer, differing from the setting in this thesis.

We will concentrate on the issues that emerge when acquiring a joint information system, having no commercial agreements to support the collaboration between the partners in the loose alliance. Collaboration is not matter-of-course in distributed organisations (Munkvold 1999). In this sense, research on inter-organisational

information technology implementation also benefits intraorganisational information technology implementations. The bond between the participating organisations in our case is the strongly felt need for the information system, which every party recognises.

The need for new forms of collaboration between universities is increasing due to the globalisation of the surrounding society and the ever growing demands for greater output, in academia as elsewhere. Evidence of this can be seen in the so-called JOO agreement, which enabled students to apply for rights to complete studies in other universities as a part of their academic degrees (JOO 2003). The JOO agreement allows the participating universities to decide the principles that are to be used when supporting and admitting the rights. This is in line with the independent nature of universities (Hearn 2003). The international collaboration is concretised in the so-called Bologna process, according to which 33 European countries committed to unify their educational degree systems (Bologna 2003).

eGovernment is a new concept that is not known in the Merriam-Webster Online Dictionary (Merriam-Webster 2005), despite the fact that the concept is now in active use. However, the concept is known to people from their everyday life. Wikipedia (2007) defines eGovernment as “the delivery of public services, where there is an online or Internet based aspect to the delivery of the services”. This definition describes the role of eGovernment in our case as students can use the electronic application form instead of physical legwork when applying for rights to study and when managing student mobility.

Decision support systems are designed to aid in decision-making and decision implementation (Alter 1980). The emphasis of decision support systems is on increased individual and organisational effectiveness instead of on increased efficiency in processing data. However, the role of decision support systems has changed (Alter 2003). Nowadays, decision support systems are helping in making better decisions within work systems in organisations. Alter defines a work system as “a system in which human participants and/or machines perform a business process using information, technology, and other resources to produce products and/or services for internal or external customers.” In this sense, he considers a decision support system a special case of a work system. Furthermore, Alter (2003) wants to speak about decision support instead of decision support systems, and gives the definition: “Decision support is the use of any plausible computerized or non-computerized means for improving sense making and/or decision-making in a particular repetitive or non-repetitive business situation in a particular organization.”

Although the importance of collaboration between organisations representing the same business area is particularly familiar from the commercial sector, inter-organisational information systems are becoming ever more familiar in the public sector as well. However, the driving force is not purely financial but also practical, as is the case in our research. When changing from paper forms to electronic forms there are always several issues to consider and to specify (Markus 2005).

Halonen (2005b, 2007) explored a change process that was experienced when a mainly manual information system was changed to a computer based system (Laudon & Laudon 1998a) that was to be used between universities. The greatest effort in that change was to recognise the process that was followed in the inter-organisational functionality.

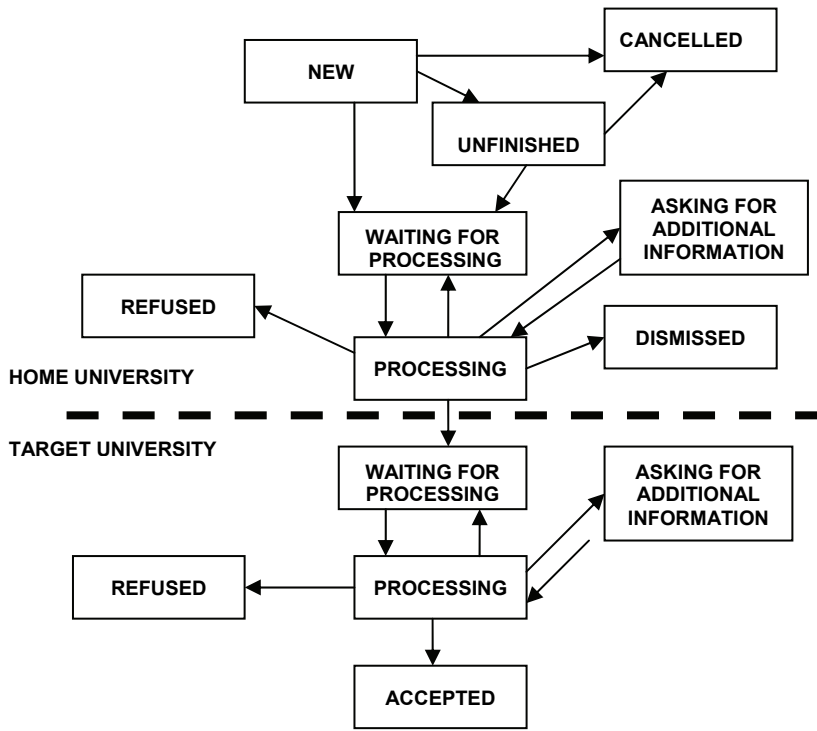


Fig. 7. Systemic states in the application process (Halonen 2005b).

Figure 7 describes the formal process when applying for rights to study when an electronic application is in use (Halonen 2005b). The process starts when a new application form is inserted into the system. The student may cancel it instead of sending it to the student affairs office. The form may be saved as unfinished and it can be continued later. Occasionally the officials need additional information before making their decisions. They may refuse their support or even dismiss the application because of its irrelevance.

When digitising any existing process, the directions of information flow (shown by arrows in the figure) have to be determined, creating a lot of discussions about the real process (Halonen 2006a). In this sense, the digitised process differs from that of the undigitised one, because it is not possible to undo (*e.g.* to take paper back from the waste) if it is not coded in the system. In addition, transferring information between actors, *e.g.* asking for additional information concerning a student, must be coded in the system, whereas officials might discuss freely with each other if the information need not be inserted into the system.

A problem of developmental duality (Baskerville 1992) is evident when information systems are developed separately from the building of security related to them. Baskerville notes that a user-friendly information system often conflicts with secure information systems. In the case of an inter-organisational information system, the aspect

of security is even more emphasised. When information flows across organisational borders, the quality of information must be validated. This gives prerequisites for the databases that act as master databases in the group of information systems. Another important issue is the recognition of users when they enter the inter-organisational system. Vaast and Walsham (2005) describe how new information technology often leads to new work practices in organisations. In the case of an inter-organisational information system, work practices may change even more. When information from other organisations' database is available instead of only information from the organisation's own databases, new practices must be developed.

The new kind of practice includes proper user administration and authentication, in addition to unified quality of databases. Building the new practice is enabled by expertise in the chosen technology, architecture and user administration, as well as by having an individual responsible for databases in the organisations.

In our case, the universities had been accustomed to managing this decision process on their own, and now they had to assess their own processes and limit their needs to meet the needs of other universities. Changes in requirements are often seen in projects where users are involved and get more active as the project progresses. The problem is visible in projects where the users cannot say what they actually want (Halonen 2003a).

2.8 Theoretical preface for action-related research

The background of the research methods is sketched out because action research as a scientific method has been criticised due to its subjective nature.

The background of the action research method is laid out in the thoughts of Charles Peirce when he introduces his concept of the fixation of belief (Peirce 2000). Peirce uses the words of Roger Bacon who, in the middle of the thirteenth century, had realised that only experience is needed when one wants to teach something. Peirce explains this further, describing the importance of reasoning and its object as being "to find out, from the consideration of what we already know, something else which we do not know". Reasoning leads us to determine one inference instead of another and to act according to some habit of mind. He calls this action a guiding principle of inference. This guiding principle is supposed to lead us to correct conclusions from true premises. Peirce continues by describing the differences between doubt and belief and states that there is a practical difference. According to him, our beliefs guide our desires and shape our actions. Doubt, on the other hand, leads us to efforts to get rid of it and to proceed to the state of belief.

In this sense, both doubt and belief have a positive influence on us. Both of them make us act and think, and our behaviour changes according to that. However, we generally reason correctly, by nature (Peirce 2000).

Action research as a concept was first introduced by Kurt Lewin (1946) in reporting his research on workers' intergroup relations. The researcher wanted to know their line of thinking, their line of action and the major barriers that the workers encountered. Lewin found that perhaps the biggest obstacle to the workers' work was their own lack of clarity about what ought to be done. Lewin continued that if people cannot judge whether an

action has led forward or backwards, there is nothing to prevent them from making the wrong conclusion and encouraging the wrong work habits. Moreover, realistic fact-finding and evaluation is a prerequisite for any learning. Lewin called his research “a type of action-research, a comparative research on the conditions and effects of various forms of social action, and research leading to social action”.

Later, Rapoport (1970) defined the central elements of action research as:

- The need to get collaboration from members of an organisation to help them solve their own problems.
- The operational research stream of mathematics, engineering and physical sciences concentrating on logistical problems of various kinds.
- The group dynamics stream researching leadership, power, group dynamics, stress and identity.
- The applied anthropology stream studying psychological warfare, intelligence and administration of occupied territories.

Rapoport (1970) reformulated the definition of action research as follows: “Action research aims to contribute both to the practical concerns of people in an immediate problematic situation and to the goals of social science by joint collaboration within a mutually acceptable ethical framework.” Susman and Evered (1978) add to the definition, saying that action research can also be viewed as a cyclical process with five phases (diagnosing, action planning, action taking, evaluating and specifying learning).

Design science and natural science, as described by March and Smith (1995), together support the thoughts of Peirce about the importance of reasoning and of a guiding principle that leads us to correct conclusions from true premises. March and Smith present a two-dimensional framework for research in information technology. They formulate information technology as technology used to acquire and process information in support of human purposes. This technology is instantiated in information technology systems which are developed to address tasks faced by individuals and groups, typically within some organisational setting. Furthermore, information technology research studies artificial as opposed to natural phenomena. In this sense, it concentrates on human creations such as organisations and information systems.

Furthermore, design science is described as focusing on creating and evaluating innovative information technology artefacts that enable organisations to address important information-related tasks (Hevner *et al.* 2004). In this sense, design science is substantially a problem-solving tool. Hevner *et al.* have introduced seven guidelines that arise from the principle that knowledge and understanding of a design problem and its solution are acquired in the building and application of an artefact. These guidelines are:

1. requirement of creating of an innovative, purposeful artefact
2. specified problem domain
3. careful evaluation of the artefact
4. novel solution
5. rigorously defined, formally presented, coherent artefact
6. use of search process
7. effective communication of research.

Hevner *et al.* note that these guidelines are important but need not be present simultaneously. The authors want to encourage researchers to be both proactive and reactive with respect to new technology, which is often overemphasised among the artefacts. Furthermore, they encourage the alignment of design-science design with real-world production experience.

Natural science means traditional research in physical, biological, social and behavioural domains, aiming to understand reality (March & Smith 1995). For that purpose, natural scientists develop sets of concepts or specialised language with which to characterise phenomena. Design science, on the other hand, tries to create things that serve human purposes, and is technology-oriented. Design science produces diverse types of outputs: constructs, models, methods and implementations. Like natural science, design science also necessitates a basic language of concepts with which to characterise phenomena.

Design science is grounded on two basic activities: building and evaluation. Building refers to the construction of the artefact, proving that such an artefact can be built. Evaluation refers to the development of criteria and the assessment of artefact performance. These are in line with discovery and justification in natural science. Discovery refers to the construction of theories that explain how or why something happens. Justification refers to theory proving. Furthermore, while natural science aims at understanding and explaining phenomena, design sciences aim at developing ways to achieve human goals. March and Smith (1995) go on to say that these two sciences have strong interactions: design science creates artefacts, creating phenomena that can be studied by natural scientists. In addition, natural scientists create knowledge which design scientists can use in their attempts to develop technology.

Furthermore, the research activities of design science (building and evaluation) aim at improving performance. Likewise, the research activities of natural science (discovery and justification) aim at extracting general knowledge by proposing and testing theories. According to this, research in the building activity should be judged based on its value or utility to a community of users. Research in the evaluation activity produces metrics to define what a research area is trying to achieve. This means that evaluation is the key activity for assessing such research (March & Smith 1995).

When the research activities (building and evaluation) express themselves in the same process, the research method is called action research (Järvinen 2001). In his comparative study of design science characteristics and action research characteristics (2007a) even claims that action research and design science should be considered as similar research approaches.

2.9 Case study and action-related research methods

The research methods are explained in this section, enabling the reader to understand why they were pertinent in this thesis.

Researching collaboration between practitioners from four software organisations and researchers from universities and technology institutes has produced a proposition about collaborative practice research as being a useful research method (Mathiassen 2002).

Mathiassen describes collaborative practice research as a suitable method to combine action research with experiments and conventional practice studies. The research method constantly meets dilemmas between practice-driven and research-driven goals and general and specific knowledge interests.

Eisenhardt (1989) defines case study as a research strategy which focuses on understanding the dynamics present within single settings. She continues that case studies combine data collection methods such as archives, interviews, questionnaires and observations. Eisenhardt also believes that case study research has important strengths like novelty, testability and empirical validity which arise from the close linkage with empirical evidence. In their commentary on theory building from case studies Eisenhardt and Graebner (2007) note that case studies emphasise the rich context in which the phenomena occur. The authors note that theory building from case studies is an increasingly popular and relevant research strategy that forms the basis of an excessive large number of significant studies. Eisenhardt and Graebner continue that research that grounds on rich qualitative data predicts challenges that, however, can be managed with careful justification of theory building, theoretical sampling of cases, interviews that limit informant bias, rich presentation of evidence in tables and appendices, and clear statement of theoretical arguments.

Ten years later, Klein and Myers (1999) introduced seven principles for conducting and evaluating interpretative case studies:

1. the fundamental principle of the hermeneutic circle
2. the principle of contextualization
3. the principle of interaction between the researchers and the subjects
4. the principle of abstraction and generalization
5. the principle of dialogical reasoning
6. the principle of multiple interpretations
7. the principle of suspicion.

However, Klein and Myers also clarify the use of their principles and warn that researchers should not follow all of these seven principles if they do not find them pertinent to their research. The idea behind the principles is to offer an approach that enables more rigour to conduct and report the results of case studies. This is possible if the researcher carefully considers how and which of the principles apply in any particular research setting.

Case studies can be divided several ways (*e.g.* Stake 2000). Cunningham (1997) divides case studies into three different types: intensive cases, comparative cases and action research. Cunningham summarises the types as presented in Table 2. In his article, Cunningham includes action research as a part of case studies. Järvinen (2001) included action research as a part of constructive research. Järvinen proposes that a researcher should describe the action research process in sufficient detail in order to help a reader to understand the situation. He adds that constructive research typically builds a new innovation, and this process is based on existing knowledge and/or new technical, organisational etc. advancements. The utility of the new innovation is sooner or later evaluated. Furthermore, in action research, building and evaluation belong to the same process.

Although we do not agree with Cunningham's conception of action research as a subgenre of case study, we find the summary in Table 2 descriptive.

Table 2. Different types of case studies (Cunningham 1997, 403).

	Type of case study		
	Intensive cases	Comparative cases	Action research
Purpose	To develop theory from intensive exploration	To develop concepts based on case comparisons	To develop concepts which help facilitate the process of change
Assumption	Creativity through comparison with existing theories	Comparison of cases leads to more useful theory	Theory emerges in the process of changing
Examples	Dalton	Eisenhard	Trist
Situation	Usually evolves out of a researcher's intensive experience with culture or organisation	Usually concepts are developed from one case compared with another case	Developing theory to assist practical and future social science
Types	Narratives Tabulation Explanatory Interpretative	Case comparisons Case survey Interpretative comparisons	Diagnostic action research Experimental action research

Action research is argued to be ideal for studying information systems in practice, it serves different interests and it offers good means to improve practice in general (Baskerville & Wood-Harper 1998). In his study on reflective systems development Mathiassen (1998) situated action research as an appropriate research method that is realised in practice as reflection-in-action. Greenwood and Levin (2000) describe action research as co-generative inquiry because it is built on professional researcher-stakeholder collaboration. Despite that, action research has received negative attitudes due to its "double challenge" of action and research, especially among information systems researchers (Baskerville & Wood-Harper 1998, Avison *et al.* 2001).

Action research can be used as a quantitative and qualitative support method (Similä 1988). In his study on modelling and analysing empirically the success of automatic data processing systems use, Similä used several research methods, and finally by using action research he integrated the scientific and practical problem-solving processes. However, in his research the researchers worked mainly as consultants to the decision makers in the implementation project. This approach differs from that of the researcher in this thesis.

Lewin (1946) noted that there are four functions in an action research cycle: evaluating the action, giving a chance to learn, serving as a basis for correctly planning the next step, and serving as a basis for modifying the overall plan. In their famous article, Susman and Evered (1978) described their developed action research cycle with five steps as organised in Figure 8.

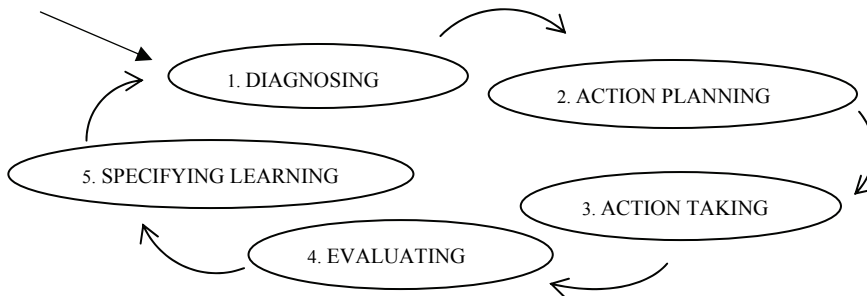


Fig. 8. The cyclical process of action research (Susman & Evered 1978).

The cycle begins with identifying or defining a problem and continues with considering alternative courses of action in order to solve the observed problem. After that actions must be chosen and taken, followed by evaluating how the actions influenced the prevailing situation. The last step in the action research cycle is to specify learning and to generalise findings from that learning. After the last step of that cycle it is expected that another action research cycle will take place, beginning with diagnosing the prevailing situation. The interaction between the information system development and the action researcher maintains and regulates some or all of these five phases jointly. Susman and Evered believe that all these phases are necessary for a comprehensive definition of action research. However, they add that the number of phases may differ in action research projects, meaning that the researcher does not always collaborate with the information system project when performing these phases.

The origins and prevailing status of action research were examined by Peters and Robinson (1984). They criticise the approach for its lack of paradigmatic nature. They have found two versions of action research – weak and strong – and conclude that both of them share the minimal requirements:

- the involvement-in-change characteristics (being problem-focused and directed toward the improvement of some existing social practice)
- the organic process characteristics (research consisting of a series of systematic cyclical or iterative stages of fact finding, reflection and planning, strategic action, and evaluation)
- the collaborative characteristic (research carried out as a joint, co-operative endeavour among the participants).

Peters and Robinson (1984) conclude that in order to develop a paradigmatic status for action research, researchers should form a professional community in which the exchange of views may lead to a better conceptualisation of the approach. However, their research was conducted over two decades ago.

The nature and validity of action research is examined in a paper by Checkland and Holwell (1998). The authors explain the discrepancies of action research compared to typical natural sciences, and highlight some problems such as lack of hypotheses or the

challenges of recoverability in action research. The authors also say that research in an organisation on how to introduce a particular information system may well evolve into research on what organisational changes are first needed to make it sensible to examine the introduction of a certain system. Furthermore, it is presumed that the roles of researcher and participant in the situation will be combined. Checkland and Holwell ponder when to stop the research in action research contrary to any laboratory tests that rely on hypotheses and their acceptance or rejection. Usually this is a question to be answered by the researcher when the researcher considers that enough has been learnt in the research area. Finally, writing the results will show whether a case can be written and whether that position has been reached.

Furthermore, the challenge of recoverability in action research is similar to that in case studies. Checkland and Holwell (1998) remind us that enough evidence should be given and written out in a manner that any other researcher could interpret the output likewise.

In addition, action research is criticised because of difficulties in controlling the research process (Avison *et al.* 2001, Mathiassen 2002). This problem of controlling the process derives from action research being highly situational, meaning that each action research project is unique and it is difficult to generalise the performed actions for use in other projects (Avison *et al.* 2001). Therefore Avison *et al.* suggest guidelines to be followed in action research projects in order to control them. The guidelines include three aspects that should be considered when determining the control structures:

1. How are action research projects initiated?
2. How is authority in action research projects determined?
3. What is the degree of formalisation in action research projects?

With the question of initiation, Avison *et al.* (2001) want to highlight three forms of initiations: client initiation, researcher initiation and collaborative initiation. Furthermore, Avison *et al.* refer to three patterns that appear in action research projects: client domination, staged domination and identity domination.

As Ayas and Zeniuk (2001) mention, “action research provides a link between scientific understanding and social action”. Lallé (2003) introduces an actor-researcher as a management researcher and a practitioner, who on one hand works in an organisation and on the other hand generates new scientific knowledge.

Although action research can seem formal and highly cyclical, it can also be seen as purely practical (Kemmis 2002). The practical form of action research has technological intention for change, but it also aims to inform the practical decision-making of practitioners. Practitioners are not only aiming to improve their practices in functional terms but also to see how their targets are modified following their ways of seeing and understanding themselves in the particular context. In addition, according to Kemmis (2002), the process of action research is a process of self-education for the practitioner when there are stories told and histories written of the ways the practitioners have participated in making changes.

Besides being ideal for researching information systems projects (Baskerville & Wood-Harper 1998), action research has been evaluated as serving the negotiation process (Akdere 2003). Akdere says that action research started to be used by practitioners on large scales to deal with intraorganisational and work life problems, shortly after its development in the late 1940s. Akdere notes that the term “action

research” can be regarded as an umbrella term that includes several traditions of theory and practice.

As a process, action research includes a set of steps in order to pursue action and research outcomes at the same time (Baskerville & Wood-Harper 1998). Therefore action research has some components that resemble the four components of principled negotiation: people, interests, options, and criteria (Akdere 2003). These components of action research are also important stages in a negotiation process. Akdere notes that action research fosters a democratic approach to the decision-making process while empowering individual practitioners through participation in collaborative and socially responsible research. Furthermore, Akdere adds an additional aim of action research: developing the self-help competencies of people to face problems.

Using action research in management has been recognised to be problematic by Walker and Haslett (2002). They consider action research as a collaborative process of critical inquiry between the researcher and the people in the situation, which in their case was the management executive. They note that the relationship between the researcher and manager participants in a long-term action research project gives rise to ethical dilemmas related to participant selection and voluntary participation, informed consent, decision-making, anonymity and confidentiality, and conflicting and different needs.

This ethical dilemma was discussed in the study by Walker and Haslett (2002), and it was rooted in the Ethics Committee in their university. The committee wanted to pay attention to the role of the participants and the researcher in action research. Furthermore, the committee wanted two elements to be catered for: 1) the research project and student-as-researcher were to be separated from the change project and student-as-change agent and 2) the research project and staff-as-research-participants were to be separated from the change project and staff-as-change agents. The authors go on to say that in action research the researcher has the role of creating the context and conditions for the conduct of his or her study. Furthermore, the researcher influences the shaping of the plans for action. Walker and Haslett state that the duality of the researcher and the participants also gives rise to other dilemmas relating to the possible conflicting and different needs of the researcher and manager participants and data collection and interpretations.

Greenwood and Levin (2000) describe action research using four definitions:

1. Action research is an inquiry in which participants and researchers co-generate knowledge through collaborative communicative processes in which all participants' contributions are taken seriously.
2. Action research treats the diversity of experience and capacities within the local group as an opportunity for the enrichment of the researcher/action process.
3. Action research produces valid research results.
4. Action research is context centred; it aims to solve real-life problems in context.

Analysis of action research applications in different systems identify five dimensions for examining action research cases: 1) system level of target system, 2) organisation of the research setting, 3) openness of the action research process, 4) intended outcomes of action research, and 5) researcher role (Chisholm 2002). Furthermore, Chisholm notes that action research is an orientation to system development or improvement and also highly cyclical.

The main concern in collaborative research is to ground well functioning relations between practice and research. To achieve this, practitioners must become objects of study and researchers must commit themselves to improving practices and to adopting flexible research approaches as practices change and new needs appear (Mathiassen 2002). Action research is difficult to differentiate from field experiments because the same research activity can be considered from both practice and research viewpoints. Mathiassen notes how the difference between these two approaches is closely related to the commitment to improving practice versus the intention to develop normative field experiments. Furthermore, the greatest weakness of action research is the limited support that it offers for structuring the research process and findings.

The relationship between action researchers and the other people in the research context is questioned by Eikeland (2006) in his literature review on ethical aspects of action research. Eikeland argues that traditional action research setting is not democratic enough. On the contrary, it is based on a juxtaposition between the researchers and their research objectives. Furthermore, he states that true collaboration, learning and research necessitate new forms of organisations.

Van Maanen (1988) remarks that ethnographic field data are constructed from talk and action and thus are interpretations of other interpretations, and that they are mediated many times. These mediations are influenced by – among other things – the researcher's own standards of relevance for what is of interest, by the queries that are performed, by the norms in the organisation culture, and by the researcher's presence on the scene as an observer and participant. Van Maanen adds that case studies are presented with differing styles, such as realistic, impressionistic, confessional, critical, formal, literary or jointly told.

In qualitative research studies the benefit of diaries is realised when writing out the cases (Newbury 2001). The purpose of personal notes is neither to present the process of research in a linear fashion, nor to clarify the communication of the research to others, but to facilitate the research process through recording observations, thoughts and questions when they happen to be used by the researcher (Newbury 2001).

Mason (2002) remarks about writing autobiographical and other notes like keeping a journal by mentally re-entering essential moments and how this assists professional development and is integral to research. Schultze (2000) describes how confessional writing produces information for scientific research. Her study focuses on the work of producing informational objects, and she identifies three informing practices (expressing, monitoring and translating). The core of the practices was the endeavour to balance the subjective nature of the information that was produced with activities that enhanced its objectivity. However, also the value of confessional writing (*e.g.* a personal diary) is assessed in her study.

3 Empirical context

In this chapter the research context is set out. First, the research objectives are briefly expressed. Then, before any empirical research is described, the researcher is positioned in the research context. After that the use of research methods is explained. The original publications are listed next, to enable the reader to understand their justification in the research path. Due to the chosen research methods, with their subjective nature it is appropriate that the personal notes of the researcher are disclosed.

The aim of this research is to find out how inter-organisational information systems are implemented in the context of several organisations participating in the development project, and what kind of challenges there are in such a project. “Information system” is understood in this research as defined in an online dictionary (ostinato.stanford.edu/hipaa-feedback/definitions.html): “Information system means an interconnected set of information resources under the same direct management control that shares common functionality. A system normally includes hardware, software, information, data, applications, communications, and people.” This definition leads us to consider information systems by using diversified approaches. The main case in this research consists of experiences when building a web-based information system to be used inter-organisationally and geographically distributed. In addition to this, background for the case is gathered from three other differing environments where information systems were implemented. The researcher has gained experience through working with implementation projects in organisations. The importance of experience is highlighted in this research following Peirce (2000, 8):

“But let a man venture into an unfamiliar field, or where his results are not continually checked by experience, and all history shows that the most masculine intellect will oftentimes lose his orientation and waste his efforts in directions which bring him no nearer to his goal, or even carry him entirely astray. He is like a ship in the open sea, with no one on board who understands the rules of navigation. And in such a case some general study of the guiding principles of reasoning would be sure to be found useful.”

The research is qualitative and cases are unique, the main material coming from one case. Action research and related methods are used, added with case study following notes by

Mathiassen (2002). The researcher was deeply involved in the main case over three years. Because of her strongly subjective approach she had to be able to act depending on the prevailing relationships between several stakeholders in the diversified project. Over the years there were signs of conflicts that had to be recognised and managed. Recognising an increasing conflict in the relationships between project personnel demands that the emotions of the people involved are identified, and in this way the chances of managing the conflict are better (Bodtker & Jameson 2001). The researcher gathered study material from the cases, and she was involved in the implementation projects except one case. The role of the researcher is explained in detail in the original publications.

The literature recognises research on implementing information systems in distributed organisations (*e.g.* Munkvold 1999, Kotlarsky & Oshri 2005), but there is not much literature about information system acquisitions made by several users representing different organisations. This research influences this gap in information systems research. New innovations like the Internet and the WWW have inestimable impacts on the way in which information systems are implemented and managed (Hevner *et al.* 2004). Although our main case does not represent a pure distributed organisation, there are many similarities with distributed organisations.

3.1 Research objectives

There are two objectives in this research:

1. to find out how an inter-organisational information system is implemented in the context of several organisations participating in the project and
2. to find out what kind of challenges there are in that kind of implementation project, where the actors are developing the system to themselves.

The literature recognises research on the implementation of information systems in distributed organisations. We want to point out issues that emerge when distinct organisations are involved in the development project. Acquisitions made by strategic alliances are not widely explored in information systems literature and this research contributes this deficiency.

As opposed to the user viewpoint, the approach used is that of an information system and its development. Furthermore, the standpoint is that of the researcher. However, users are considered in this dissertation, especially due to their active participation in the information system development, and their role is essential in the research.

3.2 Positioning the researcher

Before introducing the chosen research approach in detail it is important to position the researcher in this research. This section serves this intention by summarising the working experience of the researcher. Because of the intention, only relevant experience is mentioned.

The researcher worked for about ten years in a scientific research project financed by the Academy of Finland, acting as a project assistant *i.e.* giving technical assistance but not doing research by herself. However, during those years she was able to observe the principles of carrying out research when there were several researchers from distinct organisations participating in the research project. The approach of the project was clearly that of intervention, which differs from her current research. The role of collaboration and interaction between project participants was felt to be important and reporting about the study results, for example, was highly appreciated. Due to her former studies, the researcher was able to understand the scientific approach, but her position and experience did not allow involvement in the scientific work. Unlike during her subsequent experience, there was no significant information systems experience in this period. During those years the researcher started to think of continuing her studies in computing and information sciences.

The researcher conducted her first information systems project when she acted as a trainee as a part of her further education. Her responsibility was to design and implement an information system to enable quality control when coating cable (Halonen 2004a). Organisational changes at the managerial level had led to a new emphasis on this demand. A computer-based information system was seen as the way to meet these new demands. The data of the study consists of material collected by interviews and observations made by the author during the implementation. The factory environment was totally unfamiliar to the designer and she needed a lot of expert knowledge from the workers during the whole process. The role of users in every phase of the project was essential to the new information system.

This first experience taught the researcher a lot and its influence can be seen in her future actions. The most important findings were the influence of the users and the problem of success or failure. In this case the negative attitude of the users influenced not only the information system but also the project manager, giving her a lasting fear of powerlessness against resistance. And yet, defining the success or failure of implementations depends on the time of the evaluation, and on the eye of the beholder (Larsen & Myers 1999).

The second experience took the researcher into an information system project where an information system was developed to replace a legacy system in hospitals (Halonen 2004b, publication I). A hospital is a hierarchical and bureaucratic organisation where the duties, responsibilities and power are carefully defined at the different hierarchical levels (Viitanen & Piirainen 2003). The author of this thesis acted as a project manager in the piloting project. The future users were satisfied with their prevailing information system, which was quick and familiar to them. The new information system was totally different in appearance and functionality, and was not yet ready. One lesson learnt was that a new information system needs to be a real benefit to the users before it is accepted there. In addition, there are information systems that must be implemented due to changes in their environments, *e.g.* outdatedness of legacy systems.

The third experience came from a large implementation project in which the researcher acted outside the project collecting material for her master's thesis (Halonen 2003b). This experience taught her how many issues have to be considered before a diversified information system is implemented in a distributed organisation. This experience was also significant because the researcher was able to follow the

implementation project and got information about the versatility of assignments that are needed in far-flung implementations. During this time she worked as a designer in a European information technology services company. However, her motivation to do academic research forced her to take leave from the firm in order to get further education and to gain experience in doing research.

In the main case of this thesis the researcher acted as a project manager, and her role was consciously that of an involved researcher instead of an outside observer (Walsham 1995). She started to keep a personal diary about the progress of the project, making notes about encounters and meetings, and also recording her feelings in the diary. When acting in the project her experiences from her past guided her to act and to interpret the encounters and situations (Frankl 1963, Walsham 1993). As a project manager the researcher worked as a facilitator in the project between the customer side (i.e., universities with their student affairs officials) and the vendor side (who did the actual implementation work, coding the system and designing databases, user interfaces and other components of the information system). Following Schön (1983), her role can be characterised as a reflective conversationalist with a situation where she acted as both agent and experient, meaning a subject and a part of this experiment.

The experience gained in different organisations and information system projects there gave the researcher mixed feelings. On one hand, she had gained experience in running projects with several stakeholders and organisations. On the other hand, she had perceived the power of users and resistance to change. She had learnt that there are challenges in implementation projects that are difficult to manage. In addition to reluctant users, these challenges consist of other organisational issues *e.g.* support from the managerial level in organisations, flexible schedules, lacking information sharing and limited resources. Despite mixed feelings, the new information project predicted such possibilities to learn and get research material that there was no sense in giving up this auspicious project. On the contrary, the research approach enabled her to act and react, and whatever happened, there would be enough material to do research on the case.

3.3 Use of research methods

This section introduces how the chosen research methods were realised in this research. Collaborative practice research can be seen as an umbrella above the research methods that are used in this thesis (Mathiassen 2002).

This study is qualitative research, enabling the researcher to explain and understand social and cultural phenomena. The approach is subjective, reflecting on the past of the researcher and being also interpretative (Walsham 1993) while the data are interpreted by the researcher. The researcher has been aware that the interaction of a researcher can change behaviours in ways that would not have occurred in the absence of such interaction (Angrosino & Mays de Pérez 2000).

The main empirical material is gathered from a case, remembering Yin's notion: an exemplary case study includes five features: 1) significance, 2) being "complete", 3) considering alternative perspectives, 4) displaying sufficient evidence, and 5) being composed in an engaging manner (Yin 2003). The case is reported bearing in mind the

idea of van der Blonk (2003), who states that cases are written with a purpose that heads to the goal of the research project. This case is an intrinsic case (Stake 2000), offering a diversified environment with several stakeholders and project parties. Furthermore, Walsham (1995) notices how an in-depth case study necessitates frequent visits to the field site over an extended period of time. In our research, the researcher was involved in the research scene for several years (2003-2006). Thick description is needed when trying to understand what is happening in the research environment in connection with a complex computer-based information system, involving managers, users and designers (Walsham 1995, Schultze 2000). The main case is described in detail by using different viewpoints. In addition, an extended discussion enables deepens the description.

In this thesis we have used both intensive and comparative types of case study (Cunningham 1997). Interpretation, for example, can be found in both types in Table 2. However, because the number of cases is limited, there is a limited emphasis on the comparative case study element, concentrating on the background study that was carried out in three different implementation projects.

In addition to case study (van der Blonk 2003, Stake 2000, van Maanen 1998, Yin 2003), the research approach is a combination of action research (Argyris *et al.* 1987, Raelin 1997, Ayas & Zeniuk 2001, Coghlan & Brannick 2002, Raelin 2001, Schön 1983) and participatory observation (Flick 1999, Kemmis & McTaggart 2000). Participatory observation was used especially when user authentication and interfaces between organisations were under consideration. In those situations, the researcher was not active in the actual development work but observing and making notes when the experts in that area were working.

Furthermore, the role of observation is emphasised in the background research that was conducted in three different organisations before the main case was introduced to the researcher. Except with the last organisation, the researcher was not acting as a researcher in the surroundings but acting as a project manager in an information system implementation. During those implementations she made notes about the progress of the projects, thus collecting evidence to support future actions there. However, because of her active role in the implementation projects she was able to reflect depending on the evolving situations in the organisations and to influence them, even not knowing anything about participatory action research at that time. In the third case she was acting as a researcher and collecting material for her research even if she was not able to influence the actions in the implementation project.

In our research we could identify client initiation, researcher initiation and collaborative initiation (Avison *et al.* 2001) related in differing situations during the lifetime of the project. In the study by Avison *et al.* the authority question refers to being in charge of the research project. In our research the research authority belonged to the author of this thesis. Client domination, staged domination and identity domination (Avison *et al.* 2001) does not suit our project as such, because the client was not intentionally involved in the research project but in the implementation project. The formalisation question refers to structures that are defined in written agreements and contracts. The degree of formalisation can be evaluated as moderate because apart from the establishment letter written by the Rector of one of the universities, there were no written agreements between the project personnel. In addition, the relationships between the vendors and the client organisations were closed with contracts.

“Action research provides a link between scientific understanding and social action” (Ayas & Zeniuk 2001). This was realised by enabling the project manager to collect research material from the implementation project when running the project and working with the other project members. Lallé’s (2003) actor-researcher approach describes the role of the researcher in this project. The practical approach described by Kemmis (2002) describes clearly the research discipline in our case.

The suitability of action research in negotiations was proved in our research, especially at the beginning of the implementation project when the negotiations with the vendors were carried out (Halonen & Heiskanen 2005, publication II).

The problem of using action research in management (Walker & Haslett 2002) could be seen in our research, for example, when the project manager was collecting data by writing project memorandums that included as thick descriptions of the discussions in the meeting as possible (Memorandum September 19, 2005 and emails after that meeting September 22 and 23, 2005).

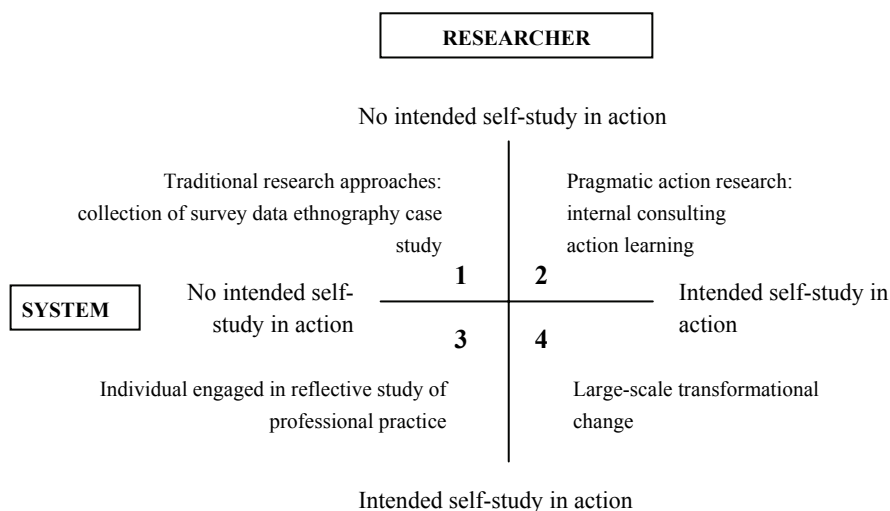


Fig. 9. Focus of researcher and system (Coghlan & Brannick 2002, 44).

The context and conditions (Walker & Haslett 2002) of our research can be found in quadrants 3 and 4 in Figure 9: The researcher is individually engaged in reflective study on professional practice, and both the researcher and the system are the focus of action.

In Figure 9, quadrant 1 represents traditional research approaches where the researcher is not interested in his or her own actions but only in the system as a target of the research. Quadrant 2 represents an approach without intentional self-study, but the interest is in the actions related with the system. In our research the researcher is interested in her own actions and learning (*cf.* quadrant 3) but the focus is also on the environment, *i.e.* an information system to support student mobility and the project itself with its people (*cf.* quadrant 4).

In this thesis, from the viewpoint of research, the role of the project manager differed from that of other project participants. Unlike the other project participants, the project

manager was acting as a researcher while running the implementation of the information system. In this sense, she was the only person who actively evaluated performed actions and their influences from the learning point of view (Susman & Evered 1978). Furthermore, the conveyed action research was not collaborative, due to its lack of collaborative steps. Instead, the form of action research resembles the form of actor-research (Lallé 2003).

Our research acknowledges Greenwood and Levin's (2000) description of action research by their four definitions. The seven guidelines related to knowledge and understanding of a design problem and its solution (Hevner *et al.* 2004) resemble the situation in our project. The researcher aimed at both proactive and reactive approaches with respect to new technology. To meet the challenge of recoverability in action research (Checkland & Holwell 1998), we used several distinct sources when collecting research material. Nevertheless, these sources were partly related to each other. This issue is described in the next section.

In the main case research, material was collected from memorandums from project meetings and emails from the files of the researcher. Some of the memorandums were written by the project manager, others by other people who were present in the meetings. The memorandums were accepted according to the protocol in the project meetings and thus they give an objective description of the situation. In addition to the official memorandums, the researcher has written notes based on discussions and encounters. There were no tape-recordings because some members refused their use in the meetings. This research aims to present the case realistically (Van Maanen 1988), critically pointing out some issues that appear problematic. However, the confessional style is present due to the personal research material of the researcher.

Furthermore, the researcher wrote a personal diary (Schultze 2000, Kemmis 2002, Coghlan & Brannick 2002) while running the project and recorded her observations there. Interviews have not been conducted, because the researcher was acting as a project manager and thus she might have influenced the opinions of the interviewees.

The principles introduced by Klein and Myers (1999) have been in the background when carrying out this research. A hermeneutic circle is concerned when trying to understand the relationships between project stakeholders in the context of the inter-organisational project organisation. Interaction between researchers and subjects has been active in project meetings and encounters, including emails. Noticing the difference between end users and customers in this case can be generalised to concern other alliances of customers (acting as one client) and end users, when both of them are participating in an information system project. Multiple interpretations are realised in this research by using both project documentation and the personal diary written by the project manager in interpreting events. The subjective interpretation of the researcher is questioned by letting third parties read the manuscript. In addition, several SMSs were sent during the implementation, giving evidence about the atmosphere and situations in the project. The principle of suspicion leads us to evaluate the subjective diary of the project manager and the short minutes that were written about meetings and encounters.

The approach is subjective and reflects the past of the researcher, relying on the remarks of Frankl (1963) when he states how our experiences and past have made us what we are. In this sense the approach is also interpretative (Walsham 1993) because the approach is very subjective, the observations and findings reflecting strongly our personal

presence. Furthermore, our interpretations are influenced by our background, knowledge and prejudices to see things in certain ways and therefore they are evidently biased (Walsham 2006).

Although the research was introduced intentionally from the very beginning of the main implementation project, the results of the research were not introduced or evaluated by the project participants while the project was still running. This decision was based on the researcher's view that the results with interpretations by the researcher could have influenced the natural interaction in the project meetings and encounters. Besides, from the point of view of the project participants the ultimate aim of the project was not to contribute scientific research but to develop and pilot an information system. In addition, another research project was underway, with the intention of studying the atmosphere and backgrounds in the project. The approach and methods of that parallel research differ from those chosen in this thesis. The results will be published in other forums.

3.4 Original publications

This section describes the original publications and their justification in the thesis as they appear in the research path. The first section describes the background on which the researcher set her concepts and experiences. The next section opens the main case.

3.4.1 Earlier experience

The role of the first publication is to lay out the grounds of the experiences of the researcher. It reports the preceding research done by the researcher and offers insights on the experiences that shape the expectations and assumptions that guide one when engaging in new information projects.

The first publication explores the implementation of information systems in three different environments. The implementation of an information system consists of different functions. This article compares the implementation projects and concludes that in spite of the differing environments and characteristics in the projects there are several functions that are common to implementing information systems. Some of these functions require the users to be taken into the implementation project and that they are considered sufficiently and at the right time relating to the process of the implementation project. The article concentrates on the resistance to technological change that generally happens when new information systems are taken into use. Furthermore, the lesson learnt in this research highlights the importance of resistance to technological change, leading to the assumption that that phenomenon always appears in every information systems project.

The first environment is a factory where the workers did not want to get an information system. It represents a small implementation project where there were less than ten users. The second environment comes from a hospital where the users consisted of health care personnel. The users expressed strongly that their main profession was to take care of people and not to look after data or computers. This was a pilot project and

there were about ten users during the project. The third case in the paper comes from a high technology organisation where the development of information technology was the main focus of the company. The case describes the first phase of a global implementation, and the number of users was to extend to thousands. The approach is user-centred and the research object is the change that is tied to the implementation of information systems. This article concludes that despite the differing variables in the implementation project there are similar influences and characteristics found in the organisations.

The first paper highlights the role of users and concentrates on their attitudes and reactions. In addition, this research paper emphasises that the most important task is to recognise resistance to change and to react to it in a phase when resistance to change has not become a threat to the success of the implementation of the information system.

- I *Halonen, R. Resisting technical change – three case studies. International Journal of Innovation and Technology Management 2004, Vol 1 (3): 1-15.*

3.4.2 Research from the main case

The next publications briefly present the research that was carried out in the study. They explore the same empirical case but the approach differs in each.

In the second publication the building of co-operation is studied, reflecting on the experiences of the authors and especially of the first author, who acted as a project manager in the project. The timeline in the paper is the first year of the project, as the project was being established. We analyse the acquisition process of the project and the circumstances that led to the actions and decisions that were performed. We also discuss the backgrounds that influenced the outcome of the acquisition process. The article shows that experience can lead us to make decisions that lead to positive outcomes. In addition, our article encourages one to rely on relationships and trust that have been built earlier.

- II *Halonen, R. & Heiskanen, A. Configuring Co-operation: A Reflective Learning History. Reflective Practice 2005, Vol 6 (3): 379-391.*

The collaboration in an information system project was studied in the third article. The starting point for the development of the information system appeared to be competitive and cagey. This research shows how the problems can be overcome and collaboration be built in cases when there are several conflicts nearby. According to the research, the solutions to problems can arise from stakeholders that are not responsible but paid partners. The main idea of the research is to emphasise the importance of collaboration between stakeholders that have an affect on the successful outcome of the project. This emphasis proves to be challenging especially when there are ulterior motives among the collaborators and even overlapping projects, as it was in our case.

- III *Halonen, R. Many faces of collaboration in an information system project. In: Sobolewski, M. & Cha, J. (Eds.) Concurrent Engineering: The Worldwide Engineering Grid. Proceedings of the 11th ISPE International Conference on*

Concurrent Engineering: Research and Applications, P. R. China, Peking 26 - 30 July, 2004. Beijing: Tsinghua University Press and Springer-Verlag, 449-454.

The fourth article researches the building of a joint information system to be used in several organisations. It describes how the organisations influenced the development, and what the outcome of the development was. This article emphasises the approach of several participants that influence the design of the information system. In addition, the joint information system produced a joint database to be used when managing the process of mobility between the organisations. Furthermore, using a joint database brings new challenges to the organisations that are involved in the collaboration.

IV Halonen R. *Building a Joint Information System. In: Kamel, S. & Irani, Z. (Eds.) Electronic proceedings of the European and Mediterranean Conference on Information Systems, 7-8 June 2005, Cairo, Egypt. 45.pdf.*

Decision-making is the focus of the fifth article. The role of decision-making is especially highlighted in cases when there are several customers making a joint decision and nobody wants to dominate. This research paper considers the difficulties in making final decisions when designing an information system. The article considers this information system to be a supportive tool that will enable efficient decision-making when in use.

V Halonen, R. *Supporting decision-making in managing student mobility. In: Wei, C.-P. & Yen, B. (Eds.) IT & Value Creation. Electronic proceedings of the Ninth Pacific Asia Conference on Information Systems July 7-10, 2005, Bangkok, Thailand, 1603-1609.*

The sixth publication introduces a hierarchical model to be used when implementing information systems. This hierarchical model is developed to analyse accidents, but this paper suggests that it is also usable when implementing information systems. We show that by using this hierarchical model, the categorisation of obstacles and risk factors in implementing information systems becomes clearer. Despite its lacking a proactive nature, the model is useful when seeking explanations for the observed obstacles and problems. The hierarchical model also has benefits in information system implementation risk management when selecting suitable methods and controls.

VI Halonen, R. & Paavilainen, J. *Hierarchical Model of Problems in Implementing Information Systems. In: Wei, C.-P. & Yen, B. (Eds.) IT & Value Creation. Electronic proceedings of the Ninth Pacific Asia Conference on Information Systems July 7-10, 2005, Bangkok, Thailand, 350-362.*

The aim of the seventh paper is to study how user authentication was built in an inter-organisational information system in the context of several organisations participating in the implementation project. This paper describes in detail how a given architecture was adopted in the organisations and what its role was when managing security between organisations and the information system. The platform did not meet the requirements as-it-was, and its implementation necessitated a lot of planning and interaction between the actors in different organisations before it was modified and taken into use.

VII Halonen, R. *Building user authentication in an inter-organisational information system. Journal of Information Systems Security, 2006 Vol 2 (3):48-67.*

3.5 Personal notes

This section introduces personal notes from the time when I acted as a project manager in the MoSu case. My background gave me some knowledge about implementing information systems and I even had experience in implementation projects where several organisations were involved (Halonen 2004b, publication I). However, this MoSu project was a special one because of its diversified nature, with a history of its own. By this “history”, I mean the specifications made by other stakeholders, and the specifications acting as a background for MoSu. In addition, the reasons for the change in actors were not presented to me, and therefore they are beyond the scope of this thesis. Despite being beyond this thesis, the unknown reasons caused me problems every now and then. This history influenced the settings from the very beginning onwards, continuing to the end of the project.

Even the first meeting in June 2003 predicted that the new project would present me with many challenges. The following note was recorded in the project memorandum: “*It seemed that the previous project owners could give only minor support to the new project.*” I felt it curious that they did not want to take any responsibility for this new project.

I started to write a personal diary in summer 2003, and so far the diary includes notes from about 350 dates. At the beginning I felt insecure because I perceived that the previous project owners already had experience in student mobility and that they participated in this project by evaluating and criticising my actions. I even anticipated that they were only waiting for me to drop the project. It seemed that the real manager was not the nominated project manager, but that the owners of the specification project in 2002-2003 tried to push their ideas and needs ahead. I strongly felt that I was the only outsider and all the others were “inside” in the area of student mobility. Despite these feelings, I insisted in the meetings that we would proceed to a pilot before any nation-wide implementation. On top of that, relying on my experience I maintained that a pilot project was needed before a successful nation-wide information system could be implemented.

My uncertainty was at its highest at the beginning, especially when the process of choosing the vendors was underway (Halonen & Heiskanen 2005, publication II). I was positive that this also belonged to the implementation, and yet I felt myself insecure despite the fact that I had been chosen to be the responsible project manager. I felt deeply my incompetence to perform the right and necessary actions when the process had to be moved on. In addition, I had no prior knowledge of how the candidates would suit this project. In this situation I was lucky because the leader in charge was experienced in this kind of acquisition, and he also acted as my supervisor. I also strongly felt that he was able to base his proposals and decisions on something that could not be written down to be used as research material.

Furthermore, I learnt that in order to be a qualified project manager I was not required to do everything by myself but had to understand that there are more competent people to act when necessary. To be more precise, using experts is wisdom, not foolishness. I had to spend several sleepless nights before learning this.

However, the more I learnt about student mobility and the more I got acquainted with the student affairs officials, the more I felt myself competent to carry out the project. The steering group was mostly very supportive and satisfied with the progress of the project. I even received compliments from the members of the steering group. This kind of experience told me that I was doing the right things and that the project was proceeding well.

Due to the skilful and co-operative vendors, conflicts between the overlapping project and MoSu were also overcome (Halonen 2004c, publication III). I was also able to be on good terms with the vendors, and that helped me when discussing the continuation of the project. I felt deeply that we project managers relied on each other. However, every now and then I felt a discrepancy between the vendors and that I had to strive to reduce it. Because of the perceived competition between the vendors, I sometimes feared problems with the schedule. One important task during those times was to negotiate with both of them and to maintain trust between the vendors and me, and to maintain confidentiality with them. In this sense, not all information received from the competing vendors was intended to be delivered to both of them.

The project progressed actively despite the changes in the organisation of one vendor. In that change MoSu lost its project manager representing that vendor (Tango) and I found this extremely alarming. The loss of that project manager appeared considerable because I had trusted on him when managing the problematic situations in the project. With this change, the role of Tango decreased remarkably. The new representatives were not able to step into the project with the experience that they claimed to have. In addition to difficulties with introducing new people to MoSu, difficulties appeared in terms of the commitment of Tango. I supposed that there were organisational problems in Tango that influenced the new individuals, reducing their motive to commit themselves to MoSu. These organisational problems were kept hidden and I found it very difficult to intervene. During that time, there were severe problems with interaction between the vendors and between Tango and me. Because the project was still in its early stage, I was not always confident about where to look for the individual responsible for the problems. All the same, I felt the discussions about responsibilities and obligations very inconvenient.

I was confident that the universities had signed contracts with the vendors instead of people working there, and that the vendors should carry out the duties that they had promised. This confidence was evident especially when we had a discussion about the role of Tango (Short minutes November 9, 2004). I found the output of that meeting astonishing because I had thought that we would get a concrete outcome. It seemed that there was none. However, due to the organisational changes within Tango, the responsibility of the other vendor (Sierra) was acknowledged and the implementation of MoSu was progressed on time.

I believed that changes in implementers might cause severe problems to the success of the information system implementation because I feared that the goers would take important knowledge with them. This time, however, the problems were not too big to be overcome. I argue that this ease was due to the deep co-operation and active interaction between the project manager of Sierra and myself. It may even be argued that the organisational changes within Tango benefited the progress of MoSu. This argument is based on the conception that from that point on there were no more discussions about responsibilities or the unfinished tasks of vendors. On top of that, from then on there was

no need to manage problems related to a lack of interaction between the vendors. In addition, the prevailing practices for implementing information systems differed between the vendors, and the vendors were not willing to unify them.

In addition to those problems with vendors, I sometimes perceived problems with the University of Victor. I felt that their goal differed from the goal of the MoSu project. Despite the fact that MoSu was intended to work alongside the service of Victor (*i.e.* FlexStu) and that resources had been spent on that, there were competing elements found when rolling MoSu out. This competition showed up every now and then especially in the project meetings, when the ability of MoSu to satisfy its future owners was questioned. More than once I had to raise my voice to limit this discussion, and return to the project agenda. At the beginning I also tried to find out who the person in charge actually was. Sometimes I even felt that the project meetings were chaired by people other than me. I wrote in my diary (March 20, 2004): “[...] *it seemed like I was gaining the speech leader status there and Victor was losing its status.*”

Another continuous problem with Victor was the question of ownership and the relationship between MoSu and Victor. There were times when I found the situation straining and I felt that I also got support from other participants in the project. I even perceived that there were people who wanted to get rid of Victor. All the same, situations changed with time, and due to changes in the circumstances, the final output was tied with Victor. At the same time future plans were raised and MoSu was described as an important part in them. These plans felt promising and I could be proud of having been the project manager who was involved so much in the development and piloting of that information system.

Finally, running an information project in the context of academia was an interesting effort, not only because of its differing nature compared to my previous experiences. From the very beginning, this information system seemed to be welcome and important. It was more than often that the need for it was expressed, even outside of the project, when it was introduced to student affairs officials in other universities. I enjoyed very much when people came to ask me about my feelings in such a desired information system project. Another envied aspect of this project was its financial situation. The Ministry of Education wanted to promote student mobility, and the budgeting for the information system came from there. In other words, there was no arguing about money between the participating organisations. There were universities that wanted to join the pilot project but their requests were rejected. Nevertheless, these wishes only increased the motivation to work with MoSu.

All in all, when MoSu was getting “ready”, and because the feedback from the users and from the steering group was mostly very positive, I was able to feel content with the project. I also felt that I as a project manager was mostly felt to be trustworthy and competent by the members in the project. In this sense, I felt that I had been lucky because the information system was highly waited for, the people involved were active and positive, and the collaboration with other actors was appreciative and enjoyable.

Working as a project manager for longer than three years was an experience that will remain in my memory. I really enjoyed giving presentations in several seminars and conferences about the progress of the project. This implementation project taught me a lot about creating an information system – its specification, planning, coding and actions when it was implemented. I also learnt that people really were enthusiastic in

participating and giving their knowledge. They wanted to share their experience and to promote the accomplishment of the system. I tried to support them whenever possible. However, it also happened that I had to slow down their propositions and suggestions due to the agreed schedule. Despite slowing down the suggestions, all of them were welcome because I was confident that that was the nitty-gritty of piloting. I also tried to acknowledge the active people whenever possible.

Looking back, I understand that I was not the only one who was outside at the beginning. At first there was nobody who could have said what was actually needed in the field of student mobility. Only the need of “support” was recognised, but changing “support” to an information system was unfamiliar to all of us in the project. Now, I would also like to question the value of experience if the experience is negative and prefigures failure and resistance to change. My earlier experience was negative and, due to the diversified group of stakeholders in this information system project, it was only natural to keep in mind the possibility of failing in some way. I even remember how I was introduced to the participants in the first meeting (June 16, 2003): *“The aim of Raija’s thesis is to describe how a joint information system for different universities was finally implemented (or why it wasn’t).”* In this sense, the negative conjecture was articulated already at the very beginning. It also happened later that when discussing annoying events in the project I was comforted by people telling me not to worry because I would still get research material whether the project succeeded or failed.

Running this information system project gave me good experience and valuable contacts for my future work, not to mention the fruitful research material that still remained in my use.

4 Analysing the empirical material

This chapter introduces how the output of this thesis, *i.e.* evidence and results from the empirical research, was analysed. Firstly the research material is evaluated. Then scientific contributions are expressed relating to the research that has been presented in the original publications attached in this thesis. After that the practical contributions are described and both the background research and the main case are considered. A detailed description of the main case is expressed in that section. The chapter ends with analysis of the results.

4.1 Analysis of the research material

The research material comes mainly from one case. The case is an implementation project that included the acquisition of an information system called MoSu (an abbreviation for Mobility Support) in the context of several universities participating in the implementation. The implementation project offered several possibilities to contribute to the field of inter-organisational information systems. In addition, it was not sensible to strive for several cases when concentrating on the environment of academia, which was versatile enough for this research.

In addition to the main research material coming from one case, the study is based on research from three different environments in which information systems were implemented. Each of these implementations was carried out in a single organisation, giving contrast to the main case in this research. Even if this background material comes from other resources, it is essential in this research because it offers insights to information system projects and adds knowledge about different implementation projects. In addition, these cases shape the experiences of the researcher, thus influencing the whole study. The experience gained is realised in the concepts of the researcher; for example, the noticeable role of resistance to change in information system implementations is hidden in the background when she is performing actions in the project. Furthermore, when interpreting events and actions, resistance to change is taken into account.

It is essential that the cases offer possibilities for learning about and gaining a better understanding of implementations in different environments (Stake 2000), and therefore they are pertinent choices in this research. Järvinen (2001) divides documents into two categories: primary and secondary sources. In this research emails, memorandums from the project meetings, informal minutes written after encounters and the personal diary written by the researcher are primary sources. The memorandums were written in a descriptive style, including several citations of those present, especially when the project manager had written them. This caused discussion about the role of the memorandums. The project manager sent an email (September 22, 2005) to the steering group: *“I myself appreciate a memorandum with notes about who said what and what was said. Thus there is no need afterwards to guess if somebody really said something. This kind of memorandum also serves as evidence if it's ever needed.”* In return (September 23, 2005), she got an email: *“I didn't understand the note about the weight of evidence.”* Some members preferred short memorandums including only decisions, some expressed thanks for the informational nature of the memorandums: *“Thank you for the good memorandum! Due to your exact and grounded notes one can get a good conception of issues and their management even if one was not present in the meeting.”* (Email November 8, 2005). The related files from the web sites of the participating organisations represent the secondary sources. However, their role is humble in this research. Even if all writing reflects our presence and is interpretative (Walsham 1993), the approach in the diary and in the minutes is more private and subjective compared to the memorandums.

The case will be reported bearing in mind the idea of van der Blonk (2003) when he states that cases are written with a purpose that heads to the goal of the research project. He continues that the researcher is interpreting the case while writing it down. The case will be described in sufficient detail to give a good understanding of the environment and to help the reader to get a view of actions that were performed.

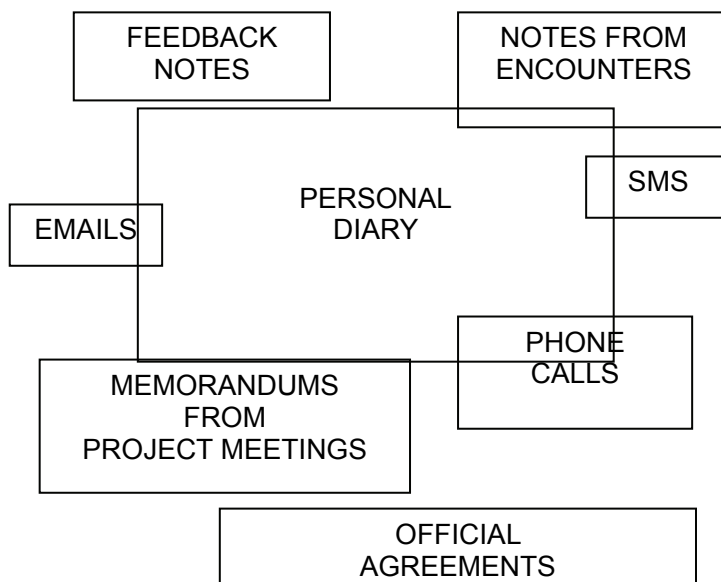


Fig. 10. Summary of research material.

Figure 10 summarises the research material and describes the relationships between the different sources in research material. Some of the emails were included in the personal diary, being either interpreted or copied as is. In addition, SMSs were written down in the diary because they were sent to the personal cellular phone of the project manager. Phone calls are described in the diary. However, they are not transcribed but only briefly interpreted there. The summary explains how, for example, project memorandums and the diary are closely related because the project manager has written her observations in the meetings or shortly after them. Even if some of the feedback notes are included in the diary, they are not interpreted by the researcher but only copied. By using several sources that support each other the researcher has ensured the validity of the research material (Schein 2001).

The role of the personal diary as research material is emphasised in this study because the researcher started her writing from the very beginning (summer 2003) when the first actions were performed in order to set up the project. In the diary there are notes from about 350 days including personal observations from meetings and encounters and copied SMSs from vendors. The nature of the diary is that of a personal research diary, as opposed to a project protocol. However, the writing meets the criteria described by Schultze (2000): authenticity (the role and identity of the researcher is explained in the text); plausibility (the text is structured, following the timeline according to the empirical case) and criticality (the diary helps to understand the attitude of the researcher and is still questioning the objectivity of the data). In addition, a self-revealing approach is

expressed by making notes about success or failure felt in the process (van Maanen 1998).

However, the role of interpretation is emphasised in other research material as well. From this approach, only official agreements, SMSs and feedback notes are totally free from the researcher's influence. For example, she was able to influence the project memorandums even if not all of them were written by her. However, other project members who participated in the meetings could also influence the memorandums because they were delivered to every participant before they were accepted in the following meetings. On the other hand, none of the documents is free from interpretation, though, because they are written by other people, using their experiences (Frankl 1963, Walsham 1993). Even if the project memorandums were accepted in the project meetings, they were written by people who were affected at least by the atmosphere in the project at the prevailing time. In this sense, the research material includes several people's interpretations.

The empirical data were collected from several sources, all of them being more or less subjective and influenced by the researcher who acted as a project manager in the main case. The research material was saved on the laptop of the project manager. Table 3 summarises the research sources that were used in the study.

Table 3. Research material classified by source.

Source	Number (of entries)
Project memorandums	48
Feedback	580
SMSs	14
Emails	352
Notes from encounters	20
Diary	350

The project memorandums represent the official view in the project because they were reviewed by the attendees of the meetings. The feedback given by the users is totally outside the influence of the project manager, and it can be evaluated as independent of her presence. In other words, most of the people who gave their feedback did not even know that there was any research going on in the project. Their feedback was aimed at serving the piloting of the information system, rather than research.

The research material was read carefully and the issues related to the research questions were highlighted. In addition, the experience gained in earlier cases influenced the interpretations if not consciously, at least in the background. The features of an exemplary case introduced by Yin (2003) were followed: 1) significance: there is not too much prior research in that area; 2) completeness: there is a strict starting point and end point in the case, and it builds a whole case; 3) considering alternative perspectives: when interpreting the events the researcher used several sources, also allowing a third party to comment on the interpretation; 4) displaying sufficient evidence: several sources were used in the study and they are documented in the research; 5) composed in an engaging manner: in the composition there are chapters that lead the reader to further understanding about the subject.

Yin (2003) lists four tests to ensure the quality of any empirical research. They were in this research: 1) construct validity was ensured by multiple sources of evidence; 2) internal validity was noted by explaining causal relationships between events and by presenting calendar markings; 3) external validity was realised only by combining findings with theory; 4) reliability was ensured by using research material that can be verified by a third party, *e.g.* emails can be found on servers and project memorandums were delivered to all attendees.

4.2 Scientific contributions

This thesis introduces how information systems enable interaction in organisations and between organisations, and what kind of challenges there are to be found when implementing this kind of information system. Varying from the research by Levina (2005), this study contributes to the field because the organisations were involved in a joint effort, heading towards a joint goal. In addition, this research emphasises the impact of end-users when they represent different organisations and participate in the implementation project. On top of that, in our case the role of end-users was highlighted because they were deeply involved in the development project from the very beginning. Furthermore, the difference between organisations as customers in relation to vendors and end-users is shown in the thesis. Our research verifies the similarities between the collaboration of commercial companies and non-commercial organisations.

Moreover, this research shows how building an information system can produce a virtual community that will prove its importance in the future. Without this information system there was no noticeable community, but even in the middle of the development phase of the information system the community had evolved. This community increased the interaction between the users, providing information and means for interaction. In addition, the idea of a community added cohesion between the participants. Because the cohesion was already evident in the development phase of the information system, it increased trust and motivation in the project work.

The literature already identifies challenges (Munkvold 1999) and action steps (Chisholm 2002) that are related to developing information systems for geographically distributed organisations. However, these experiences consist of one organisation, even if it is geographically distributed. This research tries to fill in these challenges and action steps when the acquisition concerns information systems for independent organisations.

The approach of the following sections follows the research path, *i.e.* the original publications.

4.2.1 *Similar challenges in differing environments*

According to the experiences gained in our research, it seems that when implementing new technological systems there are similar challenges to be overcome. This phenomenon was found, regardless of the working culture or industry in different environments such as factories, hospitals and information technology organisations. As a

concept, resistance to change is familiar to us from our everyday life. We encounter it at home when staring at the same television programme, sitting in the same easy chair or reading the morning newspaper while having our morning coffee. We found that resistance to change is common, regardless of level of education or business branch and, surprisingly, even a high-level information technology branch did not differ from this attitude. We found several factors that influence the experienced resistance to change. We also found that, even when problems were reacted to, the outcome is not necessarily positive.

We found that the role of users is emphasised when influencing resistance to change. Our research shows that the tools for the management of resistance may vary in different environments and working cultures. There is no sense letting information technology designers play computer games if they still do not accept the new information system. Instead, playing may reduce resistance to change among people who are not used to laptops or computers. We also highlighted the right timing of actions that are intended to manage these challenges. The wrong timing can even increase the difficulties in the implementation projects. Following Markus (2004) we found actions to be dependent on the reasons for resistance to change:

- user dependent resistance to change is influenced by training and information
- system dependent resistance is influenced by trying to improve the information system by paying attention to the fault in it or lack of speed or poor user interface
- organisational situation dependent resistance is influenced by carrying out the changes in personnel or functions early enough and remembering discussions and information.

The support of the management is important, because many powerful means of influencing resistance to change need actions that need executive level support (*e.g.* installing a computer game or letting users play it during working hours). In addition, because some of the functions in implementing information system unquestionably need users to be taken into the implementation project and require that they are considered enough and at the right time in relation to the progress of implementation project, the impact of the management is essential.

Furthermore, the first case in the background research seemed (Larsen & Myers 1999) to be a failure adding to the notes of Lyytinen and Lehtinen (1987) and Schmidt *et al.* (2001). However, later observations in the environment showed that the output was not as bad as it looked immediately after the implementation project. On the contrary, the change from paper files to a computerised database acted as a facilitator when implementing organisation-wide enterprise systems in the factory (Halonen 2004a).

In any case, the most important task is to recognise resistance to change and react to it in a phase when resistance to change has not become a threat to the success of the implementation of the information system.

4.2.2 Experience and learning in information system acquisitions

The main case included an acquisition that targeted contracts with vendors who were to implement the information system. An acquisition process can be a complicated task to

run, especially in cases when there are several parties involved. Co-operation is always a challenge (Barki & Hartwick 2001, DeChurch & Marks 2001), but when the people come from separate organisations, the challenge of co-operation increases further.

This research describes the need to take power and make decisions when it is time to do so. In addition, learning is supposed to take place in every project. Furthermore, it is only wise to use experts when there is expertise available. Despite the long timeline of the acquisition, the output may be satisfactory. We showed that it is important to react according to observed situations and to evaluate the actions that are performed. In addition, having knowledge about vendors facilitates the negotiations, especially in cases when there are several organisations acting as one customer in relation to the vendors.

The important lesson learnt was that choosing the right acquisition method enables flexible negotiations and changes, even after the negotiations are underway. In addition, being reflective and reacting to the observed signs makes it possible to change one's opinion and to act according to the new situations. Furthermore, experience from previous acquisition projects may not be undervalued. During those experiences, good relationships are grounded and these may form good starting points for new negotiations. Our research showed that reflection is valuable in every step when making important decisions. An acquisition process is a good example of these decisions.

4.2.3 Collaboration between partners

Changing project actors is a challenge that influences the project and its progress. However, there are situations when these changes must be done. Our main case is one example of this situation, even if the background to the change is not deeply considered in this research. Stepping in a project from outside of the previous phase of the project is difficult. Despite even a huge amount of documents it can be difficult to get an idea about what actually has been done in the project (Halonen 2004c, publication III). The difficulty grows bigger if there are negative attitudes towards the change or towards the new person in charge. In addition, disputes about the aim at the beginning increase the diffidence of new people in the project. A concrete example of these disputes can be the final goal of the project, *e.g.* the scale of the piloting.

We found that experiences from our previous project do carry across in conducting projects, regardless of their environments. Outside of the true information system development, we argue that it is also important to choose a suitable acquisition method when selecting the implementers. This was further proof of the benefit of experience that was noticed in our research. When acquisition method is time-consuming and there are no tools to speed up the procedure, the project is in danger of being late even at the very beginning.

Collaboration is a must, especially in cases when the parties should be heading towards a common goal. When there are several stakeholders with differing opinions about the target, it slows down the project. We also learnt that the role of specifications is essential to the progress of the implementation project. In addition, interaction between the project parties involved and the amount of shared information have a great effect on the progress. We also noticed the importance of understanding between different parties –

if there is no understanding between the project parties or people who are participating in the project work, the interaction can be severely aggravated. This may lead to difficult problems in continuing the implementation, and at the very least it will impede interaction and fruitful discussion in the project. Furthermore, in a project financed by a third party it is important to find out the will that lays background. In our case, we found that finding a “win-win” situation (Covey 1992) between the conflicting parties is a key that solves such impeding problems.

We also found that, despite the improvements in technology enabling the use of audio or video meetings, these meetings are not preferred. This is the case especially when the issues on the agenda need proper discussion and explanation. In addition, some people do not like to attend video meetings regardless of the issues that are to be discussed.

Surprisingly, the role of implementers can increase when there is no desire to negotiate about continuation. On the other hand, the true reason for the unwillingness may lay in a lack of knowledge, and the answer may be found by the implementers. Implementers may have tacit knowledge that they are able to use when discussing future plans and customer requirements that should be fulfilled within a limited time. However, trust and mutual respect are essential when the paid implementers are empowered to draw up future plans.

4.2.4 Heading towards a joint information system

Our research (Halonen 2005c, publication IV) shows how thinking may change as a project proceeds and information about the information system is realised. If the information system is to be used inter-organisationally, the need to share information is increased. The customer requirements must meet the needs of the organisations that are going to use the information system. This information exchange must be flexible and based on free will. If there will be remarkable changes in the workflows, the need for interaction increases further. Participatory design (Kensing & Blomberg 1998) proved to be an effective approach, also enabling immediate feedback on ideas and comments. Furthermore, changing workflows in independent organisations necessitate good relations and trust between members representing their organisations. These changes also require knowledge about the backgrounds of the prevailing workflows. Consequently, understanding the influence of the changes in workflows was found to be important.

The goal of information technology is to support human activities so that it produces improvements compared to earlier situations (Pipek 2005). This improvement can be achieved with a joint information system that includes a joint database. However, developing a joint database necessitates new practices in the participating organisations when the functions are related with their involved databases. The joint database also brings along new workflows because the information needed is found in the joint database instead of the different databases of the distinct organisations. This new workflow must be coded into the information system and considered thoroughly before its implementation.

4.2.5 Role of decision-making

When several organisations participate in an information system project and they act equally, the difficulty of making decisions increases (Halonen 2005a, publication V). Especially in cases when the collaboration between the organisations is free and not formally arranged, the equality may increase the difficulties in decision-making. If the decisions are delayed, the power of decision-making must be taken by the project manager. However, the changes in decisions can be approached from the action research view and considered as cycles that include diagnosis, planning, action, evaluation, reaction, and further planning. Despite that view, delays in decision-making may be costly later in the project work.

On the other hand, the difficulties in decision-making can be conjectured to have roots in the lack of a command line between project parties. If there is a strongly felt need for collaboration there may be a hidden fear of stepping on others' toes. Furthermore, due to the highly valued autonomy of academia, the organisational structure of universities does not support collaborative decision-making. From this point of view, a specified process for decision-making is worth considering, and if deliberated, eGovernment supports this functionality effectively.

4.2.6 Evaluating risks

Our research on using accident models when assessing failures in information system projects proves that hierarchical accident models can be used when modelling information system failures. We believe that these hierarchical accident models may be one answer to the concern already expressed by Lyytinen (1986) 20 years ago: "How can it be so that the information system failure syndrome continues, although so many efforts have already been made to cure it?". Even though the hierarchical accident models are developed to assess loss in accidents, they can also be used when evaluating obstacles and risk when implementing information system projects. However, the models may need some modifications before they can properly be used in information system projects.

The hierarchical accident model introduced by Leveson (2001) gives a new approach that enables the designers to categorise obstacles and risk factors in the project. We argue that the model may clarify the events and their role in the conceivable failure in an information system implementation (Halonen & Paavilainen 2005, publication VI). In addition, the use of hierarchical accident models also benefits risk management when suitable methods and controls are to be found.

Leveson (2001) developed her model from the domino model by Heinrich (1931) by adding three levels of factors to the model. Our research shows how categorising obstacles and observed problems and risk factors into three levels can help us to understand the nature of the observed negative phenomena. After understanding the nature and source of the problems we are able to design the means and tools to influence them. In addition, the model is expected to help in forthcoming information system projects when the problems are about to arise. In this sense, the model could serve as one

tool when fighting against the high failure rates in information system projects (Schmidt *et al.* 2001).

4.2.7 Building security in inter-organisational information systems

Choosing methods and architecture to manage security and user authentication in inter-organisational information systems is difficult and depends on many related issues, like the role of information that is transformed across organisational borders. In addition, the architecture of the information system influences the method. When user authentication is decentralised and there is no need to transform information there is no need for information system dependent user authentication. However, modern society requires information to be easily and quickly available, and information is increasingly crossing organisational borders.

Our research (Halonen 2006b, publication VII) showed that despite the differing architecture in user authentication applied in organisations, transferring information across organisational borders is possible and participating organisations benefit from the transfer. In complex information system projects, *e.g.* implementing an inter-organisational information system with several organisations involved, the challenges may even grow if the chosen technology is difficult or not ready or developed for that kind of use. Our research also showed that in spite of difficulties in implementing versatile technology, the output can be satisfying from the user point of view. Moreover, building security with unfamiliar technology is time-consuming and it is expected to spend more resources and efforts than estimated.

There is no difference in the emphasis between the implementers coming from the same organisation or different organisations. When there is no organisational command line between the distinct implementers, the interaction depends on the activity of the individuals in the project. In addition, if the actual individuals who carry out the actions in the organisation are unknown to each other, direct interaction is not possible. In this case the information must be pushed unaddressed using open seminars and informative meetings, for example. In those meetings and seminars it is possible to call the right people to interact and after that to use direct interaction, *e.g.* addressed emails. Email lists have proven to be important in such cases, too (Halonen 2006b, publication VII).

4.3 Practical contributions

This research supports the importance of collaboration between project parties. We also express the various issues that may arise in a multi-client, multi-vendor information system implementation project. In this section we describe the findings in detail from the practical point of view.

4.3.1 Differing information system implementations

The background research on three cases of implementing information systems suggests that there is always resistance to change when adopting new technological systems. In our research we had an information system to be used by factory workers who did not feel that they needed the information system. The second case came from a small hospital and the users were committed to healing sick people and not to developing an information system. In addition, the users felt that the new information system was too complicated and slow for their purposes. The third case came from a high-tech company where the users were involved in developing high technology to be used in network platforms.

The educational level of the users in the factory was mostly vocational training or comprehensive school. They were middle-aged blue-collar workers. However, they were used to the presence of technology in their environment, which was full of machines and technical instruments. The men were experts in coating cable and they had knowledge about changing the parameters in the coating machine when necessary. To support their decision-making they had A4 sheets full of notes about previous coatings. The researcher was responsible for implementing the information system, including requirement analysis, design, coding, distributing and training. The project was included in her studies and it lasted 6 months.

The second environment consisted of two clinics in a hospital where children and pulmonary tuberculosis patients were treated. The users of the information system were nurses and departmental secretaries who managed the patient information. That meant that the workflows had to be changed with the new system. However, because of the size of the clinics it was decided to pilot the new information system. Other reasons for the system renewal were the hardware becoming old and the maintenance people having difficulties maintaining it, not forgetting Y2K. One reason for the implementation was the mobility of customers who moved from one district to another and were taken care of in different hospitals than they used to be. The information about the customers' previous care had to be available in the new district as well. This information system project resembles the process model introduced by Newman and Sabherwal (1989) in its management information system dominated process scenario. The researcher was responsible for the piloting project, where a tailored information system was implemented for limited use in a small hospital. The research material included memorandums, emails and personal notes written during the project. In addition she was able to keep in contact with several stakeholders.

The third environment was a production line in a global information technology organisation where an enterprise information system was implemented as the beginning of organisation-wide implementation. The educational level of the users was high, most of them having an academic degree. In addition, their workplace was highly admired because the organisation represented the top development in the branch. The role of the researcher was as an outsider who only got access to files and information that was collected by other people. In addition, she worked in the organisation and was able to interview people who were deeply involved in the implementation project.

Despite these differing environments the implementation projects met challenges that had to be managed. Our research presents actions that are justified when meeting these challenges. The management support is needed to influence resistance to change. In addition, the right timing for training and information is important in order to give future users time to adopt information and adequate skills to use the new information system. Furthermore, instructions should be given in such a format that they are handy and usable in the context they are designed for. Moreover, our research proved the importance of playing in the working place, where it can facilitate the adoption of new technology.

4.3.2 Information system management insights: Case MoSu

The history of MoSu dates back to the mid-1990's when the first university students wanted to take courses in a university other than the one in which they had the right to study. Until now, students had to find the information about courses that were available in each separate university. After that, the student had to find the right application form. After filling in the application form, the student brought it back to their home university. There the form was checked and the necessary supporting information was added using local student record systems and other resources. After receiving support for the application the student would send or bring the form to the desired university, where it was processed following the local routines. If the application was accepted, the student received a letter of acceptance and he/she could register for courses at that university. After having passed the courses the student acquired a certificate and brought it to his/her home university where the information was added into the local student record system.

All these actions required a lot of manual work and checking. This also compelled the students to visit several offices. The universities began to design a common agreement of student mobility and at the same time the background work was prepared in order to specify the process of student mobility. The previous pilot project, "Students' mobility", was conducted in 2002-2003 by two university consortia. After the June 2003 signing of the JOO agreement that allows student mobility between all Finnish universities (JOO 2003), it was evident that an information system was needed as soon as possible. Therefore the new MoSu project was established.

The researcher was acting as a project manager and she stepped into the project when the first meetings were called to set up the project (Halonen & Heiskanen 2005, publication II). The researcher represented the end-user and acted as a facilitator between the implementer and the end-users' side. Because the project was based on specifications that were made by certain parties forming the project and by other parties owning the project, the inauguration meeting in June 2003 predicted several challenges for the researcher. She chose to act actively and to participate in the project work in order to gain every piece of information that was available in the project. In addition, action research (Argyris *et al.* 1987, Raelin 1997, Ayas & Zeniuk 2001) as a research method provides active participation.

When in full use, MoSu will have thousands of users in all Finnish universities: officials in student affairs offices and students who want to study elsewhere. Moreover, Finland signed the Bologna Agreement (Bologna, 2003), in which 33 European ministers

agreed a unified educational degree system. In the future, student mobility is expected also to cross state borders after the Berlin Communiqué comes into force in 2010. In addition, it is expected that unifying academic degrees will also increase national mobility.

The needs and desires of the customers need to be harmonised, especially in cases like this when the output is an information system that is going to be used as-is by all universities. The approach of this nation-wide implementation project was chosen by setting up a pilot phase where three universities were the first ones to implement the information system, MoSu, and after that all other universities would be able to adopt the information system.

In the first phase there were three universities that were going to pilot the system (the University of Alfa, the University of Bravo and the University of Charlie). A virtual university called Victor (UV) was included to emphasise the nation-wide view in the project, representing all Finnish universities (Other) in the project. The Ministry of Education (MinEdu) was funding the project and the project management was taken care of in the University of Echo (UE), which did not pilot the information system. The financier expressed its will to include the University of Delta (UD) in order to cater for the needs of universities that are not using StuRec as their student record system (Memorandum June 16, 2003).

In the project we had two vendors, Sierra and Tango (Vendors), realising the information system. The pseudonyms Sierra and Tango are used in this research to represent both the organisation and the individuals working there. This approach is justified because the contracts were signed with the organisations, and from the client's point of view the identity of the actor was not important. The grounds for selecting two vendors are described in detail in Halonen and Heiskanen 2005, publication II. The official establishment document was signed by the Rector of the University of Alfa (UA). The establishment document nominated the executive group for the project by appointing two individuals from the University of Alfa and by inviting members representing the Ministry of Education, the University of Bravo (UB), the University of Charlie (UC), the University of Delta and the UV. Other than this invitation document, there was no written agreement to set up the collaboration. The interest groups related to MoSu are shown in Figure 11.

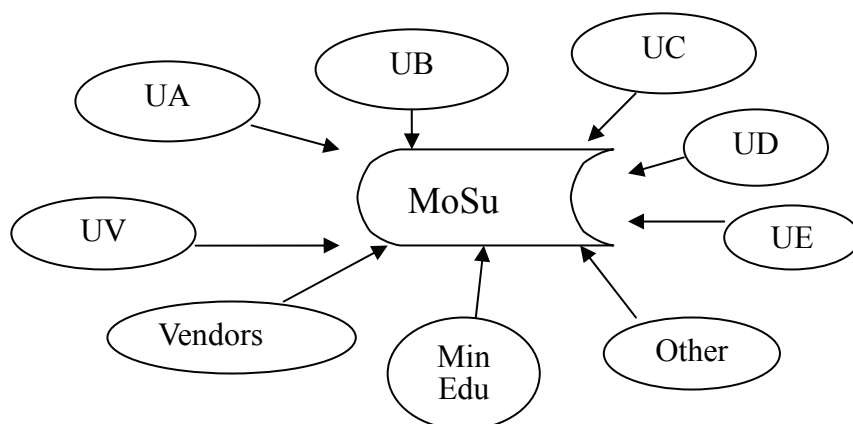


Fig. 11. Interest groups and MoSu.

The piloting universities differed from each other. The University of Alfa is the oldest university in Finland and it was founded in 1640. It is a wide-ranging educational university and it was the responsible university in the project, having applied for funding from the Ministry of Education. The other piloting universities are also located in the metropolitan area. Firstly, the University of Bravo was founded in 1849 and specialises in areas of both scientific and technical importance. Secondly, the University of Charlie, founded in 1911, aims to produce new economic sciences and to offer education in this field.

The chosen vendors also differed from each other. Both of them had experience in working with universities, but Tango acted more closely to them, giving services on a non-profit basis. In addition, it was financed by the Ministry of Education. Because Tango did not want to take on the whole responsibility for implementing MoSu (Phonecall from Tango to the project manager in October 27, 2004), Sierra was chosen as the responsible vendor. The special role of Tango was that it was specialised in user authentication and also an expert in Shibboleth, which was chosen as the authentication tool when the users enter MoSu. “Shibboleth is standards-based, open source middleware software which provides Web Single SignOn (SSO) across or within organizational boundaries” (Shibboleth 2005). It allows sites to make informed authorisation decisions for individual access to protected online resources in a privacy-preserving manner.

The negotiations with the vendors lasted over a year. The acquisition method was chosen in September 2003 and the final contracts were signed in December 2004 (Table 4).

Table 4. Acquisition tasks in the MoSu project by date (Halonen and Heiskanen 2005, publication II).

Task	Date
Choosing acquisition method	September 2003
Publishing announcement	October 2003
Sending offer requests	November 2003
Receiving offers	January 2004
Negotiations	January 2004 – December 2004
Specification refinement	January 2004 – December 2004
Choice of development strategy	April 2004
Signed contracts	December 2004

During the negotiation phase there were severe problems with knowledge sharing between the vendors due to organisational changes in Tango (Memorandum August 20, 2004; Diary September 1, 2004; Diary September 16, 2004). These problems also affected interaction between the project manager and Tango. The project manager tried to find out the grounds for the breaks in interaction and she had discussions with people in the University of Victor, which also had a contract with Tango for developing its portal. Tango's internal problems also influenced the negotiations. The project manager (PM) wrote brief minutes during a meeting on November 9, 2004 when discussing the responsibilities of Tango:

“Tango: ‘Tango can support but not take responsibility.’

PM: ‘What can Tango take responsibility for?’

Tango: ‘If I take the responsibility for a task, I’ll do it.’

PM: ‘The Client is making a contract with the organisation, not with a person.’

Tango: ‘I cannot take responsibility for other people’s jobs. If I sign, I’ll do the job.’”

After the meeting the project manager talked with the leader responsible for the project: *“Why don’t they trust themselves or their designers? To my mind, all contracts are based on trust and responsibility.”* (Diary November 11, 2004). In addition, she felt that Tango no longer trusted her (Tango's words: *“There should be a strong person who carries this through”*, Diary November 11, 2004). However, the negotiations continued until the tripartite contract was finally signed between the University of Alfa, Sierra and Tango.

Due to Tango's organisational problems, the project manager also had to carry out responsibilities that had been appointed to Tango: *“I should ask the technical people in the piloting universities about their possibilities and timetable with MoSu and Shibboleth. This has been Tango's duty but it has not been done so far and time is running out.”* (Diary October 16, 2004). In addition, the Tango's internal problems were discussed in the steering group when the project manager announced that the project was three weeks late. The role of Tango and difficulties in getting feedback from them were under discussion in the meeting of October 25, 2004. Furthermore, the lack of interaction

produced discussion about responsibilities in the project: “*Tango called and complained about all the responsibilities having been loaded onto them. ... I told him that there were tasks addressed to Tango, like the application form, process (state diagram), Shibboleth, but all of them have been shifted to Sierra so far and a lot of things have happened since then ...*” (Diary October 27, 2005).

The organisational changes caused extra duties for Sierra: “*It seems that all the documents that were Tango’s responsibilities are unfinished. This is no secret because they were not accepted in the quality review – only Sierra’s documents were accepted.*” (Diary September 16, 2004).

Figure 12 depicts the different use of Shibboleth (S-gate) in the project. In the beginning there were three universities: one with full implementation of Shibboleth, one with limited Shibboleth features and one without Shibboleth.

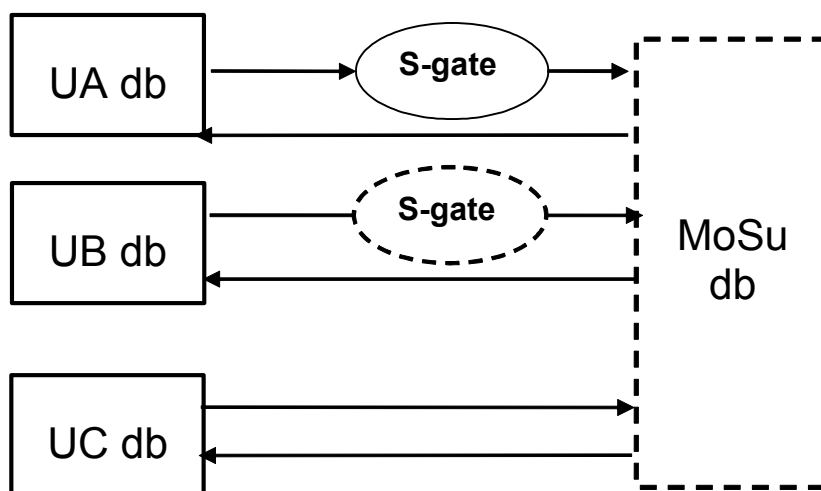


Fig. 12. Interfaces between databases (db) in MoSu. (Halonen 2006b, publication VII).

Even if Shibboleth was already in use in the University of Alfa, MoSu created a lot more problems which had to be solved before it was implemented to authenticate users of MoSu. As well as in user authentication, Shibboleth was also used when transferring information about students’ previous studies. The University of Bravo was able to implement Shibboleth during the pilot, and Shibboleth was partly in use there. That meant in practice that the students were authenticated using Shibboleth but no other information about them was available in MoSu. In addition, the data transferred via Shibboleth was managed differently in the University of Bravo from the data in the University of Alfa. The University of Charlie did not meet the criteria set by the so-called Haka Federation (Haka 2005) and it did not implement Shibboleth during the pilot project. However, MoSu was available even if the universities had not implemented Shibboleth, and the benefits of using electronic application forms and managing the

process of student mobility electronically were available. Issues connected with implementing Shibboleth in the project are described by Halonen 2006b, publication VII. Despite lacking Shibboleth, information was transferred to and from the university. Again, this was a proof of the trust that the organisations felt in each other.

Moreover, there were other interest groups close to the project, *e.g.* EDP offices in the universities. The EDP offices were responsible for user authentication in their universities, and setting Shibboleth up belonged to their mandate.

Because of the history of the MoSu project, collaboration appeared to be problematic in the beginning (Halonen 2004c, publication III). It appeared that there was an overlapping project (called FlexStu in this paper) owned by the University of Victor, which was participating in the project. From the experience gained in the case, the author thinks that the impeding problem in collaboration may lie in the role of the different parties. For example, the nature of the University of Victor differs from the roles of the universities. The University of Victor is not a “real” university but a virtual one, and its main task is to promote and develop networking among universities. The University of Victor does not exist without being actively visible by developing projects and maintaining networking. It is in the interests of people working in the developmental unit of the University of Victor to keep the organisation visible. MoSu is very much to do with networking, and it might be that the main reason for discomfort in collaboration was rooted in a power game concerning ownership of the networking and mobility between universities (Halonen 2004c, publication III).

However, the collaboration with the University of Victor continued when the project manager received a phone call (Diary January 18, 2005). She was asked if MoSu could pilot a course database for the University of Victor in autumn 2005. She replied that if the specifications for this standardisation were ready in time, it would be possible. The specifications were scheduled to be ready in February 2005 and the database would be ready in May 2005. This was a beginning to collaboration where information about courses and credits was to be transferred between universities. However, this project was too diversified and challenging to be finished before MoSu was to be piloted. The situation caused several discussions and doubts as to whether MoSu should be piloted without it or not (Memorandum May 9, 2005).

Some of the same people had been participating in both the standardisation project from its beginning and MoSu. One of them called the project manager and informed her about its importance and how it had been needed for years (Diary May 9, 2004). According to this person, MoSu would serve as a good lobbyist for standardisation if MoSu necessitates it. In addition, people outside of MoSu also questioned whether it was reasonable to continue with MoSu because the standardisation was not ready (Seminar August 22, 2005). They even suggested that it would be wise to stop the development of MoSu and wait until the standardisation was ready and in use in universities. However, the project manager was intent on piloting MoSu as a supportive information system as decided earlier and on this standardisation project being a project of its own (Memorandums September 19, 2005; September 20, 2005). Her view was supported by some members in the steering group (September 19, 2005). Furthermore, the project manager’s view was strengthened when the project manager from the standardisation project visited a project meeting and stated that the standardisation would not be finished before MoSu was piloted (Memorandum June 3, 2005). Despite that, this collaboration

caused a lot of extra discussion and planning, along with guesses about future actions in order to prepare flexible interaction between the future interfaces and MoSu.

Shifting from development to the piloting phase necessitated agreements about the servers MoSu would be running on. Because of the future nation-wide role of MoSu, the University of Victor offered their server for use during the piloting (discussions during the seminar December 16, 2004; Email January 5, 2005). However, the server appeared to be too old-fashioned to be used and there were insufficient resources to update it in time (Diary January 31, 2005). After discussions the problem with servers was solved by getting a server from the University of Alfa. It started its efforts to set up Shibboleth while Sierra set up MoSu on the same server. There were several problems when setting the services up due to access rights and privileges for Sierra on the server (Email February 28, 2005). The interaction between the project manager and Sierra was continuous and Sierra kept the project manager informed about the progress of the implementation: *"We are setting up MoSu today on the University of Alfa server!"* (SMS 12:27 February 11, 2005). *"We got MoSu up but it still always needs logging in with Shibboleth first! We'll continue with solving this matter on Monday."* (SMS 16:62 February 11, 2005).

This natural and easy interaction between Sierra and the project manager continued throughout the piloting and she got messages telling about victories in the development: *"JK got a preliminary version of the new XML reader ready today. Memory use 2Mb, CPU use 100 % when reading in, dummy courses 200000, file size 139 Mb. Time 6 secs, with full debug 4 min. With database latent 30 secs. This sounds really promising!"* (SMS 21:36 October 15, 2005).

During the project work there were several meetings where changes were made in relation to previous decisions. The project manager wrote in her diary March 3, 2005: *"In our project meeting on Tuesday we quite deeply discussed the changes that are needed in MoSu. I was very strict that we shouldn't make any changes that would hinder the pilot. I felt that the University of Victor was changing its opinion about the FlexStu front page. ... I reminded them that the project had paid a lot for making the user interface look like FlexStu and many discussions and meetings were held because of it."*

Finally the project proceeded to testing on March 14, 2005. After that the steering group had its meeting and we discussed training there. *"We agreed that the project manager would ask for experiences about training from all those who attended the training. It appeared that views on the success of the training varied greatly, especially between comments from the University of Bravo and the University of Charlie. The representatives from the University of Charlie had wondered who the training was aimed at. Attendees from the University of Bravo had said that the training was needed and sufficient. The well-defined user interface had been acknowledged in particular."* (Memorandum March 18, 2005). The project manager was astonished because she had heard from the trainer that the training had been a success and that everyone had been satisfied with it. However, she listed this as an experience to be used later. In the same meeting a visitor from the University of Victor asked if experiences were to be collected from the pilot, and the project manager answered that that was exactly the aim of the project. The project manager felt this kind of interaction to be provocative, because to her mind, the ultimate goal of piloting is to collect experiences. In contradiction to that, another member stated that this piloting goes as a process that is a pilot but at the same

time it is production. The old version of the information system would remain in use until the newer version was implemented. (Memorandum March 18, 2005).

From the very beginning the need to explain and describe was emphasised in the project meetings. As the aim of the project was to produce an electronic information system to replace paper sheets and a lot of manual searching and footwork, the need to clarify the changes between the electronic and the legacy system was great. MoSu was to be built on specifications that were made by other stakeholders (Halonen 2006a). Figure 13 describes the process of student mobility that was specified in 2001 by them. The appearance of the figure is grey and faint because the actual process chart was so big (almost 2.5 square metres) that there were severe problems even printing it out. The chart was commonly called “a bed-sheet” among the project people. Yet, despite the lack of clarity, the figure demonstrates the many layers and phases in student mobility.



Fig. 13. The process of student mobility

Not all of the process of student mobility was to be coded into an information system but only some small parts of it. The approach in this specification was that of student affairs administration, students and other actors in the student mobility process. The MoSu project was to implement a process viewed from the information system. The actual coding could not start before the process was specified and displayed as a state diagram. However, due to the differing backgrounds of the members in the project group, it was important to explain what the arrows and boxes meant ‘in practice’ (Halonen 2005b). Figure 14 is an example of pictures that modelled the use of MoSu as viewed by student affairs officials. These kinds of pictures were also used when training the student affairs officials and when giving information about MoSu in open seminars.

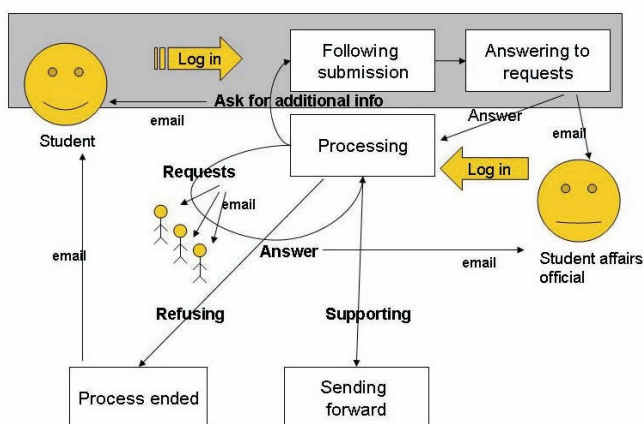


Fig. 14. Modelling the use of the information system.

Despite the good progress in the project there were discrepancies between the conceptions of the level of collaboration in the project. When the project proceeded into transferring study records, a discussion arose about the interfaces between student record systems in the universities and MoSu. The representatives of the student record system were surprised that data should be fetched from their databases and written there when MoSu would be in its intended use. A conflict was developing, and lack of information between the project participants was blamed. The project manager felt that she was blamed for this lack of information. The issue was discussed in the steering group (November 7, 2005) and even before that in emails. The project manager felt that the discussions were unpleasant because there had always been representation of the student record system in the project group. In addition, the implementer was a little annoyed and called the project manager several times: *“We [project managers] cannot push them to transfer information in their organisation. They have been present when we have discussed transferring study credits between MoSu and student information systems.”*

Transferring information had been discussed for implementation in StuRec in spring 2005, when the member representing StuRec said in a project meeting: *“NN said that*

decisions have been made in order to implement changes that enable study modules and credits to be received in StuRec.” (Memorandum May 4, 2005). In that same meeting the project group decided that the credits from target StuRecs should be available on December 31, 2005, meaning that MoSu would be able to read this information from the files that StuRec offers it. Respectively, information about MoSu credits should be ready for insertion into local StuRecs, meaning that MoSu would offer the information so that StuRec can read it. (Diary May 4, 2005).

Unlike McKinney *et al.* (2002) suggest, we explored the satisfaction of the users by collecting written feedback. At first, feedback was requested by emphasising its importance to the developers and by emphasising the possibility to influence the information system, but the amount of feedback was found to be too limited. In August 2005 the total number of respondents was 37. Then the feedback form was changed so that it opened up on the screen after the student had sent the application form to the university. That change increased the amount of feedback and gave a good picture of the use of and satisfaction with the information system. Differing from the students, the officials gave feedback by using a link in the interface (Figure 15). The feedback was divided into three categories: 1) contents, follow-on, JOO studies, 2) technical aspects, and 3) other. These divisions were made to help the developers use the feedback. Later, in November 2006, we had 520 comments on contents, follow-on or JOO-studies, 46 comments on technical aspects and 14 comments on other issues. The amount of feedback was satisfying and we gained useful experience to be used when continuing to the nation-wide information system. However, the order of the choices was as mentioned, and this might have affected the segmentation of the feedback.

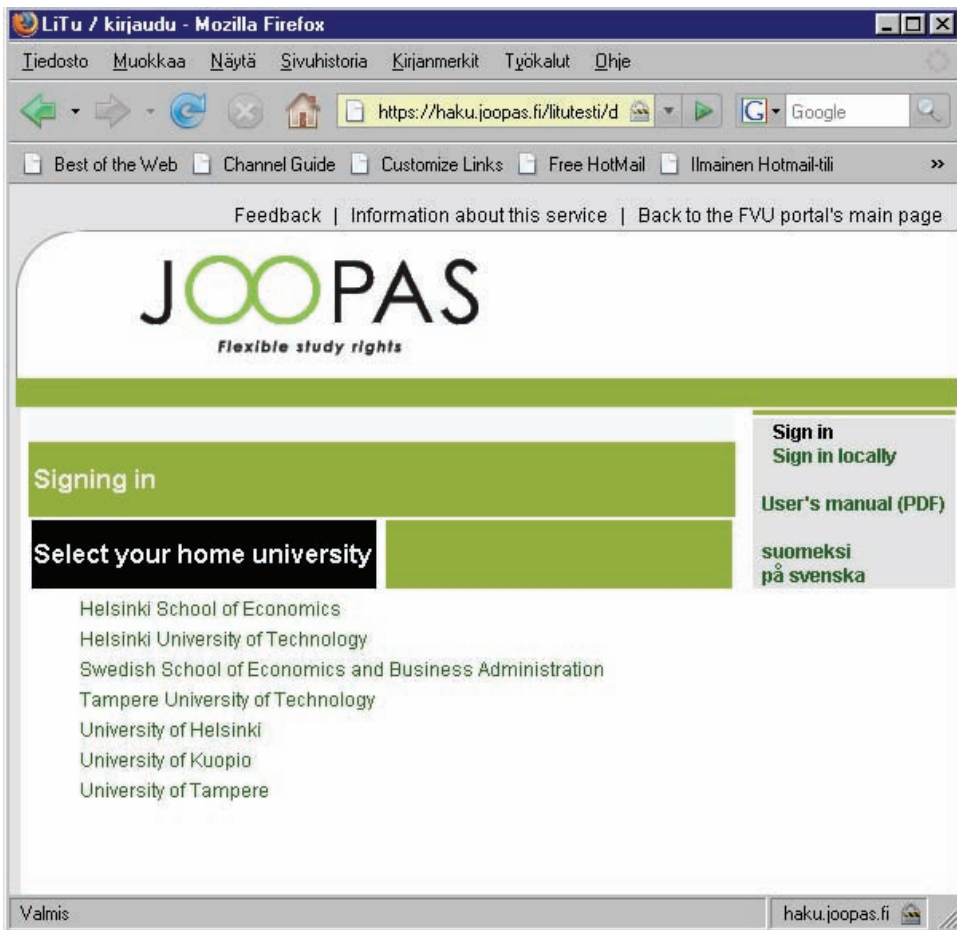


Fig. 15. The interface of the information system.

Figure 15 introduces the final user interface that appeared to the user of the electronic application. In the figure there are seven universities listed altogether. However, two of them were not part of the pilot project.

4.4 Analysis of the results

In this section the empirical data are analysed. The analysis is subjective and includes a lot of interpretation by the researcher due to the nature of the research material. However, the chosen research methods also support this kind of approach.

In the introductory research (Halonen 2004b, publication I) based on three independent information system implementations, attention was mostly paid to resistance

to change. The observed reasons for resistance to change were collected in a table to facilitate the interpretation of actions.

Table 5. Reasons for resistance to change (Halonen 2004b, publication I).

Reason	Case	Influencing tool	Reaction
Unknown user interface	Coating system	Playing, training	Decrease of resistance
	Patient information system		
Fear of losing own position or job	Patient information system	Discussion, information	No action
Fear of ignorance	Patient information system	Training, instructions	Decrease of resistance
	Production control system		
Unwilling to change	Coating system	Discussions	Decrease of resistance
	Patient information system		
New system complicated	Coating system	Training, information	Decrease of resistance
	Patient information system		
	Production control system		
Delay of implementation	Patient information system	Information	Decrease of resistance
	Production control system		
Lack of motivation	Coating system	Discussions	No action
	Patient information system		
New system difficult to use	Coating system	System development	Decrease of resistance
	Patient information system		
New system slow	Patient information system	System development	Decrease of resistance
Old system fast	Patient information system	Attitude training	No action
New system useless	Coating system	Attitude training,	No action
		information	
New system changes work	Patient information system	Discussions, information	Decrease of resistance
	Production control system		

Table 5 represents the reasons and their occurrence in the cases with different environments. From the table we could see that there are reasons for resistance to change that are common in more than one environment.

One of the first tasks in the main case was to start the acquisition process (Halonen & Heiskanen 2005, publication II). The process and its actions were documented accurately. The role of reflection was emphasised when making any moves in the acquisition phase. Several discussions were needed and the situations changed during that time (Table 6).

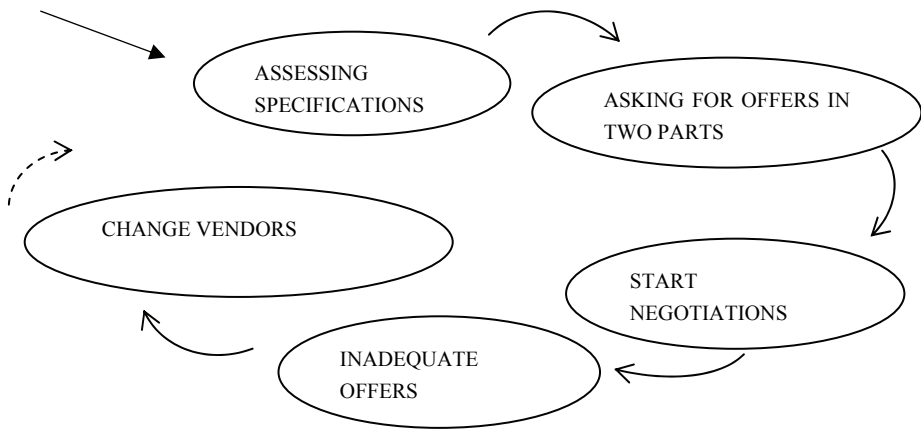


Fig. 16. Expressions of action research steps in asking for offers.

According to Susman and Evered (1978), the actions taken in one cycle when asking for offers from vendors can be described in steps as in Figure 16. The cycle starts with assessing the specifications that were at hand. In the next step actions are planned, leading to the phase of asking for offers from the vendors. That is followed by the beginning of the negotiations (step 3), leading to evaluation of the received offers. Because the offers were evaluated (step 4) as being arrogant, this led to the last step of that cycle, *i.e.* choosing other vendors to participate in the negotiations.

Table 6. Reflecting during the negotiations (adapted from Halonen & Heiskanen 2005, publication II).

Diagnosis	Action planning	Reflection	Explanation
Need for workforce	Comparing acquisition methods	Choosing negotiation-based method	Getting possibilities to change contract terms during negotiations
Inadequate specifications	Assessing possible choices	Dividing assignment into two phases	No fear of “one-vendor-trap”
FlexStu messing up source material	Planning possible solutions	Arranging information session for vendors	Finding possibilities to continue
Arrogant attitude of some vendors against customer	Assessing the vendors	Leaving Oscar and Papa out of negotiations	Getting proper partners
Fixed priced contracts not possible	Designing contracts	Planning hourly-based contracts	Negotiations proceeding
Negotiations delayed	Assessing problems due to delays	Permissions to contract on hourly basis from the steering group	Vendors allowed to proceed with project
Delays with signed contracts	Planning to change assignment	Decision to ask also implementation work from Tango and Sierra	Flexible proceeding
Negotiations still ongoing	Planning details in contracts	Contracts signed	Acquisition process ended

The collaboration between different stakeholders was perceived as a challenge by the researcher (Halonen 2005c, publication IV). Although the common target – the inter-organisational information system – was acknowledged, the path to that target was not clear to all organisations. It appeared that there was an overlapping project underway, managed by Victor, which was also participating in our project.

After the announcement was published and the official procurement process had started, the project manager was asked to join the steering group for FlexStu. It was in the first meeting with FlexStu that the real nature of FlexStu became clear to the researcher. She expressed her concern about the overlapping work but Victor wanted to continue its project because the JOO agreement would come into force nation-wide in 2004. The collaboration between MoSu and FlexStu continued in the FlexStu steering group while the starting procedure of MoSu was still going on. After several meetings with the FlexStu personnel it became clear that the aim of FlexStu was to implement the beginning of the process of student mobility. The project manager did not always know how to act in the FlexStu meetings because she felt that FlexStu was hampering the specifications of MoSu. The piloting universities had difficulties when participating in both of the projects because they did not always know what the outcome of the participation would be.

The Ministry of Education arranged a seminar as a forum of discussion for the people who were responsible for the information systems and their network in the university world. The audience in the seminar discussed MoSu and FlexStu and questioned the role

of FlexStu as an information system with no interfaces with the systems in universities. After several negotiations it was stated that FlexStu would serve as an extensive information service and offer a common paper form to the students so that they could apply for the right to study.

This audacious suggestion gained support from Victor and it was the real beginning of the fruitful collaboration between these two competing projects. The competition between these projects had reverberated through all encounters and meetings in the MoSu project. This also meant that MoSu could proceed with its original plans to implement an information system with all the functionality that was designed in the previous phase. On the other hand, FlexStu had made specifications and found out requirements concerning the student movement and the needs of student affair offices. All of its data was to be available when the implementation of MoSu was to begin.

After the fruitful collaboration started, the output slowly started to become clear to the users. The output would be a joint information system (Halonen 2005c, publication IV). However, due to the several participating organisations, the need for knowledge owned by future users was also realised. We tried to support information sharing in the project meetings, which were mostly kept face-to-face even if the means of video and audio were offered. The project manager tried to facilitate interaction between project participants and to enable understanding of each other.

Due to the diversified and lasting nature of the information system project the importance of decision-making was noted by the project management several times (Halonen 2005a, publication V). The information system was needed to support student mobility and the student affairs officials were waiting to use it. Therefore the schedule had to be kept to, despite the large number of stakeholders in the project. However, we noticed the difficulty of making decisions that would guide the coding of the information system. Due to her dual role as a researcher and a project manager the project manager tried to get the decisions written down in the project meetings. The decisions were considered carefully both during and in between the project meetings, and they often had to be reconsidered in the following meetings or in discussions afterwards. In this sense, reflection was evident and necessary in decision-making.

In addition to problems in decision-making, the concept of problem is here interpreted by the project manager. In this sense, the goals of the project may differ depending on the different points of view: the student affairs officials see it as important to get an information system that supports their actions when managing student mobility. Their goal is not dependent on the fact that issues and concerns with student mobility are changing and developing. Furthermore, the goal of the project manager included also the management of the project, which was tied to its resources and schedule.

When exploring the risks in information system implementations (Halonen & Paavilainen 2005, publication VI) we used the hierarchical accident model introduced by Leveson (2001). We listed the observed obstacles and classified them according to the levels of the model. Figure 17 describes how these obstacles were situated in the model.

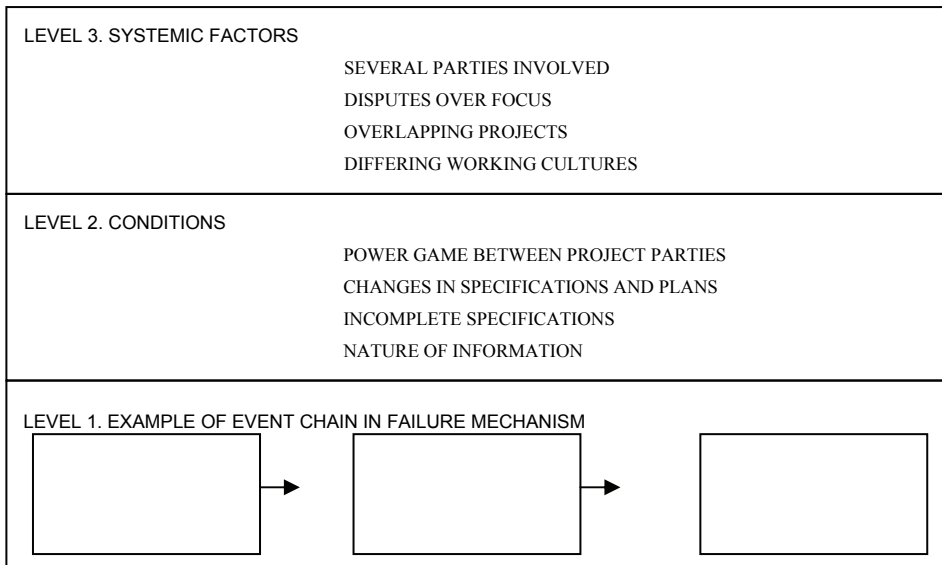


Fig. 17. Leveson's hierarchical accident model adapted in an information system project (Modified from Halonen & Paavilainen 2005, publication VI).

User authentication was explored in our case when we studied the actions when setting up a middleware to manage user authentication and related issues (Halonen 2006b, publication VII). The research material was gathered from memorandums and emails as primary sources, and pertinent web sites as secondary sources. The observations were interpreted and the results were reported to the steering group. We ascertained that the implementation of the chosen tool was a burden to the implementers but that the end users found its use easy.

5 Extended discussion

The subject of this thesis is “challenges in implementing inter-organisational information systems in the context of several organisations participating in the implementation project”. The approach is that of an insider and that can be seen in the interpretations that have been written out in this thesis. This extended discussion chapter deliberates on the experiences and observations that were gathered in the research, along with observations and thoughts outside of the original publications. Furthermore, in this chapter the research in hand is positioned within the information systems discipline.

The aim of the study is to explore what kind of challenges there are to be found when several distinct organisations including the participating organisations are involved in developing an inter-organisational information system, and to find out how this information system is built. The special nature of academia is also noted. The researcher has been involved in the subject, using the experiences that she has gathered during her work in different organisations before entering the main case of this thesis.

First, responses to the research questions are given. After that, the next section includes contemplation that thoroughly discusses the findings of the research. Then limitations are noted and the chapter ends with suggestions for future study.

5.1 Responses to research questions

We had two concurrent research questions that were closely related to each other. Neither of them is more important than the other. The responses to the questions are expressed in Tables 7 and 8. The questions are represented in the first column and the response is summed up in the second column. The summarised response can be found in more detail in the next section (Contemplation) where additional information is also given compared to the original publications and Chapter 4 (Analysing the empirical material).

Table 7. Research questions and respective results.

Research question	Results
What kind of challenges are found in an implementation project where an inter-organisational information system is implemented by several organisations?	Competition between organisations Lack of interaction between parties Changes in project parties Decision-making Security and user authentication

Table 8. Research questions and respective tools.

Research question	Tools
How is an inter-organisational information system implemented by several organisations?	Proper project management combined with experience Active interaction between project parties Frequent interaction between customer and implementers Confidential terms between project managers Reacting to events and learning

5.2 Contemplation

This section ponders the empirical research material introduced earlier in this thesis, along with observations that have arisen since the original research was published.

The first case was constructed in a factory where an information system was implemented for use in a small unit of the factory. The factory case was about replacing a manually maintained information system consisting of paper sheets containing handwritten notes with Access-based software called CoatInfo. With CoatInfo the factory workers could manage the coating process and in co-ordination they collected the coating information to be used for quality purposes. The second case was conducted in a hospital: the information system project consisted of piloting an information system in the hospital, including two clinics there. The information system was designed by five distinct hospitals, having many similarities with the main case in this thesis. In the hospital system's case a character-based mainframe system was replaced with a Windows-based client-server application. The third case came from a global enterprise, where an information system was implemented in a single division as a first step in the global enterprise. However, the researcher was not involved in the implementation project but only collected data outside of the implementation project.

In the main case the participating organisations had previous experience of participating in information system projects, *e.g.* when developing their student record system StuRec. Every actor had its own objectives and motives for participation.

The background research highlighted characteristics that were common to information system implementations, regardless of the environments or the people working there. One of the most important lessons that the researcher learnt during those implementation projects was the significance of noticing and understanding what was happening around

her. In addition, although one can read literature in order to find out what implementing information systems means in practice, only our own experiences make us what we are (Frankl 1963, Walsham 1993). In this sense, the value of the research done on the other cases in the organisations before entering the main case is worth acknowledging.

The background research also corroborates points by Schultze and Boland Jr. (2000). They have studied organisations that are seeking solutions to manage knowledge and they note that the organisations are increasingly developing technological tools to be used. The background research from the factory (Halonen 2004b, publication I) showed that stepping from a legacy information system or a system without technology at all into a computerised information system is a challenge, but one worth taking. This case also showed that there are means to fight against resistance to change and these means should be used despite their appearances, *e.g.* playing Solitaire (Halonen 2004a). Furthermore, resistance to change is a phenomenon that should be recognised in its early phase when it is still manageable. The means depend on the roots of the resistance to change. However, our background research shows that forcing users to use an information system is difficult; sometimes even impossible (Halonen 2004a).

Co-operation is a challenge (Barki & Hartwick 2001, DeChurch & Marks 2001), but in our main case the challenge was found even more demanding because of two reasons. First, the client consists of several universities, influenced by two distinct university consortia. Second, the failure rate of information system projects is generally known to be high (Schmidt *et al.* 2001). All the same, the right time to evaluate the outcome of a project is not self-explanatory (Larsen & Myers 1999, Halonen 2004a). Furthermore, the answer may depend on the respondent, as our background research from the factory showed (Halonen 2004b, publication I). In the main case of the current research the outcome was evaluated as successful, based on the feedback that was collected from the users. The future will tell if the satisfaction felt will last for the whole life cycle of the information system.

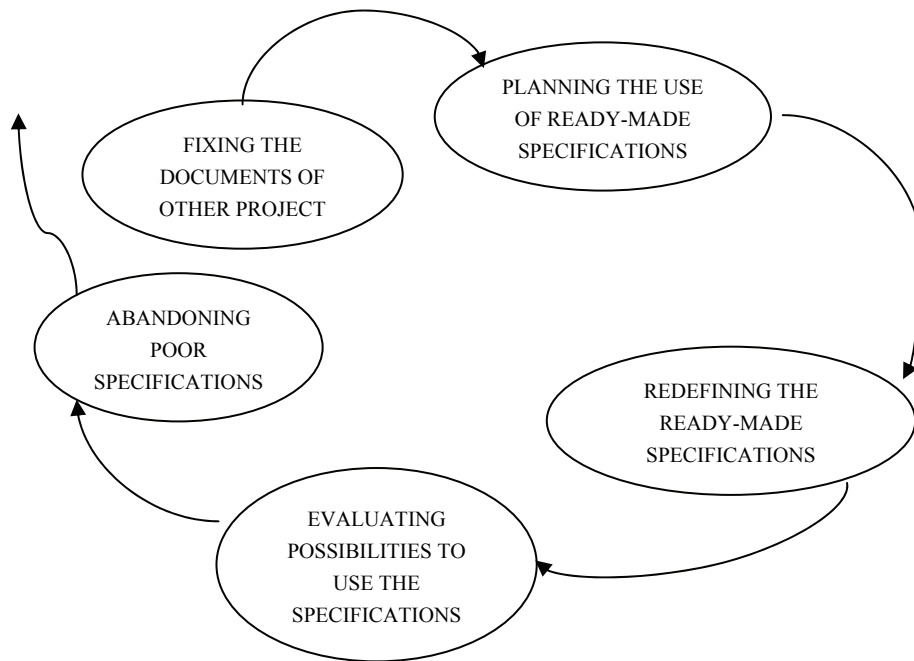


Fig. 18. The cyclical process with ready-made specifications.

The main case was based on groundwork laid by other participants, meaning that the specifications were made in another project managed by other stakeholders. This created challenges, although the versatile environment was already challenging enough. Using “ready-made” specifications cost time and money but in spite of this the project was finished in time (Halonen 2006a). Figure 18 simplifies the process of selecting valid specifications from the poor ones. In addition, when the project was in progress, an overlapping project was introduced by the University of Victor, which was participating in the project. Managing the overlap took up resources as described in the original paper II. However, more was to come when MoSu was on its way to being finalised. As described in this thesis, MoSu proved to be a success when it was in use in the piloting universities. Besides the piloting universities, other universities outside of the pilot were also interested in stepping into the pilot project.

The importance of collaboration was highlighted from the very beginning in the MoSu project (Memorandum June 16, 2003). In their research on collaborative engineering, Trossen *et al.* (2002) list aspects that had to be covered, namely management of the conference environment (*cf.* enabling MoSu sessions for several users at a time), provision of a common conference database (*cf.* a common database consisting of information about student mobility), handling security aspects (*cf.* security level when crossing organisational borders) and managing network resources (*cf.* keeping service available to users). In addition, the authors note the importance of enabling concurrent access to shared resources like storage devices (*cf.* access to the database regardless of the university).

The users were involved and participating in the project. In our case users participated in designing both the new process and the information system (*cf.* Markus 2004). There were student affairs officials participating in the project work from the very beginning (Memorandum June 16, 2003) and students involved when the first version was to be tested. In addition, during the piloting phase the student affairs officials gave feedback whenever needed. Using this feedback MoSu was improved without delays. The project manager sent several emails to Sierra thanking them for their flexible co-operation and understanding. However, several times Sierra had to explain to the student affairs officials what the intended changes meant in practice. It was not easy to understand what the decisions caused in the process of student mobility or how labour-intensive some of the changes were (Halonen 2006a).

Besides collaboration, the significance of interaction between different stakeholders was also emphasised in this project. Due to the internal problems experienced by Tango the flow of information was diminishing, which thus caused delays in both the schedule of the project and negotiations of contracts between the customer and vendors (Short minutes November 9, 2004). This case stresses the necessity of noticing changes in interaction in time despite the lack of information about internal problems. In our case the project manager tried to use several informants to get information about the real situation. She received an email from Tango on August 23, 2005: *“Do you see a need for Tango’s experience in MoSu now? I find it difficult to see any value added from Tango to MoSu in its second phase using our available resources.”* The project manager found this email staggering and a sign of a desire to withdraw from the project. Furthermore, if there are internal problems the trust felt will suffer and due to that, interaction may come close to ceasing altogether.

Apart from organisational changes in Tango there were also organisational changes in the University of Victor. They reflected the MoSu project by trying to emphasise its influence. The responsibility of the University of Victor was already described in the project plan as to take care of the nation-wide approach in the project. However, because of the limited schedule and need to pilot the information system, not all the functionalities and characteristics could be included in the pilot project. In addition, the standardisation project, for example, did not even get finished until MoSu was piloted. Despite this unfinished state, the importance of standardisation project was highlighted every now and then in the project (Memorandum May 9, 2005; Seminar August 22, 2005). Furthermore, the University of Victor surprised the project meeting in September 20, 2005 by expressing doubts that MoSu would be spread nation-wide. Instead, the University of Victor would code an information system of its own for that purpose.

This surprise was followed by requests (Email September 21, 2005) from the University of Victor which aimed at making changes to the project plan that had been accepted in the steering group. The project manager considered this to be an effort to take control of the project even though it was not finished. However, this was proof of underlying conflict over ownership in student mobility and its supportive information systems. These requests were in unison with decisions that had already been made in the University of Victor on March 8, 2005, when the university had announced in its consortium meeting that they would produce a nation-wide information system, which would however exploit MoSu where possible.

Except for occasional problems, collaboration between the vendors and the project manager was mainly fruitful and made contributions. The interaction was flexible and open, and there were several messages sent between the project manager and Sierra. Some of the emails included confidential information beginning with “*This email is only for you ...*” In addition, Sierra sent SMSs to the project manager informing her about successes in finding solutions to problems or when proceeding within a tight schedule: “*Tomorrow the first version of MoSu will be set up! I suppose that we survived ...*” (SMS from Sierra 17:24 March 23, 2005) and further: “*MoSu to be tested. On Tuesday we’ll make the last modifications to this version. Happy Easter!*” (SMS from Sierra 15:38 March 24, 2005). This kind of interaction increased the high confidence in this vendor.

Susman and Evered (1978) list five phases that are seen in an action research cycle: 1. diagnosing, 2. action planning, 3. action taking, 4. evaluating and 5. specifying learning. According to Susman and Evered, the actions that were performed when building collaboration with the University of Victor can be described by using the phases in an action research cycle (Fig. 19).

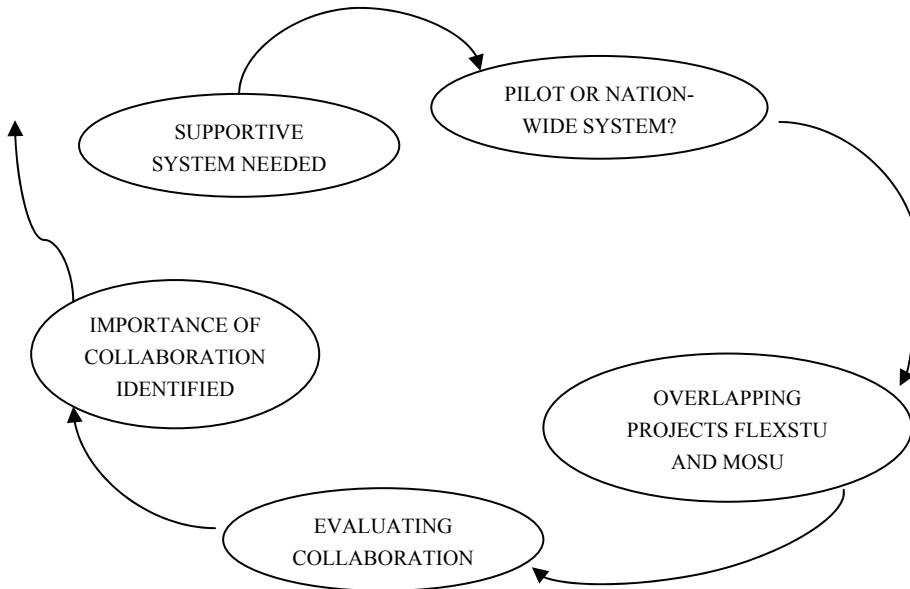


Fig. 19. Expressions of phases within an action research cycle in building relationship between FlexStu and MoSu.

The importance of having knowledge about the substance was emphasised when running the project. An example of lacking understanding or knowledge was seen in the project meeting (May 4, 2005) when the planned piloting was shifted because there would be no study credits to be transferred in December 2005. This schedule had been under discussion several times but the lack of data did not become evident until then. *“I was very disappointed and I tried to inform the student affairs officials that this was really a big change in the schedule. However, they were not upset about it. It was funny – they didn’t care. After the meeting Sierra and I discussed it and Sierra said to me that the officials do not think about it in the same way that we project managers do.”* (Diary May 4, 2005).

Our main case showed that even a complicated information system project can succeed, also when there are several organisations involved. In our case we had universities and two university consortia involved, along with two different vendors. This collection predicted extra challenges for the development project, even if the literature already complains about how the success percentage is known to be low (e.g. Lyytinen & Lehtinen 1987). However, our case also showed that it is possible to implement this kind of inter-organisational information system even when there is no formalised organisation in the background. In our case we had several universities and the main document was the letter of establishment signed by the Rector of the University of Alfa. This document nominated people working in the University of Alfa as members of the MoSu project. There was no other written document to tie these organisations together. Despite this, the collaboration was fruitful and the output is acknowledged by the users, both the student affairs officials and the students to whom MoSu is available.

Furthermore, our research consolidates the formation of a co-operative alliance as described by Kumar and van Dissel (1996). In addition to the four factors (environmental forces, motives of the co-operative parties, support role of information technology and enabling role of information technology) we add strong interaction between implementers and project manager, and highlight trust as a supportive force there.

The “learning ladder” introduced by Ciborra and Andreu (2001) was used in the MoSu project, for example when Shibboleth was implemented for use with MoSu in the universities. The representatives of the Shibboleth operator, the information technology office of the University of Alfa and Sierra had to share their knowledge and information every now and then. This sharing was particularly essential when the piloting was about to start at the beginning of 2005.

Electronic data interchange (EDI) is an inter-organisational system that is connected with several (at least two) distinct applications (Iacovou *et al.* 1995). The participating organisations benefit from EDI when all their partners are using it. This is also the case in an inter-organisational information system when the system is going to replace a legacy system, e.g. managing student mobility between universities. The electronic application form serves well when it is in use but there is no means to force all universities to adopt it. In our case this means that students who apply for the right to study in a university not using MoSu need to use paper forms, even if the student has the right to study in a university which uses MoSu. Because of this, the student affairs officials have to manage both electronic and manual processes, using the same sources of information as they used to prior to MoSu. In this sense, it was in the interest of the student affairs officials that all universities adopted MoSu as soon as possible (Memorandum September 19, 2005).

Our research also questions the use of specifications that have been made in other projects by other owners. The quality of the specifications of the information system is essential to any information system (Lyytinen & Lehtinen 1987, Schmidt *et al.* 2001). In our case the specifications were slowing the project down (Halonen 2006a). However, with considerable interaction between project members – especially project managers – these problems can be overcome. In this respect, our research emphasises the high-felt confidence between project managers, which also allowed critical opinions. Furthermore, the life cycle of our information system differed from the classic model introduced by Lucas (1985). We noticed that Design, Specifications and Programming were coexistent at several points. This approach was possible due to the flexible procedure that was followed in our project. In fact, that was not the planned procedure but we had to follow it, and it proved to be fruitful.

As well as ready-made specifications, our research questions the role of given architecture as a part of an information system. In our case we had to take Shibboleth as the authentication method due to prior work in universities. However, implementing Shibboleth appeared to be such an effort that not all the piloting universities could manage it (original paper VII). This cast a shadow on MoSu as well, and on several occasions the project manager had to make it clear that Shibboleth and MoSu are distinct entities (*e.g.* Seminar August 22, 2005; November 3, 2005).

It seemed to be very difficult to understand the difference between acting face-to-face in student affairs offices and applying for rights to study electronically, in other words, by using eGovernment. Several times it appeared that the representatives of the universities did not understand until afterwards what the decisions meant in practice. Occasionally several discussions about the functionality and coding them into the process were considered annoying by the student affairs officials: “*You may make yourself an information system that you can learn to use and manage the mobility of students for us.*” (Diary notes from a project meeting in March, 2005). Likewise, Griffith and Northcraft (1996) have noticed that understanding the technological approach is essential in information system projects. Despite their experiences, making decisions concerning the functionality of the information system appeared to be very difficult and the decisions had to be changed several times after the project meetings. However, because the information system was considered so important, the workings of the project were kept flexible. This information system could also be classified as a work system (Alter 2003) with student affairs officials making better decisions, not only the mobility process being quicker than earlier. Because the information system was first piloted in three universities but at the same time a nation-wide information system was to be implemented, the approach had to be flexible and extensive during the process.

Choosing a centralised architecture created extra requirements for user administration in the information system when users crossed organisational borders with their information. Another lesson learnt came with the chosen authentication method (Shibboleth 2005). It was the will of the Ministry of Education that Shibboleth would be the authentication method in academia. Shibboleth was already in use between some of the libraries and more universities were to join in the collaboration. In this sense Shibboleth was the given method and our project had to adopt it. However, there were big problems when implementing the technology because it was not developed to be used as needed in MoSu.

Because the use of Shibboleth differed from its previous use in libraries, the University of Alfa took the challenge as a pilot use of Shibboleth (Seminar August 22, 2005). Through implementing Shibboleth for use with MoSu the individuals responsible gained experience that was to be valuable in future when inter-organisational information systems were to spread. The individuals responsible were very satisfied because the users found Shibboleth handy and practical. However, the need for strong and fruitful interaction was emphasised when implementing Shibboleth in our MoSu project, when several components were changed independently and simultaneously.

Our research cannot totally be categorised into any approach introduced by Hirschheim *et al.* (1997). Nevertheless, we can acknowledge all of the goals of the five information system development approaches described by Iivari *et al.* (1998):

1. To shed light on the social issues surrounding organizational change and implementation of information systems.
2. To provide a methodology for modelling communicative action in organisations, especially speech acts of changes: creating, maintaining, reporting, modifying and terminating organizational commitments.
3. To provide a learning methodology to support debate on desirable and feasible changes.
4. To develop conditions for effective worker participation in order to support democracy at work and quality of work.
5. To promote increased professionalism of information system designers.

The main case introduced an inter-organisational information system that was designed and implemented by organisations that were to use it. Prior to this research, there is not much literature about such implementation projects. As the information system was only piloted during the project, the final evaluation about its success or failure remains in the future, following notes by Larsen and Myers (1999). However, we can acknowledge the observations of Markus (2005) when she sums up the most important lesson: “Perhaps the most important lesson is that the benefits an organization achieves depend on how an inter-organisational information system is implemented technically and organisationally, not just by the organisation itself, but also its partners.” Despite her research coming from the business sector we have found similar phenomena in our study.

From the experience gained in the MoSu project we would like to add one more challenge to those mentioned in Benamati and Lederer’s (2000) article, where they list the managerial challenges in an information technology project. In our research we found that competition between two overlapping projects affects the progress of the development project, especially in cases where the projects aim at similar targets and when the collaboration between the project owners is expected to be seamless. In addition, our research showed that the relationships between project parties can turn totally upside down. Heiskanen *et al.* (2000) reported on dynamic relationships and how these relationships change over time. In our research the relationships between software developers and the client changed dramatically when there were changes in the personnel of the software developers. This change was seen in our case especially during the early years of the project.

Looking back over the project history of MoSu, we may highlight the perceived flexibility of project work. Despite the lack of rigour in project management the final

schedule was kept and the output was evaluated as satisfactory, even excellent by some users. It seems that the high level of trust among project members and especially between project managers enabled the fruitful working atmosphere for the project work. In addition, the experience of the student affairs officials was delivered freely and distributed, reflecting the respect that they seemed to pay each other. Furthermore, often suggestions and decisions were concluded based on “the responsibility of an official for the legality of his actions”.

In conclusion, following Markus (2004), the MoSu implementation project can be divided as follows:

before: student affairs officials tired with manual work

during: collaboration, negotiations, learning project work

after: satisfied student affairs officials and students, joint database available.

5.3 Implications for science

Next, the implications for information processing science of this research are evaluated and discussed.

Generally speaking, inter-organisational information systems and their implementations have been investigated and presented in literature (Johnston & Vitale 1988, Laudon & Laudon 1998b, Karahannas & Jones 1999, Hong 2002), because, on one hand, information systems have been implemented during the past many decades and, on the other hand, many organisations have evolved towards distributed and collaborative settings. However, information system implementations where especially rather informal coalitions of user organisations or their representatives are involved in joint planning and management of system development projects carried out by third parties, have not been explored in depth – despite the fact that various kinds of inter-organisational relationships and networks have been the focus of interest for example in business-oriented software research (Kinnula 2006).

Taking this into account, this research adds to the body of existing information systems research by addressing issues involved in implementing an information system for inter-organisational needs, where the user organisations are involved in managing and co-ordinating the implementation project as active participants, and the main development effort is carried out by an external expert organisation. Because the user organisations involved have been independent both financially and in terms of their actual information systems needs, their active involvement brings in special requirements and views into the information system development. This also causes many of the issues that were found from the research data and needed to be resolved, in practice, during the investigated project. Analysis of the reasons for, the consequences of and the implications for managing such issues in this kind of context can be seen as belonging to the core results of the research for the information systems science community.

These results support the view that in a setting with several independent stakeholders there are diverse problems that are not seen in intra-organisational development projects or have not been reported for example in more formal inter-organisational activities (Munkvold 1999, Kumar & van Dissel 1996). The rather informal relationships between various stakeholders appear to be problematic especially when there are stakeholders participating in the joint effort with different ambitions and goals. As said, many of the reasons are stemming from, but also some of the consequences are particularly visible in the type of inter-organisational context in case. Thereby the results of this study are considered to add specific new knowledge to the general understanding of inter-organisational information systems development.

Adding to that, the study shows that without a strong or formal organisational command line between the distinct parties, both the interaction patterns between organisations and the power of one organisational party to affect the project depend heavily on the activity of the individuals in the project. This is intuitively understandable – maybe even self-evident, but on the other hand the influence of the lack of formal organisational command line between stakeholders on information system projects has not been that widely studied and described in literature. It is also obvious that much remains still to be investigated, thinking also that the inter-organisational context is not stable, but tends to change either based on the influence of individuals or an emerging evolution towards more formal structures. Our research also added to the comparison study of Salmela *et al.* (2000) with the incremental approach in the development. The impending changes in student mobility will continuously cause changes in the environments and therefore comprehensive practices would cause problems in the information system development.

A specific aspect related to this is that the study adds to information systems and software acquisition process research, also because of the particular context in which the research was carried out, *i.e.* several independent stakeholders acquiring a system for their inter-organisational needs, relying on external system developer (publication II). The results show that an acquisition process may be complicated. Therefore the insights gained in inter-organisational information systems acquisition processes are seen as a valuable contribution to information systems science. Again, although software and systems acquisition have been investigated during the past many years, and there best practice type recommendations especially for purchasing organisations, the issues involved in joint systems acquisition by a group of independent organisations aiming at collaborating through the acquired system, have not been investigated in depth. This research also emphasised the need to reflect on encounters. This result is consistent with findings in related research on planning for, building and evaluation inter-organisational collaboration (publication III). One of the key findings was that early reflection is needed to find solutions to rather difficult situations that were or could be changing to conflicts between the stakeholders. Again, because of the informal inter-organisational context, it can be expected that the consequences of such situations would be more devastating to the joint project than in more formally managed contexts, where conflict resolution is often a built-in part of the inter-organisational structure. Consider for example cases, where management disputes have been planned and are realised as part of the contractual agreements between the parties (Warsta 2001).

One of the resulting implications for information systems research is the need to better understand the role of trust in inter-organisational collaboration. Trust has been studied and described as among the most important issues in information system implementations (Karahannas & Jones 1999, Kramer 1999, Evaristo 2003). In other words, it is a classic information systems research topic. The main case in this research supports this conception, however, adding to the existing studies that trust also acts as a facilitator when stakeholders who represent different organisations seek common solutions when they are heading to a joint artefact. In this research, the joint artefact was an inter-organisational information system meant for the future joint use of the participating organisations. It is reasonable to suppose that the role of the evolving artefact in creating trust between the parties with only informal inter-organisational relationships was much more important than in formally managed joint projects. Moreover, considering that the lack of formal inter-organisational management brought in the influence of individuals into the project scene, it can be even thought that without the single artefact to be used by all the parties, the whole collaboration scheme could have been collapsed. Vice versa, the results indicate that joint success in specifying, managing and experimenting with the shared artefact helped to resolve many of the conflicting issues, and in the end may have affected to the joint opinion between the stakeholders that the project was a success as a whole.

Therefore, this research supports the view to the formation of inter-organisational information systems introduced by Kumar and van Dissel (1996): resource pooling for getting the shared artefact done was felt as an important motive to build collaboration, in practice (publication IV and publication VII). Furthermore, the research (publication V) also supports the findings by Kumar and van Dissel on interdependence between inter-organisational units.

As said above, information systems and their development have been studied already for decades. Lucas (1985) described the implementation process with a trajectory of eleven steps, which can be seen in many ways as an example of a classic view to the mentioned process. This research shows, however, that the trajectory introduced by Lucas, and other similar information system development process frameworks, is not imperative in order to achieve the desired output. That kind of trajectory is not applicable if the cycle is not continuous, as was the situation in the case studied in this research. By this we do not mean only that instead of a linear or sequential arrangement of the implementation process activities, a more dynamic view to the development activities must be taken – considering the spiral model or other non-linear system development models as examples (Laudon & Laudon 1998b).

Instead, based on the results of this research we believe that even more dynamic models should be developed that would fit in information system development that varies based on the interests, goals and influencing factors of the stakeholders. Even the so called agile processes (Williams & Cockburn 2003, Wikipedia 2007), although aiming at highly dynamic software development processes, do not yet address inter-organisational development concerns, not to speak of informal inter-organisational collaboration settings. In the main implementation case of this research the system development work was very flexible indeed, there were for example times when the process seemed to go backwards. Despite that, the resulting shared artefact was considered as success by the users both in the beginning of the pilot and at the end of the pilot. Moreover, the efforts

spent in the joint project were not deemed to be too high. How to envision this kind of information system implementation trajectories, how to manage them and possibly how to avoid managing them in too formal ways – to avoid hampering the evolving shared artefact, are all interesting areas of research to which this study could initially contribute.

This study supports the view that action research methods are suitable in information system implementation studies, even when there are several organisations are involved. A recently published article (Järvinen 2007a) about similarities between action research and design science introduces a new approach to the theory on implementing information systems. Our research also demonstrates that these research approaches complement each other. A new viewpoint can be seen in our study especially regarding the early stages of the information systems implementation project. The process used for choosing valid system specifications (Fig. 18) can be thought to correspond to the process of design science, awareness of problem, suggestion, development, evaluation and conclusion. In particular, a design science view enables us to analyse the ready-made specifications (Fig. 18) as interim artefacts that were evaluated in the project meetings. Finally the specifications were abandoned when the project group was developed and empowered to make that decision. A significant incident in the process was the conflict with the University of Victor when the quality of the specifications was questioned. Without perceived development in the social process the decision to abandon the specifications would not have been realised.

This research displays that action research enables us to research how people act in the process when an information system development is progressed. Respectively, design science enables us to focus on the output – the inter-organisational information system – and on how it is treated or how the development steps were followed in the process. This finding supports the guidelines introduced by Hevner *et al.* (2004). The new information system (MoSu) was an innovative artefact with its purpose as a supportive tool to manage student mobility. The problem domain was specified in the diversified context with several organisations and participants with partly divergent goals. The artefact was carefully evaluated during the construction process and after its implementation by the users. The solution was novel in its context as a joint - not individually tailored - information system. The output was a coherent information system. The artefact was truly explored with available means to reach the desired output. Finally, the research has been welcomed both in technology-oriented as well as management-oriented audiences in several conferences and seminars.

In addition, this research shows that specifications made by other stakeholders do not, by definition, benefit the progress of an information system development. On the contrary, according to the findings of this research, given specifications may appear problematic and negatively influence the development project. Despite a huge amount of documents, it may be difficult to find out what actually has been done. While our research supports the accident model by Leveson (2001), it also argues that the hierarchical model can be used when evaluating obstacles and risk in information system projects (publication VI). The hierarchical model approach also enables the designers to categorise obstacles and risk factors in the project.

User involvement and its contribution to information systems have been explored in several studies (*e.g.* Markus 1983, Kumar *et al.* 1998, Dewulf & van Meel 2002). This dissertation adds to the research by findings from three cases that differ from each other

in many respects (publication I). The findings show that resistance to change is likely to appear regardless from the area of business. The background study also supports findings from earlier research on resistance to change. It verifies that resistance to change may appear as emotional phenomenon of conflict (Bodtker and Jameson 2001), and supports the importance to recognise the type of resistance (Markus 1983). In addition, a new standpoint is expressed to the discussion of success or failure (*e.g.* Lucas *et al.* 1990, Furton 2003). The background study shows that a simple information system - even failed - can act as a facilitator when the trend is towards more complicated information systems.

This research widens scientific knowledge of distributed projects and their management (Erickson & Evaristo 2006) with research on inter-organisational information system implementations and issues related with their management. The importance of project management is emphasised in inter-organisational information system projects compared with distributed projects that include only one organisation, even distributedly located. The research highlights problems especially with decision-making and power taking. We argue that there are situations when the power must be taken and decisions made instead of waiting for others to respond. In this, however, the importance of understanding other parties and their needs must be emphasised. Our findings suggest that the difficulties in decision-making may root in the lack of a formal command line between project parties. It is also not obvious that a specified process for decision-making can be established in the informal inter-organisational collaboration setting.

In their study on changing work practices, Vaast and Walsham (2005) have reported that new technology leads to new work practices. Our research widens their findings by emphasising the need of increased interaction especially when there are remarkable changes in the workflows and when the context is inter-organisational. In addition, in spite of difficulties in implementing versatile technology, the output can be found satisfying from the user point of view. Furthermore, the findings show that despite the differing architecture in user authentication, transferring information across organisational borders is possible.

This study explores the implementation of an inter-organisational information system from its beginning to its delivery to the users. Therefore, the research offers interesting viewpoints and experience both to researchers and practitioners. This research is among the first studies that discuss the issues that arise from an inter-organisational implementation process, as seen from the inside. In a similar insider way, Heiskanen (1994) explored how to do research at the same time when doing practical information system implementation work, and acting as a pioneer in applying reflection-in-action as a research approach. Varying from the viewpoint of Heiskanen, Mathiassen (1998) elaborated the reflective systems approach from the point of view of an academic teacher. These studies are complimented in this dissertation with insider research on challenges in an inter-organisational information system implementation, where the viewpoint was that of a researcher who acted as a project manager. The researcher was able to react on events and encounters, and her dual role was evident to all project participants. The decision-making power was perceived to be fluid and the ownership of the project was questioned many times. Despite these circumstances the output was evaluated successful by its owners and by the users.

5.4 Limitations

The focus in this study is an inter-organisational information system in its implementation context. The context is considered to be more important than the information system that is not described in detail. Therefore, the technical issues are excluded. The limitations of this research are found in the collected research material that is closely related to the researcher due to her role in the project. The approach is that of the researcher rather than of the participating organisations or of other stakeholders. The development of the information system is the focus, but the organisational changes in the involved organisations – even if they are perceived – are not explored further.

In addition to the empirical material, the influence of the researcher with her experience is also inevitable in the theoretical material collected from the literature. Despite the use of search engines and library catalogues, the researcher has made conscious and unconscious choices when selecting the articles.

In this study there are no interviews done because the role of the researcher as the project manager might have influenced the interviewees and their responses. In addition, in the research material there are several assumptions that might need evidence, *e.g.* the impact of changes in organisations or reasons for them. These reasons are not contemplated because the researcher limited them out of the scope of this study.

Furthermore, when considering the actions of individuals in this research, the individuals are considered to represent the organisations in which they work. This approach is due to the researcher's views when she proposes that the people are chosen in the project to stand for their organisations.

5.5 Future research

The diversified setting in this information system project offers possibilities for further research, especially regarding the backgrounds of the participating organisations. In such an inter-organisational development project there are many relationships that influence events. On top of that, adding more points of view certainly gives interesting findings and new research settings. The main case offers a fruitful environment for the exploration of the organisational approach and to find out the user point of view, in comparison to that in this thesis. In addition, giving the project personnel the possibility to express their views on the actions and output will give important knowledge about letting users participate in implementing information systems.

So far, competing information system developments are not studied to that extent they deserve. Information system literature lacks research on that kind of competition. Another deficiency is found in research that focuses on reconciliation between information system projects and their intended collaboration as one information system development. This dissertation is only a starting point for that kind of research and future research is needed there.

Furthermore, measuring the success or failure of information system projects depends on the timing of the measurement. This observation, too, offers possibilities for further

research on how the output is perceived later when the use of the current information system is extended nation-wide.

The social development perceived in the project group offers interesting viewpoints to future studies. The inter-organisational information system as a joint artefact might stand for a basis for additional research and thus offer new insights to combine action research and design science.

Another interesting subject could be the organisational change that was evident during the piloting. As an information system implementation is said to be an organisational change we can suppose that an inter-organisational information system influences several organisations and thus offers ample research possibilities. Adding to that, change from acting face-to-face to the use of electronic application form is remarkable. It is worth further exploring to find out what kind of information should be inserted in an information system that it covers the gap between acting face-to-face and an electronic system.

Moreover, as the information system development in the main case did not follow a linear either a cyclical process model, future research is needed to explore the reasons for that and to find out if a new model is needed to explain this kind of information system development.

Due to the large amount of sent and received emails, research concentrating on these documents could also offer interesting findings about relationships between the actors in the project, interaction in information system developments and co-operation.

6 Conclusions

This chapter sums up the results and discussion and introduces additional remarks made by people other than the researcher herself. The chapter ends with a summary of “the lessons learnt” by the researcher.

6.1 Final account

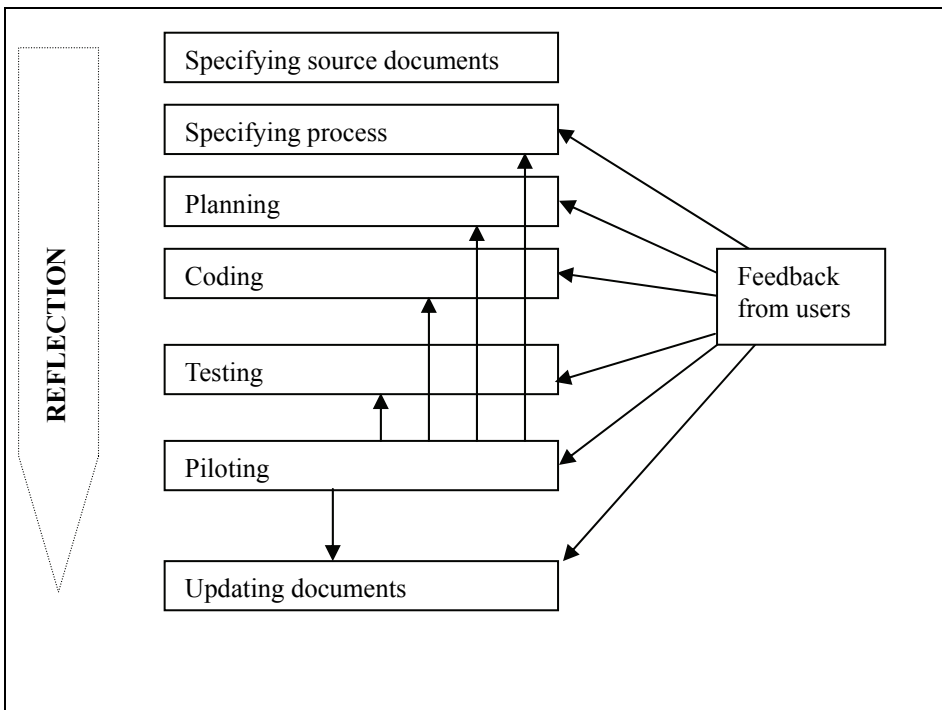


Fig. 20. Influence of reflection on functions in the development project.

The goal of this thesis was to find out how inter-organisational information systems are implemented and what kind of challenges there are in such implementations when several organisations participate in the development project. This section concludes the findings in Figure 20 where feedback from users and reflection throughout the project is shown. The feedback was allowed to influence back as far as ‘Specifying process’ and the life cycle described by Lucas (1985) was not followed in our project.

Conversely, a flexible procedure with continuous feedback from users was followed in the project. In practice, it was necessary to make changes in the specifications and plans even in the late days in the project. Only the first task (specifying the documents which was carried out by other actors) remained untouched after it was finished in this project. Even the process that acted as a basis for the information system was changed during the development work. The documents (*e.g.* technical documents and user manuals) were updated at the end of the project because they had to be up-to-date when the output of the project was delivered to its future owners. This flexible functional model was possible because of the confidential terms between project managers.

However, the description given in Figure 20 is limited to the functions in the information system development without taking into account what happens outside of the development work. Before the development could even start, the actors had to be chosen. Furthermore, when participating in a project, collaboration between project participants has to be ensured. This research proved that a strongly-felt need is a good catalyst for collaboration.

The best tool to respond to events and situations in an information system implementation is to be aware of what is happening and to react to it in proper time.

The next section adds to this output by its outside nature, as the voice of other people is heard.

6.2 Additional remarks

This research is subjective and interpretative. However, the requirements of scientific research postulate that certain criteria are met. This research intends to follow the principles introduced by Klein and Myers (1999). These principles were:

1. the fundamental principle of the hermeneutic circle,
2. the principle of contextualisation,
3. the principle of interaction between the researchers and the subjects,
4. the principle of abstraction and generalisation,
5. the principle of dialogical reasoning,
6. the principle of multiple interpretations and
7. the principle of suspicion.

The sixth principle of multiple interpretations was assured in this research by letting third parties read and comment on the manuscript. These were three members from the project personnel: a representative of one vendor, a student affairs official who had been involved in student mobility for several years, and a member representing a consortium

of the universities. In addition, two of them had also been involved in the project that had first specified student mobility prior to the MoSu project.

The comments given confirmed the researcher's ideas. In addition, there were comments about the events in the project (cf. page 94, Diary May 4, 2005):

“I think that this is a good example of some kind of break in interaction ... We student affairs officials simply didn't realise the need to react to the issue in time. There may be many reasons. I myself skipped the detail probably because automatically I thought that every participant knew when the invoicing was to be performed. That is said in the agreement, too.”

“... you talk about the difficulties when student affairs officials made decisions that had been 'right' and unchangeable. This is a real fact and there are several explanations for that. The fundamental reason is probably the 'process thinking' that is quite new to many of us. Secondly, nobody of us could give this project as much time and thought as was needed and they themselves wanted. Many times when opening my mouth I know that there are several different opinions on the issues at hand purely and simply in my own university, the whole scale is available. And in the background there is the thought that this system is being developed for us and that we are paying for it. If there are mistakes or if there are unsatisfactory decisions – it shouldn't be the end of the world.”

“Compared to ours, you and Sierra have different motives in this development. It is good to keep that in mind and express it here, too.”

“One reason for the success was that in the beginning the project managers were given the right to introduce their ideas about the solutions. The organisations were not able to give a joint opinion in the limited time available.”

“The description meets my idea of the situations and incidents in the project.”

“[...] I found it positive that new resources (people, financing, discussions with experts etc.) appeared, and negative that ready-made tasks had to be assessed in a new situation. To some extent, ready-made issues or ready-made plans were lost. There were new people who had no “history” related to this context. Therefore it was really hard again to carry out the same discussions (and to some extent ready-made plans, too) that had been performed before, and so-called tacit knowledge about the issue and work was not transferable as-is.”

“In addition, there were breaks in interactions on organisational grounds, overlapping and disguised decision situations. ... From the administration point of view, the project was transferred to a new actor in a new budgeting situation. Furthermore, the decision about the platform was decided by other actors and we were led to solutions that we found and still find problematic.”

“Now that MoSu has been implemented, we can state that, despite many problems, it as a system has functioned to that extent that it looks to be produced, pretty well. However, I argue that integration with the user interface, future development plans

and their changes, for example, could have been more profound. In addition, the work on many levels could have been done with less friction.”

“Unfortunately, during the project, factions have appeared in psychological terms, i.e. people have formed conceptions of other stakeholders. These conceptions may have unanticipated influences on the further development that may not have appeared if the setting – that to my mind should also be expressed in this presentation – i.e. the problem with customerhip that has been at least difficult during this piloting.”

“Now we know that the project succeeded pretty well despite all the factors that were preventing the implementation. Should you write about factors that were behind the success and that anticipate success? Is it possible to list such factors? However, in addition to all the complexity described in the literature, this case is in its own class because of its factors. It is a real miracle that the system has now been implemented into nation-wide use!”

6.3 Concise “lessons learnt”

What is a successful project? That with a commended output or that which has been carried out according to a strict process and project procedures? These questions came to my mind when I was thinking of the lessons learnt in this project.

Although the final assessment of a project depends on the timing of the evaluation, I feel that this project was a success. When reading notes from encounters and meetings, I find positive comments addressed directly to me e.g. *“Things are going exactly as they should.”* (March 30, 2005). These comments warm my heart but why did we succeed? In addition, I still remember the first meetings and discussions with people who had been involved in the previous project when student mobility was specified and the first steps towards an information system were taken. I felt the atmosphere to be very sceptical and even oppressive at times. On the other hand, I was not aware of the workload that some of the people faced.

Today, I know how this project was managed and I can confess my limitations when acting as a project manager. I know that the literature lists requirements for proper project management and I remember the percentages of failed information system projects. However, now I also know how an information system can be developed in the context of several universities participating in the development project. To my mind, the keywords are trust between project participants and flexibility, which is enabled with a high degree of reflection and awareness of what is happening in the project.

We were lucky that the project was organised as it was. There was one university that had applied for financial support from the Ministry of Education. In addition, it was the will of the Ministry to support student mobility between universities. The other universities participated with their motivated student affairs officials and this combination realised the need for the information system. In this way, the groundwork was laid. The chosen vendors were appropriate for this kind of information system, where

the requirements were not clear to the future users. In this project, the personal characters of the project managers also served the output.

Due to the financial situation in the project there was no need to argue about the costs and shares of payment. Instead, the project participants could concentrate on development work and on improving the process of student mobility. This situation also reduced the workload in the project management. As the project manager, I was under no pressure to limit the characteristics and functionalities that were requested by the student affairs officials when they felt it important that they be added to the information system. I only had to keep in mind the project schedule that was announced in the financing plan and agreed already in the first meeting that I attended to in June 2003. In addition, due to the financial situation, the universities did not compete about the functionalities that they felt to be important. Instead, they collaborated and aimed towards a common goal. In this sense, proper funding was essential to the positive output: a practical information system to support student mobility in universities.

In addition to the universities we had representatives from two university consortia that gave their expertise when needed. This expertise was essential because the MoSu information system was to serve among several others in the universities, and due to its inter-organisational nature several interfaces had to be built. Furthermore, one important – albeit unwritten – mission of MoSu was to push the universities to adopt Shibboleth as their authentication tool. The universities had committed to adopting Shibboleth but the implementation appeared to be a burden to them. With MoSu several universities implemented Shibboleth and in this sense MoSu also proved the benefits of Shibboleth.

Working as a project manager in such an inter-organisational information system implementation was interesting and rewarding. There were situations in which I perceived dissatisfaction in the project meetings and other events. Despite this unpleasantness I had to continue and carry the project forward. Even if I tried to avoid a formal approach as much as possible, I was hired as a project manager and my assignment was to get the information system ready and piloted according to its schedule. However, more than dissatisfaction, I felt the satisfaction and enthusiasm that arose every now and then. These positive and encouraging attitudes gave support to all the people who participated in the project in the middle of their daily work.

From the very beginning my role was that of a researcher and a project manager. However, I did not emphasise my researcher role in the project meetings because I felt that from the student affairs' point of view, the fundamental goal was to get a pertinent information system to support student mobility. On the other hand, my role as a researcher was never hidden from the participants. On the contrary, on several occasions we had fun when I joked that I would write their comments down to be used as my research material. Yet, my research was secondary to them and they were called to participate in the implementation work, not to contribute to my academic research.

As I write these concluding words, the information system is already forwarded to its new owner and administrator. The journey from the beginning, with conflicting ideas about the goal, to the transfer of the piloted information system was diverse and interesting and absolutely worth doing.

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- I Halonen R (2004) Resisting technical change – three case studies. *International Journal of Innovation and Technology Management* 1(3): 1-15.
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