

Department of Industrial Engineering and Management

Information and communication technology adoption at work

Employees' experiences of adoption and learning

Eija Korpelainen



INFORMATION AND
COMMUNICATION TECHNOLOGY
ADOPTION AT WORK
Employees' experiences of adoption
and learning

Eija Korpelainen

Doctoral dissertation for the degree of Doctor of Science in
Technology to be presented with due permission of the School of
Science for public examination and debate in Auditorium TU 1 at
the Aalto University School of Science (Espoo, Finland) on the 26th
of November 2011 at 12 noon.

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Aalto University publication series

DOCTORAL DISSERTATIONS 125/2011

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ISBN 978-952-60-4385-2 (printed)

ISBN 978-952-60-4386-9 (pdf)

ISSN-L 1799-4934

ISSN 1799-4934 (printed)

ISSN 1799-4942 (pdf)

Unigrafia Oy

Helsinki 2011

Finland

The dissertation can be read at <http://lib.tkk.fi/Diss/>



Author

Eija Korpelainen

Name of the doctoral dissertationINFORMATION AND COMMUNICATION TECHNOLOGY ADOPTION AT WORK
Employees' experiences of adoption and learning**Publisher** School of Science**Unit** Department of Industrial Engineering and Management**Series** Aalto University publication series DOCTORAL DISSERTATIONS 125/2011**Field of research** Leadership, organizations, and workpsychology**Manuscript submitted** 2 November 2011**Manuscript revised** 8 November 2011**Date of the defence** 26 November 2011**Language** English **Monograph** **Article dissertation (summary + original articles)****Abstract**

The aim of this thesis is to investigate employees' experiences of a successful adoption of information and communication technology (ICT) systems at work. Since organizations actively implement new ICT systems and previous literature has identified end users as the most common source of ICT implementation problems and failures, the topic of this study is relevant and timely. The literature reviews carried out for this thesis suggest that in the ICT adoption research there is a lack of studies which apply theoretical approaches that view ICT adoption as a dynamic and social process and which have a qualitative and interpretive research approach. The three empirical sub-studies in this thesis make a contribution to the existing knowledge of ICT adoption by studying qualitatively and comprehensively employees' experiences when they adopt ICT systems, for example, how the employees learn how to use ICT systems and what problems they encounter during the adoption and learning process. This thesis considers an ICT adopter as a solitary and autonomous actor but also as a social actor who is tightly engaged in his or her social environment and context.

The data were gathered from qualitative semi-structured interviews among 50 employees in three case organizations. The three case organizations represented different contexts: public and private and education, military, and industrial. The data were analyzed using a thematic analysis approach. The main findings show that employees prefer informal ways of learning how to use ICT, e.g., they ask for help from peers; the social context was the main source of use-related problems in ICT adoption, and self-determination in ICT adoption was experienced as a successful yet unsystematic way of adopting ICT. The main finding was that eight enablers for the successful adoption of an ICT system by employees were distinguished.

The theoretical implication is that this thesis shows how three alternative theoretical research approaches, the activity system model, the model of institutionalization as a structuration process, and a learning approach, can be applied in order to analyze and understand the adoption of ICT by individuals. The practical implication is that the thesis provides useful information for support staff, managers, and designers on the adoption of ICT by individuals, such as how the adoption of ICT systems proceeds, how employees learn how to use ICT systems, and what problems they encounter.

Keywords adoption, activity system model, implementation, information technology, information and communication technology, institutionalization, learning, structuration theory, technology acceptance model

ISBN (printed) 978-952-60-4385-2**ISBN (pdf)** 978-952-60-4386-9**ISSN-L** 1799-4934**ISSN (printed)** 1799-4934**ISSN (pdf)** 1799-4942**Location of publisher** Espoo**Location of printing** Helsinki**Year** 2011**Pages** 232**The dissertation can be read at** <http://lib.tkk.fi/Diss/>

Tekijä

Eija Korpelainen

Väitöskirjan nimiTIETO- JA VIESTINTÄTEKNIIKAN OMAKSUMINEN TYÖYMPÄRISTÖSSÄ
Työntekijöiden kokemuksia omaksumisesta ja oppimisesta**Julkaisija** Perustieteiden korkeakoulu**Yksikkö** Tuotantotalouden laitos**Sarja** Aalto University publication series DOCTORAL DISSERTATIONS 125/2011**Tutkimusala** Johtaminen, organisaatiot ja työpsykologia**Käsikirjoituksen pvm** 02.11.2011**Korjatun käsikirjoituksen pvm** 08.11.2011**Väitöspäivä** 26.11.2011**Kieli** Englanti **Monografia** **Yhdistelmäväitöskirja (yhteenveto-osa + erillisartikkelit)****Tiivistelmä**

Tämän väitöskirjan tavoitteena on tutkia työntekijöiden kokemuksia tieto- ja viestintäteknisten järjestelmien (TVT-järjestelmät) omaksumisen keskeisistä edellytyksistä. Aihe on tärkeä ja ajankohtainen, koska organisaatiot ottavat koko ajan uusia järjestelmiä käyttöön ja kokevat haasteita muun muassa siinä miten työntekijät omaksuvat ja oppivat käyttämään uusia järjestelmiä. Tätä väitöstutkimusta varten tehdyt kirjallisuuskatsaukset viittaavat siihen, että aikaisemmassa TVT-järjestelmien käyttöönoton tutkimuksessa on vain vähän aikaisempaa tutkimusta, joka tarkastelee käyttöönottoa dynaamisena ja sosiaalisena prosessina ja joka hyödyntää laadullisia ja tulkitsevia tutkimusmenetelmiä. Väitöskirjan kolme empiiristä osatutkimusta vastaavat aikaisemman tutkimuksen puutteisiin tutkimalla työntekijöiden kokemuksia TVT-järjestelmien käyttöönotosta laadullisilla ja tulkinnallisilla menetelmillä. Tämä väitöstutkimus tarkastelee TVT-järjestelmien käyttäjiä kokonaisvaltaisesti niin yksittäisinä ja itseohjautuvina kuin samalla tiukasti sosiaaliseen ympäristöönsä sidottuina toimijoina.

Aineisto kerättiin haastatteleamalla kolmessa organisaatiossa yhteensä 50 työntekijää. Kohdeorganisaatiot edustavat erilaisia toimialoja: julkinen ja yksityinen sektori sekä koulutus-, sotilas- ja teollinen ala. Aineisto analysoitiin laadullisesti teema-analyysillä. Tulokset osoittavat, että työntekijät haluavat oppia TVT-järjestelmien käytön informaalien oppimistapojen avulla, kuten kysymällä apua työtoverilta, ja että työntekijöiden sosiaalinen toimintaympäristö aiheuttaa eniten ongelmia käytön omaksumisen ja oppimisen aikana. Lisäksi havaittiin, että itseohjautuva käyttöönotto koetaan onnistuneena vaikka epäsystemaattisena tapana oppia TVT-järjestelmän käyttöä. Väitöstutkimuksen päätöksensä on kahdeksan työntekijöiden kokema tekijää, jotka mahdollistavat TVT-järjestelmien onnistuneen käyttöönoton.

Teoreettisena kontribuutiona väitös tuo esille kolme vaihtoehtoista teoreettista lähestymistapaa perinteisille lähestymistavoille TVT-järjestelmien käyttöönoton tutkimuksissa: toimintajärjestelmän malli, malli institutionalisoitumisesta strukturaatioprosessina ja käyttöönoton tarkasteleminen oppimisen näkökulmasta. Käytännön antina väitöstutkimus tarjoaa ohjeita tukihenkilöille, johtajille ja järjestelmien suunnittelijoille, kuten miten työntekijöiden TVT-järjestelmän omaksumisprosessi etenee, miten työntekijät oppivat käyttämään järjestelmiä ja mitä ongelmia he kohtaavat.

Avainsanat institutionalisoituminen, käyttöönotto, omaksuminen, oppiminen, strukturaatioteoria, toimintajärjestelmä, teknologian hyväksymisen malli, tieto- ja viestintäteknikka

ISBN (painettu) 978-952-60-4385-2**ISBN (pdf)** 978-952-60-4386-9**ISSN-L** 1799-4934**ISSN (painettu)** 1799-4934**ISSN (pdf)** 1799-4942**Julkaisupaikka** Espoo**Painopaikka** Helsinki**Vuosi** 2011**Sivumäärä** 232**Luettavissa verkossa osoitteessa** <http://lib.tkk.fi/Diss/>

Acknowledgements

The work on this thesis was carried out at the Department of Industrial Engineering and Management of the Aalto University School of Science. I would like to express my sincere thanks to my supervisor, Professor Matti Vartiainen, for the opportunity to work at the department, for his interest and positive attitude towards my work, and his instructions and insightful comments. I am deeply grateful to my instructor and co-author, Doctor Mari Kira (Aalto University School of Science), who always stood by my side and encouraged me, and helped me with constructive feedback and concrete development ideas, which substantially improved the outcomes of my thesis. I am grateful to my instructor Professor Jyri Manninen (University of Eastern Finland) for his skillful guidance and insightful comments. I am also grateful to Doctor Niina Rintala and Doctor Jyrki Kasvi for their interest and productive comments. I would like to thank the two pre-examiners of this thesis, Professor Kari Kuutti (University of Oulu) and Professor Samuli Pekkola (Tampere University of Technology), for their valuable efforts and insightful comments on the dissertation. It has been a privilege to have such experts read my work. I would like to express my gratitude to my colleagues at Aalto University and to my fellow students and Doctor Laura Helle in the Doctoral Program for Multidisciplinary Research on Learning Environments for their support and friendship.

For financial support, I would like to thank the Finnish Work Environment Fund, the Doctoral Program for Multidisciplinary Research on Learning Environments, the Finnish Doctoral Program in Industrial Engineering and Management, the Emil Aaltonen Foundation, and the Olga and Vilho Linnamo Foundation.

I further wish to thank the managers and the employees of the participating organizations, the University of Helsinki, the Finnish Defence Forces, and the Global Technology Company, for their time and interest and for giving me access to the data which have made this thesis possible.

Otaniemi, Espoo, October 30th 2011

Eija Korpelainen

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	ORIGINAL PUBLICATIONS	

List of original publications

The dissertation consists of an overall summary and the following original publications:

- 1 Korpelainen, E. (2011). Theories of ICT system implementation and adoption – A critical review. *Aalto Publication Series, Science + Technology, Working Paper 9/2011*.
- 2 Korpelainen, E., & Kira, M. (2010). Employees' choices in learning how to use ICT systems at work: Strategies and approaches. *International Journal of Training and Development*, 14(1), 32–53. DOI:10.1111/j.1468-2419.2009.00339.x.
- 3 Korpelainen, E., & Kira, M. (2011). Systems approach for analysing problems in IT system adoption at work. *Behavior & Information Technology*, DOI:10.1080/0144929X.2011.624638.
- 4 Korpelainen, E., Vartiainen, M., & Kira, M. (2010). Self-determined adoption of an ICT system in a work organization. *The Journal of Organizational and End User Computing*, 20(4), 51–69. DOI: 10.4018/joeuc.2010100103.

Copies of the articles are appended to the report. All the articles are reprinted with the original publisher's permission.

Contribution of the doctoral candidate: in the co-authored articles 2, 3, and 4 the data were gathered and analyzed by the author. She is also responsible for writing the articles, while the other authors participated in composing the theoretical frameworks and provided feedback on the manuscripts.

1 Introduction

Information and communication technologies (ICT) have spread to all fields of society, and they connect organizations, homes, and schools (Heiskanen, 2004; Iivari et al., 2010; Webster, 2006). ICTs offer organizations new opportunities to increase the effectiveness of interaction and collaboration, workplace learning (Andriessen, 2003), and work performance (Ciborra & Patriotta, 1996; Jones & Kochtanek, 2004; Nunamaker, 1997; Orlikowski, 1996). For example, they speed up the exchange of information, create easy access to information, allow many people to receive information at the same time, and make it easier to reach people (e.g., Andriessen, 2003, p. 20). Therefore, contemporary organizations invest actively in new and more advanced ICT systems in order to maintain and improve their performance capacity and competitiveness. However, new implementation projects often face problems and failures (Bullen & Bennet, 1990; Burns & al., 1991; Grudin, 1989; Kwon & Zmud, 1987; Orlikowski, 1993), and the literature has recognized end users as the most common source of implementation problems (Adams et al., 2004; Jiang et al., 2000; Kim & Kankanhalli, 2009; Klaus et al., 2007; Lorenzi & Riley, 1995; Markus, 1983; Orlikowski, 1993). This thesis focuses on employees' adoption processes as they begin to use ICT systems in order to enhance their work, collaboration, and learning at work. Thus, this thesis adds to the theoretical knowledge by applying alternative theories and models in order to analyze and understand ICT system adoption. It also adds to the practical knowledge on how the adoption of ICT systems proceeds, how employees learn how to use ICT systems, and what problems they encounter.

1.1 Research objectives and questions

In this thesis I focus on the adoption of ICT systems by employees, and study employees' experiences concerning ICT system adoption, the ways in which they prefer to learn how to use the systems, and the problems they may encounter. Adoption is understood as an individual change process which is one part of an organizational change process in which a new ICT system is implemented in an organization. The adoption of new ICT systems requires employees to adapt their knowledge, skills, and work routines in order to meet the new requirements resulting from changes in work practices (cf. Billett, 2008; Fenwick, 2001). Thus, the adoption of ICT systems

by employees can also be viewed as a learning activity in which employees modify existing work routines or establish new ones (Becker, 2004; Becker et al., 2005).

The objective of this thesis is to add to the theoretical and practical knowledge concerning the adoption of ICT systems by employees. Therefore, I formed an overall research question: what kinds of factors do employees experience as enablers for the successful adoption of an ICT system at work? A successful adoption refers to the employees' subjective experiences of a meaningful and smooth but effective way of adopting and learning how to use ICT systems at work. I answer the overall research question by combining the results from three empirical sub-studies, namely sub-studies 2, 3, and 4. The three empirical sub-studies serve as sub-aims of the overall objective of the research by examining their individual research questions, each of which focuses on essential phenomena related to ICT adoption by employees (Table 1). Sub-study 1 is a literature review, and its aim is to examine which theories have been applied and which topics have been studied concerning ICT system adoption and implementation in the field of management and business research.

In this thesis ICT adoption by individuals and organizational ICT implementation are examined through employees' experiences and perceptions. This means that the employees' experiences and perceptions that construct their subjective realities are studied. Emphasizing the subjective nature of reality is in line with the phenomenological view, according to which a person and the world are inextricably related through the person's lived experience of the world (Sandberg, 2005). Examining individuals' experiences is beneficial since descriptions of lived experiences bring authentic information about the individuals' observations, emotions, beliefs, thoughts, opinions, conceptions, and valuations (Latomaa, 2005). Thus, the researcher is able to find out and understand, for example, what is important or trivial for the interviewees, and what they pay attention to and why.

Table 1. Brief description of the research questions, theoretical frameworks, data, and research methods applied in each sub-study.

Sub-study	1	2	3	4
Title of the article	Theories of ICT system Implementation and Adoption – A Critical Review	Employees' choices in learning how to use ICT systems at work: Strategies and approaches	Systems approach for analyzing problems in ICT system adoption at work	Self-determined adoption of an ICT system in a work organization
Research Questions	1a) What theories and models are used by the most cited publications (articles and books) in order to analyze and understand ICT system implementation and adoption? 1b) How are the theories and models applied and what themes are addressed in the most cited articles in the field of ICT system implementation and adoption research?	2) What kinds of approaches to learning and what kinds of strategies for learning and problem solving do employees choose when learning how to use ICT systems in work settings?	3) What use-related problems do employees experience when they adopt ICT systems at work?	4) What possibilities and problems do the users perceive in the self-determined adoption and use of an ICT system?
Theoretical framework	Examines what theories have been applied in ICT adoption research and how	The elements of a learning activity in the context of ICT systems at work	Activity system model	The model of institutionalization as a structuration process and self-determination theory
Philosophical foundations	Interpretive and positivistic "descriptive"	Interpretive	Interpretive	Interpretive
Research design	Bibliometric method combined with qualitative analysis	Basic qualitative study, elements taken from the phenomenological and case study designs	Basic qualitative study, elements taken from the phenomenological and case study designs	Qualitative single case study design
Data	1303 articles retrieved from the ISI Web of Science with ICT implementation- and adoption-related contents	39 semi-structured interviews with ordinary users and support persons	39 semi-structured interviews with ordinary users and support persons	11 semi-structured interviews with support and HR persons, operational employees, and middle managers
Analysis	Qualitative content analysis, citation analysis	Thematic analysis	Thematic analysis	Qualitative content analysis

The first sub-study in this thesis reviews ICT system implementation and adoption studies which have been carried out previously in the field of management and business research. I actually conducted sub-study 1 after I had completed the three empirical sub-studies. After many years of studying ICT adoption and learning how to use ICT in organizational settings my observation was that there are only a few other studies examining ICT adoption and learning from the same theoretical and methodological points of views as I did. Thus, my objective was to conduct an extensive systematic literature review in order to complement the theory reviews I had already produced earlier for sub-studies 2, 3, and 4. The prior knowledge from these theory reviews guided me to choose the relevant search words I used in the systematic literature research in sub-study 1.

Sub-study 1 focuses on the most influential theories applied and the research topics studied. Other reviews have been conducted addressing ICT implementation and adoption in organizations (e.g., Jeyaraj et al., 2006; Venkates et al., 2003). These reviews focus on analyzing the functionality and validity of implementation and adoption theories and models. They often examine one theory or model and base their findings on a relatively small sample of articles (e.g., Legris et al., 2003 and Lee et al., 2003 on the technology acceptance model (TAM); Fickman, 1992 and Prescott & Conger, 1995 on diffusion of innovations (DOI)). The existing reviews do not provide an extensive overview of the most influential theories which are used in implementation and adoption research and of their applications. Thus, a wide and structured review of the most influential theories and models in ICT implementation and adoption research, their research topics, and theoretical implications seems to be missing. Therefore, sub-study 1 is a literature review with the following research questions:

- 1a. What theories and models are used by the most cited publications (articles and books) in order to analyze and understand ICT system implementation and adoption?
- 1b. How are the theories and models applied and what themes are addressed in the most cited articles in the field of ICT system implementation and adoption research?

The second sub-study in this thesis describes how employees learn how to use ICT systems in order to enhance their working, learning, and collaborating in organizational settings. The focus is on the elements of the learning process, employees' approaches to learning, and their strategies for learning and problem solving. The adoption of a new ICT system may require considerable effort from its users since, in addition to using systems technically, they also need to learn new ways of working (West et al., 2007), communicating, training and studying with the help of the system (Andriessen, 2003). Users' skills and their fluency in using ICT systems have a critical

impact on whether the desired goals of the adoption of the system can be achieved (Committee on Information Technology Literacy, 1999). Despite the fact that several researchers view learning theories and concepts as being beneficial in explaining and understanding ICT implementation and adoption (Attewell, 1992; Auer, 1998; Bagozzi et al., 1992; Boudreau & Robey, 2005; Fickman, 1992; Gallivan, 2001), I was only able to find a few studies which apply theoretical learning models or learning-related concepts when studying ICT adoption by individuals in organizational settings (e.g., Spitler, 2005; Twidale, 2005). Thus, there seems to be a need for a study which promotes the understanding of ICT adoption by individuals at work from the point of view of learning. Sub-study 2 is an empirical study with the following research question:

2. What kinds of approaches to learning and what kinds of strategies for learning and problem solving do employees choose when learning how to use ICT systems in work settings?

The third sub-study in this thesis examines the use-related problems that employees experience while they adopt and learn how to use ICT systems. User problems are a widely studied topic in information systems research, and the studies frequently focus on user resistance (e.g., Adams et al., 2004; Jiang et al., 2000; Klaus et al., 2007; Lapointe & Rivard, 2005; Lorenzi & Riley, 1995; Speier & Venkatesh, 2002; Worthley, 2000). The research field focusing on the adoption of technology by individuals has developed a strong theoretical framework by using technology acceptance models, as sub-study 1 and several other studies show (e.g., Davis et al., 1989; Jeyaraj et al., 2006; Mathieson, 1991; Venkates et al., 2003). These models aim at predicting and explaining potential adopters' attitudes, beliefs, and intentions when adopting ICT systems. However, it has been argued that they pay only rather limited attention to organizational and social factors (e.g., Bagozzi, 2007; Attewell, 1992). For example, Kaptelinin et al. (1999) argue that social and contextual factors are necessary in human-computer interaction (HCI) studies. Thus, there seems to be a need for a research study which would take comprehensive account of organizational and social factors in order to better understand what use-related problems employees encounter. So as to map comprehensively the various problems experienced by users in ICT system adoption, models that pay attention to the adoption process and its contextual factors are needed. Therefore, I chose the activity system model (Engeström, 1987) as the theoretical framework in order to analyze and understand individuals' ICT adoption problems as comprehensively as possible. As a theory, the activity system model includes, in a broad

manner, the various elements in a work system as well as their interactions, and thus allows the phenomenon to be assessed from many angles (Bannon & Bødker, 1991). Sub-study 3 is an empirical study, which includes the following research question:

3. What use-related problems do employees experience when they adopt ICT systems at work?

Finally, the fourth sub-study in this thesis focuses on a successful adoption process in which the employees were allowed to decide freely whether to adopt an ICT system or not. A successful adoption refers to the employees' subjective experiences of a meaningful and smooth but effective way of adopting and learning how to use ICT systems at work. Since problematic ICT adoption processes have been documented efficiently in previous studies (e.g., Jiang et al., 2000; Klaus et al., 2007; Lapointe & Rivard, 2005; Lorenzi & Riley, 1995; Markus et al., 2000; Worthley, 2000), this successful adoption process provided an interesting and dissimilar case for a sub-study. There are several descriptions of models for the introduction and adoption of ICT systems in the literature. Most often, the models depict an implementation process which proceeds step by step from the scanning of organizational needs to a full and effective use of technology in daily practices (e.g., Cooper & Zmud, 1990; Kwon & Zmud, 1987; see also Orlikowski & Hofman, 1997, for a critique and an alternative view of change). However, the initial analysis of the case in sub-study 4 indicated that the adoption proceeded with a bottom-up approach and was more dynamic than those described in the previous literature. My co-authors and I found that the insights of Barley and Tolbert (1997) concerning structuration theory and institutional change resonated in the case depicted in sub-study 4. The model made it possible to view the adoption process as a dynamic and social process. Therefore, we decided to use Barley and Tolbert's (1997) approach to describe a dynamic and social ICT adoption process, and identify and analyze the factors which had an impact on the successful adoption. Sub-study 4 is an empirical study with the following research question:

4. What possibilities and problems do the users perceive in the self-determined adoption and use of an ICT system?

1.2 Two research projects as the basis of the thesis

This thesis is a result of two research projects. The first, preliminary project was called “Use of collaborative work systems from the perspective of the development and maintenance of personnel’s competence” (in Finnish: Ryhmätyöjärjestelmien käyttö ja toimivuus työorganisaatiossa henkilöstön osaamisen kehittämisen ja ylläpidon näkökulmasta, OPPI). It took place in 2005, and was funded by the Finnish Work Environment Fund. A global technology company served as a case organization. The project focused broadly on the introduction and use of ICT systems in work organizations and on their benefits and challenges. The purpose was to identify research problems for a larger research project. The second, larger research project, called “Collaborative ICT systems supporting organizations’ capabilities” (in Finnish: Yhteistyöjärjestelmien käyttö ja toimivuus organisaation kyvykkyyden tukena, KYKY), took place from the spring of 2006 to the end of 2007. Two organizations, the Finnish Defence Forces and a global technology company (the same company as in the first research project), served as case organizations. The research project studied the introduction and use of collaborative ICT systems in organizations. The project focused on how these ICT systems supported work activities and learning at work and what kind of support and guidance their users needed. The project was funded by the Finnish Work Environment Fund, the Finnish Defence Forces, and the global technology company involved in the study. A significant part of the project was funded by the Doctoral Programme for Multidisciplinary Research on Learning Environments (OPMON). The results of this project were presented, for example, at the Educational Website Seminar in the Finnish Defence Forces, Santahamina, Helsinki, on November 2007 and in the Finnish Work Environment Fund public seminar which was held in order to deliver the research results for the practical use and benefit of those interested in the field (the Finnish name of the seminar is Tutkimus tutuksi) in February 2008. The research at Helsinki University was conducted at the same time, but it was not a part of the larger project.

1.3 Storyline of the study

The four sub-studies form an entity. Sub-study 1 reviews the previous literature on ICT adaption research, focusing on articles published in the ISI Web of Science. It examines theories that have been applied and research topics that have been studied in ICT adoption research, and shows the

strengths, limitations, and research gaps of the previous literature. Additionally, sub-study 1 complements the theory reviews made in the empirical sub-studies 2, 3, and 4. The chronological order in which the articles were written is not the order in which they are presented in this thesis: I wrote article 4 first, then articles 2 and 3, and finally the review article 1. Writing sub-study 1, that is, the review, as the last article may appear somewhat surprising, because literature reviews are usually written first. The reason why I wanted to conduct a wide literature research after the empirical articles was that during the course of my doctoral studies, starting from 2005, I realized that despite considerable endeavor in searching through the relevant literature I had found only a few publications focusing on ICT adoption and learning how to use ICT at work from the theoretical and methodological points of view from which I studied them. Thus, I wanted to confirm my discovery and conducted a wide and systematic literature research that paid special attention to learning. However, I chose to discuss the literature review in sub-study 1 as the first sub-study in this thesis.

The empirical field sub-studies 2, 3, and 4 aim to fill the research gaps detected both in the systematic literature research in sub-study 1 and in the theory reviews of each empirical sub-study, and to explore the unanswered questions from new and innovative angles. The empirical sub-studies represent qualitative research as they focus on individuals' experiences of ICT adoption in organizational settings from different points of view. Sub-study 2 focuses on the first steps of the adoption processes of individuals by examining the employees' experiences of how they choose to learn to use ICT systems, and how this kind of learning process proceeds. It also examines the on-going use of ICT systems by focusing on problem solving related to ICT use. Sub-study 3 supplements the learning approach and shows the potential learning challenges by examining the problems employees experience when they learn how to use ICT systems and solve use-related problems. Additionally, sub-study 3 proposes an alternative theoretical framework to the traditional technology acceptance models detected in sub-study 1 by applying Engeström's (1987) activity system model. Engeström's model allows employees' ICT adoption-related problems to be comprehensively analyzed and understood in the context of a dynamic and social system. Sub-study 4 also proposes an alternative to the traditional stage models of ICT implementation (see sub-study 1) and thus proposes a new way to examine ICT implementation and adoption in organizations. The model of institutionalization as a structuration process by Barley and Tolbert (1997) makes it possible to capture both the dynamics and the unexpected changes of an ICT system adoption process. Sub-study 4 examines a successful adoption process of an ICT system, focusing particularly on organizational structures and daily work activities, and how these interact with each other. However, the adoption process is examined from the perspective of the employees: how they experienced the adoption of an ICT system in which they

voluntarily adopted an internet-based meeting system and in which their interests guided the adoption process, as well as how the system was used. By studying structures and their formation in an organization, and by considering a concept related to learning, namely self-determination or self-direction, sub-study 4 brings additional insights into the experiences associated with an individual case of ICT adoption. All three sub-studies point out that employees are not only passive recipients of technological systems, but play an important and active role in making ICT systems work in organizational settings (McLaughlin & Skinner, 2000). With these three sub-studies I was able to examine the overall aim of this thesis, namely the enablers for a successful adoption of ICT systems in organizations.

1.4 The structure of the thesis

This thesis consists of a summary and four separate articles. Three of the articles (sub-studies 2, 3, and 4) have been published in international scientific journals. One article (sub-study 1) has been published in the Aalto Publication Series as a working paper. The purpose of the summary is to recap and review the research process and key findings and contributions of the articles. The four articles are enclosed in appendixes, and they are reprinted with the permission of their original publishers. The articles are referred to as sub-studies. I will also use descriptive names for the sub-studies when needed in order to concretize the context of the sub-studies: sub-study 1 is “the review”, sub-study 2 “the learning model”, sub-study 3 “the problems”, and finally sub-study 4 “the self-determination”. Each sub-study focuses on a specific area of ICT adoption. I examine the four sub-studies separately in most of this summary in order to bring out their individual contributions. I have enclosed tables and summaries in order to grasp the entity which the four sub-studies form. Finally, I answer the overall research question on the basis of the three empirical sub-studies and summarize the research contribution. Therefore this summary also provides a contribution of its own.

The structure of the summary is as follows. In the second chapter I consider the theoretical foundations of this thesis. First, I address the terminology and key concepts of this thesis. Then, I consider three different theoretical frameworks, namely the elements of a learning activity in the context of ICT systems at work, the activity system model, and the model of institutionalization as a structuration process. In the third chapter I consider the research design, methodology, and research processes of each sub-study. In the fourth chapter I examine the findings and

contribution of each sub-study and answer the overall research question. Finally, in the fifth chapter I summarize the research findings and discuss their contribution to the existing literature, discuss the theoretical and practical implications, assess the reliability and validity of this thesis, discuss the limitations of the research, and give recommendations for further research.

2 Theoretical foundations

In this chapter I define the essential terminology and key concepts of this thesis. First, I review the terminology applied in ICT implementation and adoption research, and define how I comprehend ICT in my thesis. Second, I discuss ICT implementation and adoption as processes, and review the terminology used. I also define the two essential terms I use in every empirical sub-study, namely ICT implementation and adoption. Third, I briefly define how learning is understood in this thesis. Fourth, I depict the theoretical frameworks in sub-studies 2, 3, and 4. In these sub-studies, I have applied existing theories in a new research context in order to discover fresh and innovative insights and analysis concerning ICT adoption.

2.1 Terminology and key concepts of the thesis

2.1.1 Terminology in ICT implementation and adoption research

The terminology related to information and communication technology (ICT) research varies and is changing all the time because of the rapid development of the field (Andriessen, 2003). First, different research communities may define terms differently; for example, in computer science and software engineering implementation refers to the actual coding of the system, while in information systems research and practice it refers to “the process of introducing the technology in an organizational setting” (Munkvold, 2003b, p. 30). Second, researchers may use various terms referring to information and communication technology, for example, groupware technology (Orlikowski & Hofman, 1997), new technology and collaborative technology (Majchrzak et al., 2000), advanced technology (DeSanctis & Poole, 1994), and collaboration technology or telematics (review by Andriessen, 2003). Third, different research communities may name their research area differently, for example, virtual teams (Majchrzak et al., 2000), computer-mediated communication, or computer-supported cooperative work (review by Andriessen, 2003). Additionally, there is a wide variety of technology systems, applications, and software (e.g., Munkvold, 1999) which the researchers may refer to when reporting their research

findings. This multitude of terms makes it difficult to identify previous research in ICT system implementation and adoption (e.g., whether all the relevant search terms have been identified and used), and to make comparisons between different findings and research implications (Andriessen, 2003) (e.g., what kinds of systems, applications, and software the results apply to).

In general, information technology (IT) refers to “the development, implementation, and maintenance of computer hardware and software systems to organize and communicate information electronically” (Information Technology, n.d.). In the literature IT and information systems (IS) are often thought to be synonymous. However, the Software Engineering Institute (n.d.) defines IS as “any combination of information technology and people’s activities using that technology to support operations, management, and decision-making”. In this study I use the term information and communication technology (ICT) systems in order to emphasize its purpose of use, namely, that these systems include technology to store and utilize knowledge, as well as technology which enables communication and interaction to take place. Thus, in this thesis the term ICT systems refers to all information technology tools and applications which are designed to support interaction and collaboration in work within or across organizations and with customers (cf. Korpelainen & Vartiainen, 2007). ICT systems are used for several purposes, for example, the exploitation of shared knowledge, learning, co-ordination of activities, and offering various services for customers. In the final analysis, ICT covers all the equipment, infrastructure, and applications which are used to process and manage information in organizations.

2.1.2 ICT implementation and adoption as a process

Kwon and Zmud (1987, p. 231) define ICT system implementation “as an organizational effort to diffuse an appropriate information technology within a user community”. Munkvold (2003a, p. 3) provides a more detailed definition of implementation, which is in line with Kwon and Zmud’s (1987, p. 231) definition: “organizational implementation incorporates all activities related to deployment and adoption of a new technology, namely requirements specification, acquisition and/or design and development, installation, training and internalisation of routines for effective utilization”. Cooper and Zmud (1990) and Kwon and Zmud (1987) conceptualize an ICT system implementation process as a six-stage model (Table 2). (The name of the model is originally ‘Model of information systems implementation process’.) The model covers an implementation process from the scanning of organizational needs to a full and effective use of the technology in daily practices. However, an actual implementation process is rarely linear, but iterative, and the different stages partly overlap (Cooper & Zmud, 1990; see also Munkvold, 2003b). The strength

of the model is that it helps in gaining a comprehensive understanding of the different stages, the activities and terms connected to each stage, and the prominence of each stage in an ICT implementation process (e.g., Prescott & Conger, 1995; Soh & Markus, 1995).

Table 2. The model of an ICT system implementation process (based on Cooper & Zmud, 1990; reviewed by Munkvold, 2003b; Kwon & Zmud, 1987).

Stage	Activities
1. Initiation	Scanning organizational needs and ICT solutions
2. Organizational adoption	Negotiations to get organizational backing for novel ICT implementation
3. Organizational adaptation	Developing, installing, and maintaining the ICT system. Developing new organizational procedures. Training users both in the new procedures and in the use of ICT
4. User adoption and acceptance	Inducing the members of the organization to use the technology
5. Established use	Use of the ICT system is encouraged among employees as a normal activity
6. Infusion	The intended benefits of the technology are obtained through effective use of the technology

The term ‘adoption’ is often used to depict a decision process whether or not to accept the use of the system. Thus, adoption refers to “a decision to make full use of an innovation” (Rogers, 1995, p. 21, see also Davis, 1989; Venkatesh et al., 2003). It can refer to either organizational adoption or user adoption (e.g., Cooper & Zmud, 1990; Kwon & Zmud, 1987; Rogers, 1995). However, implementation research also employs other terms to depict the implementation and adoption processes, such as assimilation and adaptation. These two terms refer to a more focused phenomenon than the organizational implementation depicted in Table 2. The term ‘assimilation’ is used to describe how the technology is taken up by a user community. Assimilation refers to “the extent to which the use of a technology diffuses across organizational work processes and becomes routinized in the activities associated with those processes” (Chatterjee et al., 2002, p. 66; see also Fichman & Kemerer, 1997). The term ‘adaptation’ is also used to describe how technology is adopted for use by a user community (DeSanctis & Poole, 1994). For example, Majchrzak et al. (2000) consider adaptation and refer to a dynamic process in which people incorporate new technology into their work practices with technology. They studied the ICT adaptation of a virtual team focusing on social and technological structures.

In this study, I define ‘implementation’ according to Kwon and Zmud (1987) and Munkvold (2003a) as referring to an organizational effort incorporating all the activities related to the deployment and adoption (or diffusion) of a new technology into the user community, as

depicted in Table 2. Adoption is a focal term in this thesis, and it refers to the adoption of an ICT system by an individual, in which an individual learns how to use an ICT system and how this process proceeds. Thus, in this thesis, adoption refers to wider phenomena than merely the decision whether to accept the use of an ICT system or not (cf. Davis, 1989; Rogers, 1995; Venkatesh et al., 2003). Actually, it includes three stages from Cooper and Zmud's implementation process (Table 2), namely the organizational adaptation stage (i.e., training of users), the user adoption and acceptance stage, and the established use stage. From the user adoption and acceptance stage onwards, the linear process depicted in Table 2 may be interrupted. Users explore and learn to use the system bit by bit; they may use some operations of the system fluently, even though some other operations are still unfamiliar. Users may also choose different ways of acting instead of those suggested by the ICT system or existing institutional rules, resources, and values. Thus, the adoption of ICT systems, as it is understood in this thesis, also includes activities that occur after the introduction and initial adoption of the system. The adoption process is evolving and dynamic when users get to know more about the system and its use, and they may even find new ways of using it (cf. Karsten, 1999; Korpelainen et al., 2008, pp. 8-11).

2.1.3 The adoption process as a learning activity

Since I compare an ICT adoption process to a learning process, I define learning and clarify briefly the way in which learning is understood in this thesis. I emphasize that this thesis focuses on individual learning, and group and organizational learning are not studied. Learning, and especially learning at work, has been defined and approached in many ways. For example, Illeris (2004; 2011) and Billet (e.g., 2006) focus on workplace learning, Boud and his colleagues (1993) on experience-based learning, Lave and Wenger (1991) on situated learning, Wenger (1999) on communities of practice, Marsick and Watkins (1992) on informal learning, Engeström (2001) on expansive learning, Bereiter and Scardamalia (1993) on expert learning, and Argyris and Schön (1996) on organizational learning with an emphasis on individual learning. Illeris (2007, p. 3) defines learning broadly as “any process that in living organisms leads to permanent capacity change and which is not solely due to biological maturation or ageing”. He points out that it is crucial that the change is permanent to some extent, and that the change is not due to maturation. Illeris (2011) stresses that learning must always involve both individual cognitive processes and social processes, and they must occur at the same time. Thus, there are always direct or indirect interactions between people in learning processes (Illeris, 2004). Even when learners are alone in

learning situations, they are influenced by the social environment mediated through, for example, reading or electronic media (Illeris, 2011). Learning is also a situated process (Lave & Wenger, 1991): it takes place in a specific situation or context which has an impact on the learning possibilities and process, and the outcome of that process (Illeris, 2004; 2011).

Illeris's (2007; 2011) emphasizes that all learning has three dimensions, namely: the content dimension (what is learned); the incentive dimension (motivation, the mental energy), and the interaction dimension (interaction processes between the learner and the social and societal environment). Learning occurs by assimilating, in which learners add or connect new experience to their existing knowledge. This can also be called ordinary learning. Learning also occurs by accommodating, in which learners adjust or adapt their existing knowledge to the new situation by creating new knowledge. Accommodative learning is more psychologically demanding than assimilative learning, and it is connected to "a high degree of individual understanding and particular forms of comprehension" (Illeris, 2007, p. 40). Illeris depicts one more type of learning, namely transformative learning, which refers to the restructuring of an individual's self or identity, or a new understanding or a fundamental tenet. It is a demanding and far-reaching way of learning, and can be mobilized in more unusual contexts. This type of learning influences the individual at different levels; besides cognition, emotional and social aspects of an individual may also change. To summarize, in this thesis, learning is understood as a process that leads to changes in the individual's capacity. Learning always involves both individual cognitive processes and social processes at the same time, and it takes place in a specific situation or context which has an impact on the learning possibilities and process, and the outcome of that process.

2.2 Theoretical frameworks in the empirical sub-studies

In this section I address the theoretical frameworks in the empirical sub-studies. However, sub-study 1 is a review, which examines how existing theories have been applied in ICT implementation and adoption research and does not have a theoretical framework of its own. Therefore, I do not address sub-study 1 here. In sub-studies 2, 3, and 4, I have applied existing theories to a new research context in order to find different and fresh insights and analysis regarding the adoption of ICT systems by individuals. This means that I have "analyzed and interpreted the data in the light of the concepts of a particular theoretical orientation" (Merriam,

2009, p. 70). The intention was to broaden the understanding of the theory more than to build a new theory or test an existing one. In sub-study 2, my co-authors and I composed and applied a learning model based on the previous literature. The intention was to help to analyze employees' approaches to learning, as well as strategies for learning and problem solving. In sub-studies 3 and 4 I applied two theories which identified and analyzed the adoption of ICT systems from new perspectives. In sub-study 3, I applied Engeström's (1987) activity system model in order to analyze and understand comprehensively the use-related problems employees encountered when they adopted ICT systems. In sub-study 4, I applied the model of institutionalization as a structuration process conceptualized by Barley and Tolbert (1997), in order to examine a successful ICT adoption. Barley and Tolbert's model brought a new and dynamic approach to examining ICT adoption.

2.2.1 Elements of a learning situation (sub-study 2)

In sub-study 2, I examined how employees learned how to use ICT. My co-author and I created a framework in order to describe the various elements involved in learning during the adoption and use of an ICT system. The framework is based on the activity system model of Engeström (1987), and the same elements can be discerned in the approaches of Ramsden (1988) and Berings et al. (2005). The activity system model emphasizes that human activity always has an object, that is, an individual has a purpose for doing something. It also pays attention to the social and contextual factors in which the human activity takes place, and to the fact that members of the organization and the work environment have an impact on the individual who is acting. The framework was used in order to analyze and understand the learning-related data collected in this study. The learning situation is created by the interaction between the context of learning, the object of learning, and the learner (Figure 1). Additionally, approaches to learning and strategies for learning and problem solving can be seen as the tools with which the learner accesses the object of learning and achieves learning outcomes, i.e., the dynamic and continuously developing skills needed to use the ICT system (called in brief "skills in using ICT" in sub-study 2).

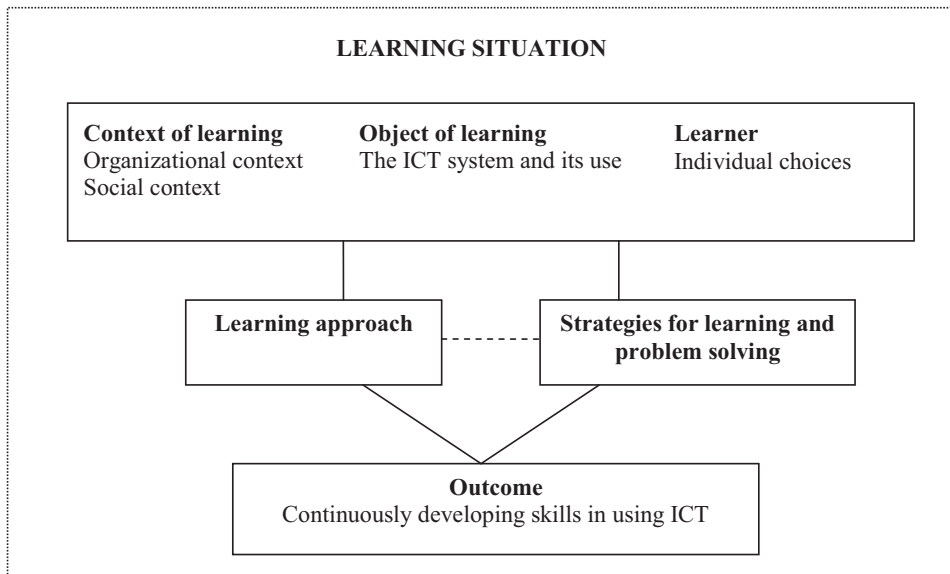


Figure 1. The elements of a learning activity in the context of ICT systems at work (inspired by Ramsden, 1988; see also Berings et al., 2005; Engeström, 1987).

The *context of workplace learning* can be approached from two perspectives: first, the organizational context of learning, describing the degree of organizationally induced formality or informality present in learning (e.g., Hager, 1998; Malcolm et al., 2003); second, the social context of learning, addressing whether the learning is a solitary effort on the part of the learner, or whether it takes place by learning from others or together with others (e.g., Doornbos et al., 2004). The *object of learning* is the ICT system and its use. According to activity theory (Engeström, 1987), when people work, they focus on the work task and the ICT system is the mediating tool. However, when employees learn how to use an ICT system or when they encounter problems in it, they temporarily place the main focus on the system itself and it becomes the object of their learning activity.

The *learner* is an actor in a learning situation, and makes individual choices during the learning process. This study focuses on employees' actual choices and behaviors while learning – how, in general, they approach the learning activity and what strategies they choose for learning and problem solving. Approaches to learning refer to a set of motives and strategies which learners choose and use to achieve the desired learning outcomes (Biggs, 1988; Marton & Säljö, 1976). People may choose qualitatively different approaches to learning, namely surface, deep (Biggs, 1988; Entwistle, 1998; Marton & Säljö, 1976), and strategic (Entwistle & Ramsden, 1983) approaches. Entwistle (1998) in particular has elaborated these approaches. The surface

approach to learning refers to learning where the intention is to complete task requirements. The motivation is often extrinsic. The learner focuses on the task and discrete pieces of information, and associates facts and concepts unreflectively. According to Entwistle, the outcome is a superficial level of understanding. A deep approach refers to learning where the intention is to understand the object of learning. The motivation is often intrinsic and comes from interest in the subject matter and its perceived relevance. The learner organizes the content into a coherent whole, and the outcome is a deep level of understanding and grasping the meaning of the object of learning (Entwistle, 1998). The third category, the strategic approach, which has been recognized as a study approach, combines deep and surface approaches in order to achieve high grades by using effective study methods and time management (Entwistle & Ramsden, 1983). In the context of workplace learning it could refer to learning in which the learner's intention is to learn well but fast only the most essential things needed. An approach to learning is not a characteristic of the learner, but it is a representation of what a specific learning task is for the learner in a specific context (Marton, 1988), making every learner capable of using all three approaches (Ramsden, 1992).

Learning strategies refer to practices that learners use to aid the acquisition and development of new knowledge (e.g., Kardash & Amlund, 1991; Weinstein & Mayer, 1983). Problem solving is considered to be a powerful way of learning in work settings, since learning takes place in a concrete manner while learners are engaged in problem solving in daily workplace practices (Bereiter & Scardamalia, 1993; Ellström, 2001; Lohman, 2002; Schön, 1987). In line with Chi and Glaser (1985), I understand a problem as referring to a situation where an individual has a goal (although the goal may not be clear, but vague and continuously changing (Ellström, 2001)), and must find some means to reach the goal. However, these means are not automatically available and a non-routine situation emerges (Marsick & Watkins, 1992). My co-authors and I formulated a simplified matrix to classify and analyze learning strategies and problem-solving strategies according to the two learning contexts (Figure 2). In the matrix, each learning or problem-solving strategy is characterized by its degree of formality or informality (the organizational context) and by whether it focuses on learning alone, from others, or with others (the social context). I have placed some examples of learning strategies in the matrix in Figure 2.

	Social context		
Organizational context	Alone	From others	With others
Formal	Takes a self-study course guiding ICT use	Participates in a user training session	Carries out a training exercise with colleagues in a user training session
Informal	Tries things out, reads manuals	Asks for help from other people	Tries things out with others and they assist each other while working

Figure 2. Examples of learning strategies in a simplified matrix to classify and analyze learning strategies according to two different learning contexts.

Finally, in the elements of a learning activity the last element is the *outcome* of learning. The purpose of learning in the context of ICT adoption is usually to gain or enhance the skills needed to use ICT systems at work. The desired learning outcome in ICT system adoption is often an increase in competence, or in the ability to do one’s work with the help of the system. The learning outcome in this model is defined in line with the principles of the activity system model, in which the outcome of the activity is not predetermined, but it emerges and is shaped during the activity (Engeström, 1987). Thus, the learning outcome in the model refers to the dynamic and continuously developing skills needed to use the ICT system.

The theoretical framework of sub-study 2 depicts a conceptualization of a learning situation in an organizational context, and focuses on how employees learn how to use ICT systems. It concentrates on the employees’ approaches to learning, as well as on strategies for learning and problem solving. The emphasis of this learning situation is on informal ways of learning, and on the individuals’ ways of choosing how to learn. The matrix for classifying and analyzing learning strategies offers a useful tool for analyzing whether strategies for learning and problem solving are formal or informal and what kind of learning the social context enables to take place.

2.2.2 Activity system model (sub-study 3)

Sub-study 3 focuses on examining use-related problems of ICT system adoption in work settings from the perspective of the activity system model. The activity system model was chosen in order to make ICT adoption processes visible with their various elements and interactions. Such a holistic and dynamic framework offers a comprehensive description for analyzing and understanding ICT adoption processes and their problems and consequences. I apply the activity

system model in two ways in this sub-study: (1) to describe the adoption of ICT systems in organizational contexts, and (2) to describe and analyze the use-related problems arising in work systems as a result of the adoption of ICT. The activity system model is based on Engeström's (1987) conceptualization of activity theory. Activity theory is broadly defined as "a philosophical and cross-disciplinary framework for studying different forms of human practices as development processes, both individual and social levels interlinked at the same time" (Kuutti, 1996, p. 30). Kaptelinin et al. (1999) argue that activity theory gives much-needed attention to social and contextual factors, which are necessary for human-computer interaction (HCI) studies. In addition, activity theory emphasizes the historical development of a work system and helps to trace the root causes of the present contradictions and tensions among the elements of the work system. The activity system model considers how employees carry out their work with the help of tools, and how working is influenced by several elements of the work system, such as rules, conventions, and the division of labor.

The activity system model is a comprehensive framework which recognizes the key elements that form a work system. Human activity is the starting point of an activity system (Kuutti, 1991; 1996), and it consists of a subject (i.e., the actor), object (of an action), and outcome of the activity (Engeström, 1987). However, every activity is mediated both by the tools applied and by the socio-cultural context, including the members of the community in question and the division of labor and the rules that regulate their collaboration. The elements of the activity system model are illustrated in Figure 3. The basic human activity is located in the centre of the full triangle in Figure 3, and it consists of the subject, object, and outcome. The mediating tools and socio-cultural context are positioned above and below the basic activity, respectively.

Activity theory is based on four perspectives (Prenkert, 2006), which are also shared by the activity system model: the object-orientedness of an activity, the tool-mediation of the activity, the social context of the activity, and contradictions as a source of change. The core of human activity is object-orientedness (Engeström, 1999), which means that the subject (i.e., the actor, such as an employee) strives at an object when acting. In activity theory, tools are used in the transformation process, in which an object is transformed into outcomes (Engeström, 1987). A tool can be a physical artifact such as a hammer or a psychological artifact such as procedures, concepts, methods, and experiences (Bardram, 1998). ICT systems are rather new tools in many organizations, and they have been implemented fairly rapidly (Munkvold, 2003a), and yet they penetrate many aspects of the operations of the organization (Kochan et al., 1999; Rückriem, 2003). ICT systems are challenging to adopt: they are often designed without adequate knowledge about the end users, work tasks, and the organizational, physical, or social contexts of their use (e.g., Grudin, 1994). In order to be used, ICT requires both practical competences and a

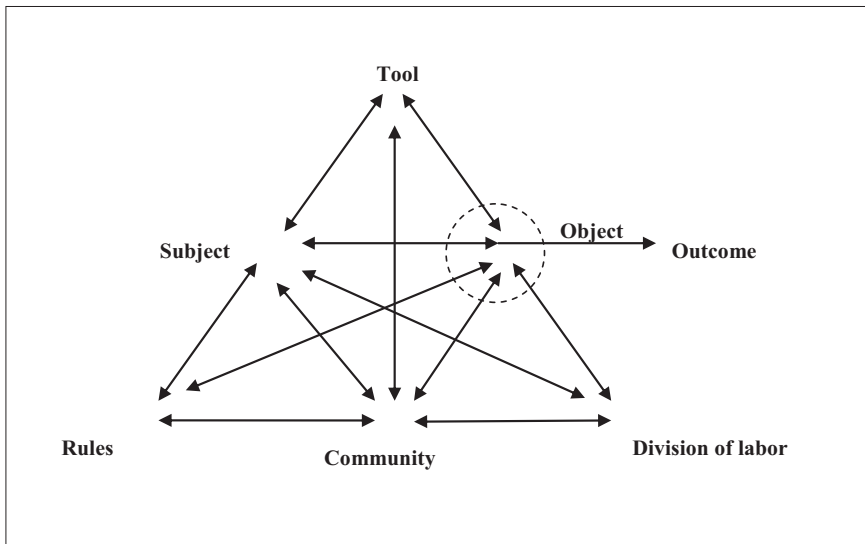


Figure 3. A general model of Engeström's activity system model (1987, p. 78, used with permission).

lot of intellectual activity (Tikhomirov, 1999), and the adoption of ICT is reflected in changed work processes (Kuutti, 1999). In sub-study 3 ICT systems are comprehended as tools which help employees to reach their goals related to work tasks; that is, the ICT system is not the object of the activity. However, in sub-study 2, an ICT system is the object of the activity, because employees focus on learning how to use the system.

Finally, the community, rules, and division of labor form the social context in an activity system. The community refers to individuals who share the same object (Engeström, 1987). Subjects belong to communities, and their participation in the community affects the activity in the activity system. Additionally, their relationships with the community are mediated by rules and all the tools of the community (Bellamy, 1997). Rules in organizations refer to the explicit and implicit regulations, norms, and conventions which govern the individuals acting in an activity system (Engeström, 1987). Rules in activity systems applying ICT tools refer, for example, to rules and conventions on how to work, learn, and collaborate with the help of the system, and also how to organize, manage, and support the introduction, adoption, and use of ICT. The division of labor refers to the division of responsibilities and tasks among a community's members. In the context of ICT system use the division of labor means, for example, that some employees work with the help of ICT systems, while others help and assist them to use the systems. There are also technical support staff, who take care of the technical

aspects of the use of the ICT system, human support staff, who support, guide, and train ICT users, and managers, who manage change in the ICT introduction process. All these members of the community work in their designated roles towards the adoption and use of the ICT system, with the goal of enabling employees to use the system and be efficient.

The activity systems in which the work is carried out are in a state of continuous change and development. Often, an activity system starts to change when something new enters it (Engeström, 2002). For example, when a new ICT system is put into use, it creates tensions and requires the other elements of the activity system to adapt and change. A new element in an activity system also causes contradictions between and inside the elements of the system, as some of them adapt to the new situation, while some continue to operate on the basis of the earlier logic. A contradiction refers to a historically accumulated structural tension (Engeström, 2001). It is “a misfit within elements, between them, between different activities, or between different developmental phases of a single activity” (Kuutti, 1996, p. 34). Basharina (2007) describes a contradiction as a situation in which a person is torn between two or more opposite goals. A contradiction is usually not directly observable, but it expresses itself through different symptoms – as “problems, ruptures, breakdowns and clashes” in the functioning of an activity (Kuutti, 1996, p. 34). The analysis of contradictions means that problems and tensions are observed and analyzed, after which the structural contradictions behind these symptoms are revealed. Moreover, when the system begins to reorganize itself and its various elements search for new harmony, innovations and development become possible (Engeström, 1987).

The theoretical framework of sub-study 3 depicts an activity system in which all the relevant factors are involved; it offers a tool for analyzing individual problems related to ICT adoption in an organization. Though it focuses on an individual employee, it also emphasizes that ICT usage problems are not only an individual matter, but the entire organizational and social context has an impact on the individual. It also pays attention to the historical development of ICT usage problems, that is, the fact that rules and routines that exist before an adoption process have an impact on the individual adoption process, and should also be observed through time. For example, individuals have work routines, which they have to change in order to modify or establish new ones (Becker, 2004; Becker et al., 2005).

2.2.3 Institutions, actions, and self-determination (sub-study 4)

Sub-study 4 examines a successful ICT adoption in an organization. A successful adoption refers to the employees' subjective experiences of a meaningful and smooth but effective way of

adopting and learning how to use ICT systems at work. An organizational ICT system implementation process is usually conceptualized as a series of stages (e.g., Orlikowski & Hofman, 1997). Most often, the models depict an implementation process proceeding step by step from the scanning of organizational needs to a full and effective use of technology in daily practices. For example, Kwon and Zmud (1987) developed a six-stage model of an ICT system implementation process, shown in Table 2. However, in sub-study 4, my co-authors and I propose that it is possible to outline an alternative model for ICT implementation that is based on the model of institutionalization as a structuration process of Barley and Tolbert (1997). Barley and Tolbert's model originates in structuration theory and it has features of institutional theory. Structuration theory is founded on Giddens' (1984) conceptualizations of social processes as involving reciprocal interaction between human actors and institutions (loosely speaking, Giddens calls these 'structures'). Barley and Tolbert (1997, p. 96) define institutions as "shared rules and typifications that identify categories of social actors and their appropriate activities or relationships". Human actions are thus enabled and constrained by institutions that are the accepted ways of doing things. At the same time, the institutions emerge – over time – from human actions (Orlikowski, 1992) that create and establish ever-new shared rules and typifications. Institutions, therefore, are created, maintained, and changed through actions. According to structuration theory, the potential for both stability and change exists in any social situation: human actions may promote change while institutions promote stability. In sub-study 4, the model of institutionalization as a structuration process was applied as a preliminary theoretical concept (cf. Yin, 2003a) in order to describe the case.

Figure 4 depicts an ICT system implementation as a process of human actions and institutional change based on Barley and Tolbert (1997). The model considers emerging and existing discrepancies between the concrete activity level and the more abstract institutional level. In the model, the realm of institutions refers to shared values, rules and norms on how things are and how they should be. ICT systems offer specific types of rules, resources, and capabilities, and govern how information can be managed by their users (DeSanctis & Poole, 1994). Values, norms, and recourses provide employees with an understanding of the environment they operate in (Furumo & Melcher, 2006), and show how they should act as members of a particular community. The realm of actions refers to daily activities at work (Kira & Forslin, 2008), especially those mediated by ICT systems. The model suggests that institutionalization is a continuous process, and the operations can be observed only through time. The bold horizontal arrows in the figure stand for the temporality of the two realms of the social structure, namely institutions and actions.

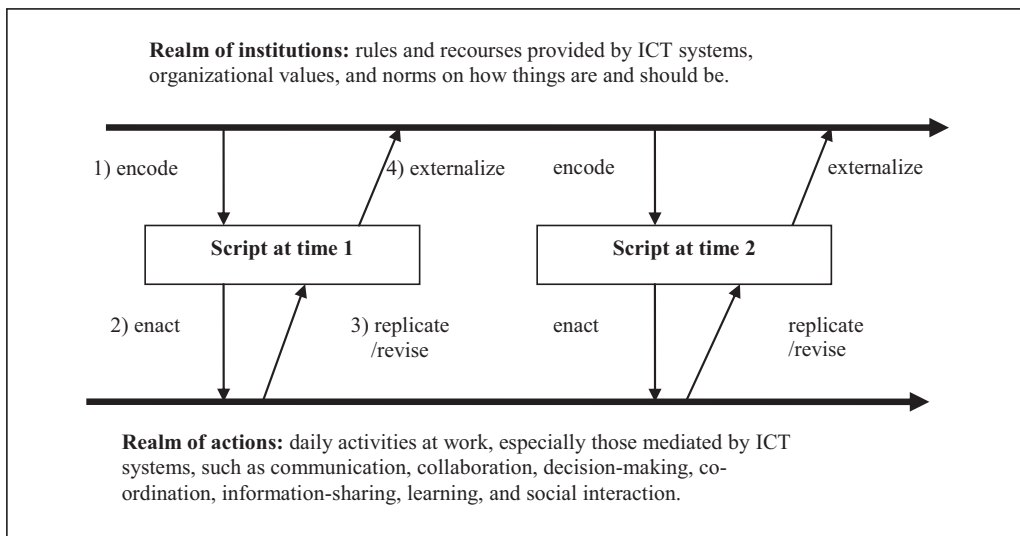


Figure 4. Model of institutionalization as a structuration process in the context of ICT system adoption (based on Barley & Tolbert, 1997). (© 1997, SAGE Publications. Used with permission.). (See also DeSanctis & Poole, 1994.)

The realms of institutions and actions ‘communicate’ via scripts. Barley and Tolbert (1997) define scripts as behavioral regularities; however, scripts may also be viewed as shared mental models that underlie behaviors. In Figure 4, a script refers to a mental model – a subcase of a schema – which describes a characteristic sequence of events in a particular setting (Gleitman et al., 1999). For example, a script may be a mental model of the correct way of working.

The first arrow refers to the encoding of institutional principles in the scripts to be used in specific situations. Encoding takes place in socialization as individuals internalize rules and interpretations of behavior appropriate for particular settings (Berger & Luckmann, 1967). The second arrow refers to action, in which individuals enact these scripts in their activities, for example when employees use an ICT system to perform daily working tasks. The third arrow refers to the choice of individuals: if they choose a different way, they revise the script, and if they choose the institutionalized way, they replicate the script. Barley and Tolbert (1997) state that a change in an organization’s environment is often needed for employees to collectively question and revise scripted patterns of behavior; otherwise, actors are likely to replicate them. For example, changes in technology, such as the development and availability of new ICT-based tools, or changes in business conditions, such as economic downturns, increase the probability of individuals transforming a script. The last arrow refers to the externalization of the patterned

behaviors and interactions produced while posing questions and making innovations. Revised scripts may change the shared assumption of how things should be done, and these revised actions may become institutionalized. Most importantly for our purposes, new ways of using ICT systems discovered in daily activities may impose changes on institutionalized rules and beliefs.

Besides the model of institutionalization as a structuration process, sub-study 4 focuses on self-determination. The self-determination theory of Deci and Ryan (2000) draws a distinction between autonomous motivation and controlled motivation. Autonomy or self-determination refers to acting with a sense of volition and experiencing the possibility of choice. Ryan and Deci (2000) show that self-determination induces interest in an activity and excitement about it, and boosts confidence, performance, persistence, and creativity. On the contrary, controlled motivation builds on the pressure to engage in socially expected actions and/or actions that are not an end in themselves, but only the means to reach something else, e.g., rewards (Deci et al., 1999; Gagné & Deci, 2005). Activities connected to controlled motivation can lead to a lack of motivation, as the person has few chances to regulate his or her behavior and experience the goals of his or her activity as being meaningful. The possibility of self-determination therefore supports employees' motivation at work, while the lack of this possibility undermines motivation and full engagement in work activities (see also Sundholm, 2000). Self-determination or self-direction has also been shown to lead to motivated and effective learning in educational research (e.g., Knowles, 1975).

The model of institutionalization as a structuration process offers a framework in which an ICT adoption process can be analyzed and understood as a dynamic and unforeseeable change process in an organization. It shows that employees are active actors in a change process, and that the result of an ICT implementation process may be other than the management has planned. This framework focuses on the entire organization, its actions and structures during a change process, and on an individual employee as an active actor. It helps to analyze and understand why ICT adoption projects may fail or the intended adoption results are not reached. Additionally, focusing on self-determination, it shows that adopters' autonomy in a change process can be a significant motivator.

3 Research design and methodology

3.1 Research approach

In this section, I depict the research approaches and processes of each sub-study. Sub-study 1 is a review, and therefore I do not address the ontological and phenomenological assumptions that refer to its research context.

3.1.1 Ontological and epistemological assumptions

Sub-studies 2, 3, and 4 represent qualitative and interpretive approaches. Interpretive qualitative research focuses on “understanding how people interpret their experiences, how they construct their worlds, and what meaning they attribute to their experiences” (Merriam, 2009, p. 5; Sandberg, 2005). My research employs a phenomenological perspective, in which “we can only know what we experience by attending to perceptions and meanings that awaken our conscious awareness” (Patton, 1990, p. 68, citing Husserl, 1913). The qualitative research paradigm has two essential and tightly interlinked assumptions regarding the research conducted. First, the epistemological viewpoint assumes that the researcher interacts with the phenomenon being studied (Creswell 1994). The researcher interviews the participants, analyzes the data (Merriam, 2009), and finally writes the research report. In this kind of reality, researchers do not find knowledge, but they construct it (Merriam, 2009). Second, the ontological viewpoint assumes that reality is socially constructed (Merriam, 2009), which means that it is subjective and interpreted differently by those who are involved in the study (Creswell, 1994; Patton, 1990). I next examine the phenomenological approach and the consequences of its two essential assumptions in the context of my study.

I myself have an important role and a substantial influence on this study, because I am the primary instrument conducting the interviews, analyzing the data (Merriam, 2009), and writing the research report. Because the primary data in this study were collected by means of semi-structured interviews, reality is produced by the speech of interviewees during the interviews (Eskola & Suoranta, 1998). The interviewees’ words are their interpretations of their reality.

Likewise, when I analyze their words I produce my own interpretation of their interpretations. Thus, the whole research study may be considered as interpretive (Eskola & Suoranta, 1998). The data are finally expressed as written text, which describes events and thoughts, and constructs social life. This kind of data provides knowledge which is human, subjective, and limited, and which is bound to values, social life, and the culture of the interviewees (Syrjäläinen, 1994). The voices of the interviewees do not form one truth, but there are different potential truths and meanings. The truth arises from each person through interpretation and understanding by the researcher (Kaikkonen, 1999, p. 430). There is no absolute or final truth, and I can only reach a truth which is valid and right for the present (Harré & Secord, 1972).

The interviews produce data in a text format, which means that the researcher actually analyzes and interprets language, how it is used, and what is said (Eskola & Suoranta, 1998). This language is mainly produced through the experiences of individuals. Individuals gain experiences while observing the environment through their sensory systems (Patton, 1990): individuals watch, remember, and think about the surrounding reality (Saariluoma, 1995). In this context, experience refers to observations, emotional experiences, mental pictures, beliefs, thoughts, opinions, conceptions, and valuations (Latomaa, 2005). Most of the incidents in the mind are experiential and consist of meanings, and therefore other people cannot observe them (Latomaa, 2005). Thus, interviews as a data collection method offer the researcher rich and versatile material for analyzing, understanding, and interpreting human behavior and all the phenomena related to it.

During the interviews, as discovered above, the interviewees told me about their experiences according to their subjective interpretations, but also the way they remembered them at the time of the interview. Though some of the interviewees might have participated in the same event at the same time, they possibly told me different things or the same things from different perspectives, because of their subjective experience and interpretation of the event. However, these experiences provided me with authentic information about what was important or essential for the interviewees. In the analysis, I decided what to include in and exclude from each emerging category (see, e.g., Miles & Huberman, 1994, p. 56). The interviewees provided a variety of different voices and views. Thus, I have combined these different voices, but I have tried to maintain the richness of the descriptions by reporting the results widely. For example, I have reported employees' problems widely by including the problems which are most common, but I have also included the rarest ones. When I analyzed the data, I identified themes which were important to the interviewees and relevant from the perspective of my research questions, but I

also considered the themes from the theoretical perspectives which I have chosen and interpreted (see, e.g., Miles & Huberman, 1994, p. 58).

In order to gain an overall understanding of the phenomena in their contexts (Merriam, 2009; Yin, 2003), I examined organizational documents and manuals, participated in user training sessions, seminars, and online sessions, and had discussions with other participants in the organizations. I have also tried out and examined the ICT systems that were studied, and a group of students made a heuristic usability test of each ICT system. I did not analyze the data gained from these documents, sessions, tests etc., but they provided me with a better understanding of the organizational contexts and, thus, enabled me to perform a more accurate analysis of the interview data.

3.1.2 Research design and methods used in each sub-study

Sub-study 1 (the review) is a combination of qualitative and quantitative methods. I used quantitative citation analysis as a systematic search method for articles and books. Citation analysis is one type of bibliometric method; these involve counting citations of other publications in a body of literature in order to develop statistical distributions. Thus, it was a useful method for mapping and examining the structure and contents of the literature on the implementation and adoption of ICT systems in the field of management and business research. I used qualitative content analysis as a method to examine these articles and books in more detail, that is, to organize and describe the contents of selected publications (Elo & Kyngäs, 2008; Miles & Huberman, 1994).

Sub-study 2 (the learning model) and 3 (the problems) can be classified as basic qualitative studies (Merriam, 2009), which have elements taken from the phenomenological and case study designs. Phenomenological research focuses on depicting “the essence or basic structure of experience” using specific tools (Merriam, 2009). A phenomenological approach is rather applicable for assessing affective, emotional, and intense human experiences (Merriam, 2009). I have applied a phenomenological approach by focusing on individuals’ experiences concerning a phenomenon (i.e., adopting an ICT system in work settings) and their interpretations of their experiences (Creswell, 1998; Patton, 1990; Moustakas, 1994). I included some case study elements into the study (Stake, 1994; Yin, 2003b), because the work context in which the data were collected was a significant part of the phenomenon being studied. For example, data about the work context and the ICT tools were collected from multiple sources; in addition to the interviewees’ experiences, attention was also paid to ICT systems in their

organizational contexts. Thus, sub-studies 2 and 3 include elements of a case study, but it cannot be classified as a pure case study as defined by Yin (2003b).

Sub-study 4 (the self-determination) is a single special case study and describes a self-determined adoption of an ICT system in an organization (Stake, 1994; Yin, 2003b). I chose a single case study design (Siggelkow, 2007) because it offers a powerful way to provide a special insight into an adoption of an ICT system as a transformation process in an organization at the level of institutional structures and assumptions. My co-authors and I applied the case as an illustration to make a conceptual contribution; in other words, the case was a concrete example of an abstract construction of institutional structures called ‘a sequential model of institutionalization’ as conceptualized by Barley and Tolbert (1997, p. 101).

3.2 Research process in the review study (sub-study 1)

The data set of sub-study 1 (the review) consists of articles published in leading management and business journals during 1999-2010. The data were retrieved from the Social Sciences Citation Index (SSCI) of the ISI Web of Science. This database contains information on articles published by the leading scholarly journals in which the major research contributions can be considered to be accumulated (Judge et al., 2007; Webster & Watson, 2002). The data collection and analysis both had two main stages, which I describe next.

3.2.1 Data collection

I limited the search to articles published in 1999-2010 in the management and business research. The last ten years have been an active period for ICT research. Because I searched for the articles in February 2010, the number of articles for the year 2010 represents only those articles accumulated in the database at that point in time. In order to identify the relevant articles for this study, I first identified the essential and widely used search terms by scanning previous research (cf. Raghuram et al., 2009). Then I conducted a systematic literature search by combining two search terms in the ISI Web of Science in each search. I used three search terms for the technology, which were “information technolog*”, “information system*”, and “information and communication technolog*”. I used also three search terms for the activities, and they were “adopt*”, “adaptation”, and “implement*”. The search terms were sought in the titles, abstracts

and keywords of the articles. The final data set consists of 1303 sample articles in 122 different management and business journals with references to 43,320 sources. The data set can be considered as a representative sample of the ICT implementation and adoption literature: it is a large data set with 1303 articles, and the articles are gathered systematically from the most influential journals. The systematic way of collecting the articles ensures that the data cover relevant literature on the topic and are “not confined to one research methodology, one set of journals, or one geographic region” (Webster & Watson, 2002, p. XV). The data collection and analysis processes are depicted in Table 3.

Table 3. Stages of the data collection and analysis.

Stage	Method	Procedure	Outcome
Data collection			
1.	Systematic literature search, timespan 1999-2010	Retrieve articles from Social Sciences Citation Index (SSCI) of ISI Web of Science	Final data set 1303 articles with references to 43,320 sources
2.	Checking and correction of the Microsoft Access databases	Manually checking and correcting all information in the Microsoft Access databases	Congruent citation information in databases in a Microsoft Access file
Data analysis			
3.	Microsoft Access database of the most cited publications (books and articles), and qualitative content analysis	Identification of publications which sample articles cite the most. Recognizing the theories and models of these publications	20 most influential publications addressing seven theories or models
4.	Microsoft Access database of the most cited sample articles and qualitative content analysis	Identification of the most cited articles in the pool of sample articles (which received 12 or more citations, N=60). Recognizing the themes of these articles (i.e. thematic groups).	52 most cited articles addressing seven thematic groups

I exported all the citation information of the sample articles from the ISI Web of Science into a Microsoft Access database on a personal computer with the help of the Sitkis software (Schildt, 2002). The ISI Web of Science entries have errors regarding citations (Schildt, 2004; Smith, 1981), and different journals write their citation information in various ways. Thus I checked and corrected all the information in the Microsoft Access database. I checked and corrected the names of the authors (e.g., authors’ middle initials are used inconsistently) and journal and book names into a similar spelling (e.g., MIS Q and MIS QUART represent the same journal). I also checked and corrected the volumes of journals (e.g., Sitkis does not notice the different page numbers of each article, and thus counts different articles by an author in the same

publication as a single entry) and editions of books (different publications appear as independent entries) in order to be congruent.

3.2.2 Limitations of the data collection: some questions concerning the validity of sub-study 1 as the literature research of this thesis

The literature reviews of this thesis appear in two places: in the literature research in sub-study 1 and in the theory reviews of empirical sub-studies 2, 3, and 4. In this section, I discuss the validity of the literature research conducted in sub-study 1 by reflecting on the validity of the method used, citation analysis, against the three empirical sub-studies and their theory reviews.

Despite the fact that citation analysis is a systematic and objective method for literature research, it causes four limitations related to the validity of the data in sub-study 1. First, the selection of the search words always sets some limitations on the area covered by the systematic literature search; the search covers only those publications and the research field defined by the specific search words used. Thus, the literature research in sub-study 1 excludes studies beyond the search terms used. However, the validity of the data collection process in sub-study 1 was improved substantially, because my knowledge from the previous sub-study-specific theory reviews enabled me to choose relevant and valid search words. Second, citation analysis emphasizes historical and most cited publications and cannot cover new and emerging research. This limitation is also present in sub-study 1. Third, the analysis method used does not recognize changes and developments in the research field which occurred during the time period examined. For technical reasons, it was not possible to divide the time period that was studied into, e.g., two or three consecutive sections and examine transitions over time in the use of the theories. Fourth, it was only possible to gather the data in the ISI Web of Science as the Sitkis software was developed to process data only from the ISI. The ISI database does not cover all periodicals (see review by Osareh, 1996), which excludes relevant journals with ICT system implementation and adoption content. For example, the *Journal of Organizational and End User Computing (JOEUC)* and *Computer-Supported Cooperative Work (CSCW)* are not represented in sub-study 1. (JOEUC was accepted as an ISI journal only after the data collection of sub-study 1).

However, the purpose of the literature review in sub-study 1 was to complement the specific theory reviews I conducted in the empirical sub-studies 2, 3, and 4. In these theory reviews I employed other search methods than in sub-study 1, and, thus, they cover different publication forums than sub-study 1 did. I searched and scanned widely relevant ICT adoption-

related journals and proceedings, such as Computer Supported Cooperative Work and the Journal of Organizational and End User Computing, and learning-related journals such as the Journal of Workplace Learning and the International Journal of Training and Development. I also searched for articles and other publications in Google Scholar with specific search words. Despite considerable efforts when searching for relevant literature for sub-studies 2, 3, and 4, I was able to find only some publications which studied ICT adoption by individuals and learning how to use ICT systems specifically from the same points of view as I did.

Only after I had conducted the literature research in sub-study 1 was I able to detect that it actually did not cover the theories and methodologies I was interested in. Thus, sub-study 1 does not represent the theoretical framework of this thesis, but rather a general view of the most cited publications and theories applied in ICT adoption research. In sum, the literature review conducted in sub-study 1 – with all its limitations – makes a valuable contribution by generating new knowledge and understanding of the structure and content of ICT system implementation and adoption literature published in the leading scholarly journals in the field of ICT adoption in organizational settings. However, a comprehensive and valid study of the previous literature concerning this thesis is achieved only when the literature research in sub-study 1 is combined with the theory reviews in sub-studies 2, 3, and 4.

3.2.3 Data analysis

I analyzed the data from three perspectives using a qualitative content analysis approach (Elo & Kyngäs, 2008; Miles & Huberman, 1994). First, in order to cover the most influential publications in as broad a manner as possible, I chose 20 publications (articles and books), in other words, those publications which received most citations from the sample articles. I analyzed their contents, that is, the theories and models applied, using a thematic analysis approach. In the analysis I recognized seven groups defining the theories and models used. Second, I found out the most influential groups of literature among sample articles. My analysis resulted in seven thematic groups that included 52 articles. I analyzed their contents, that is, the research subject or research questions, the main theory and theoretical concepts used, the main contributions, and the level of analysis. The difference between the 20 most influential publications and the most cited thematic groups is that the most cited publications are formed from citations to any sources, but the most cited thematic groups are formed from citations inside the pool of 1303 sample articles. Third, I had initially hoped also to have information from the learning theories and models applied in the ICT adoption, but no such theories or models came up in the first two analyses.

Since it was also my intention to examine learning- related articles, I decided to have a special look at learning, and picked up articles handling learning in the most cited sample articles. I coded the role of learning at any place in the 52 sample articles where learning or learning-related concepts (e.g., training) were mentioned. However, I excluded articles which only mentioned learning theories or concepts without actually discussing the concepts. Finally, seven articles used learning theories or concepts to explain and understand ICT implementation and adoption. I categorized them into three themes relating to the role of learning.

3.3 Research processes in the empirical studies

3.3.1 Case organizations and ICT systems studied

I selected the three case organizations in sub-study 2 (the learning model) and 3 (the problems) purposefully (e.g., Miles and Huberman, 1994): first, the organizations had introduced the ICT systems being studied within a few years prior to the study; second, the ICT systems that were studied differed from each other in terms of their purpose of use (an intranet, an educational website, and an internet-based meeting system); third, the three organizations offered an opportunity to study different organizational contexts (public, private; education, military, and industrial); and finally, the organizations were also different from each other in terms of the success of the ICT introduction process; in other words, there were both smooth and problematic introduction processes. Thus, the three organizations formed a multifaceted sample of cases, and offered various perspectives on learning processes in sub-study 2 and on adoption-related problems in sub-study 3 (see Creswell, 1998; Yin, 2003b). The findings from the different organizations were not compared to each other, but rather used to formulate an ample description based on analytic generalizations (Creswell, 1998; Herriot & Firestone, 1983; Yin, 2003b). In each organization, employees were also given the opportunity to choose the ways in which they adopted and learned how to use the systems. In each organization, I focused on an ICT system that was generally considered essential for employees' work. The case organizations and the ICT systems that were studied are described in Table 4. The University of Helsinki and the Finnish Defence Forces chose to be identified by name, and the Company chose to remain anonymous.

I selected the case organization in sub-study 4 (the self-determination) purposefully, as well. The Company had recently introduced a new and collaborative internet-based meeting

system, and thus offered a good case for a preliminary study focusing on the adoption of a collaborative ICT system and on its benefits and challenges. The Company had invested in the planning of an electronic scheme including the IT applications in the entire organization and the selection process of the ICT system that was studied. The Company applied, among other things, a key user method in introducing the system to employees, but unfortunately experienced problems in the introductory phase. (A key user is an employee who is trained to use the system, works as a next-door support person, and who has all the rights to use the system). However, management groups discovered an alternative way of using the system in the organization, and succeeded in diffusing the ICT system in the organization gradually. Thus, the Company's employees had a lot of varied experiences of the adoption process. The Company is the same organization as in sub-studies 2 and 3.

Table 4. Summary of the case organizations and ICT systems that were studied in the empirical sub-studies.

Sub-studies	2 and 3	2 and 3	2, 3 and 4
Organization	The University of Helsinki	The Finnish Defence Forces	The Global Company
Number of employees	7700	15,000	25,000
ICT system	Intranet	Educational website	Internet-based meeting system
General purpose of the use of the ICT system	Intranet provided a joint and asynchronous working and communication platform. The intranet was mainly used to search for or publish information.	Educational website provided a forum for organizing synchronous and asynchronous distance education.	Internet-based meeting system provided a forum for online internet sessions for meetings and training inside the organization.
Put into use	2004	2003	Used by executive and internal project management teams since 2002. Introduced in the entire company in 2005.
Specific context of the use of the ICT system during the study	The system was examined as one of the ordinary working tools used by employees in their daily work tasks	The system was examined when it was used as a tool for providing continuing education. It was mainly used for delivering training material and information.	The system was examined when it was used in internal product and sales training (sub-studies 2 and 3) and as an online meeting tool inside the organization (sub-study 4).
Time of data collection	2007	2007	2005 (sub study 4) and 2007 (sub study 2 and 3)

3.3.2 Participants

In total, 39 qualitative interviews were conducted in sub-studies 2 (the learning model) and 3 (the problems). The focus was on the 32 interviews with users, while seven interviews with support persons gave background information. Table 5 lists the employees and support persons interviewed in each organization. The interviewees were selected on the basis of certain criteria (Creswell, 1998; Miles & Huberman, 1994). Most interviewees were end users, but a few support persons were interviewed in order to gather background information on the introduction and adoption processes of the systems. Three of the support persons were next-door support persons and four had been involved in the implementation processes from the very beginning; they developed the system further and also served as next-door support persons. The end users were chosen in such a way that one third viewed the system favorably, one third unfavorably, and one third had a neutral attitude. Additionally, both experienced and inexperienced users were chosen in order to involve employees on various skill levels in the use of the systems. For practical reasons, the contact persons in the organizations chose the interviewees according to these criteria.

Table 5. Size and demographic details of the sample in sub-studies 2 and 3. In the column “employees” trainers refers to employees who trained or taught other employees in the organization, while trainees refers to employees who participated in the training.

Organization	Interviewees			Gender: male – female	Average age	Employees' experience of using the system: much – some
	Employees: trainees – trainers – employees at work	Support persons	In total			
University	0 – 0 – 9	3	12	2 – 10	36	2 – 7
Defence Forces	9 – 4 – 0	2	15	13 – 0	39	2 – 11
Company	6 – 4 – 0	2	12	9 – 3	45	2 – 8
In total	32	7	39	24 – 13	40	6 – 2 6

In total, 11 qualitative interviews were conducted in sub-study 4 (the self-determination) (Table 6). The interviewees were selected from three different professions: next-door support and HR persons, operational employees, and middle managers. The aim was to cover different viewpoints on the introduction and adoption of ICT in the company. Three interviewees could be called key informants: they had been involved in the selection and implementation process of the

system from the very beginning, they were key users with all rights to use the system, and they trained and supported end users and developed the use of the system. The rest of the interviewees were end users who had made the decision to adopt and use the system. Thus, the 11 interviewees formed a small but typical group of users at the time of the data collection (see e.g., Kuzel, 2000; Miles & Huberman, 1994, p. 27; Patton, 1990, p. 169).

Table 6. Size and demographic details of the sample in sub-study 4.

Organiza- tion	Interviewees				Gender : male – female	Average age	Employees' experience of using the system: much – some
	Next-door support persons	Opera- tional employees	Middle managers	In total			
Company	4	4	3	11	8 – 3	37	7 – 4

3.3.3 Data collection and analysis

The data were collected through qualitative interviews focusing on the learning strategies and approaches employees chose in order to learn how to use the systems (sub-study 2), the problems they encountered related to the use of the system (sub-study 3), and the possibilities and problems of a successful ICT adoption (sub-study 4). The interview protocols are presented in Appendix 1. This data collection method was selected because it gave freedom to the interviewees to talk about and describe the experiences they wished to, and, at the same time, the loosely set themes in the interview protocol assured the handling of all the selected issues. The interviews were personal interviews and lasted from 15 to 90 minutes; the average time was about 60 minutes. The interviews were recorded and then professionally transcribed. Participation in an interview was voluntary. The interviews in sub-studies 2 and 3 were carried out during the spring and summer of 2007, and the interviews in sub-study 4 during the spring of 2005.

The analysis strategy that was used was thematic analysis (Boyatzis, 1998; Braun & Clarke, 2006; Cavanagh, 1997; Elo & Kyngäs, 2008; Joffe & Yardley, 2004; Mayring, 2000; Miles & Huberman, 1994; Weber, 1990). Thematic analysis is called by different names and, therefore, I have used either the term “thematic analysis” or “content analysis” in the sub-studies, depending on the convention in the publication context in question. For example, I used “content analysis” in sub-study 1 (the review), because all the other literature reviews in this field referred to content analysis. Nonetheless, in practice, I used the same qualitative analytical process in all the sub-studies. The empirical sub-studies had a clear unit of analysis, and in each individual sub-study it was an individual learner’s experience (Creswell, 1994; 1998).

In practice, I conducted the analysis process in sub-study 2 (the learning model) in three phases with a pre-existing coding frame (Braun & Clarke, 2006). First, I read through all 39 interviews to get an overall view of the interviewees' experiences of learning how to use ICT systems and how to use them in their work. Second, I coded the data deductively into five main themes: approaches to learning; initial learning strategies; problem-solving strategies in ongoing use; strategies for learning and problem solving which interviewees did not choose, and factors which depicted the interviewees' levels of expertise in using that particular ICT system. Third, within each theme I carried out a further deductive thematic analysis. For example, I organized learning and problem-solving strategies according to Warr and Allan's (1998) six cognitive and behavioral strategies, and then further into organizational contexts and social contexts. I analyzed the problem-solving strategies in the same way as other learning strategies, because of the everyday learning-oriented nature of problem-solving activities in the context of ICT systems (see the theory section). Additionally, I organized each interviewee's approach to learning into deep, surface, or strategic approaches. I identified interviewees' approaches to learning from the interviewees' descriptions of their experiences, skills, and attitudes while using and learning how to use the systems.

In sub-study 3 (the problems) I first identified the problems in each organization and then analyzed them separately. The results proved to be very similar in all three organizations and thus I reported them as one activity system in the results section. Reporting every organization's problems in one activity system made it possible to form a clearer and more comprehensive picture of the problems emerging in organizations when adopting ICT systems. However, differences between the case organizations can still be discerned as well (see the original article 3, Appendix 2). In practice, I conducted the analysis process in sub-study 3 in three phases. First, I identified problems inductively from the interviews. Second, I categorized the problems with a pre-existing coding frame (Braun & Clarke, 2006) according to Engeström's activity system model. In addition, I counted the frequencies of the expressions of problems in each interview. Third, I divided the problems into three groups: (1) problems in the social context; (2) problems with the tool, and (3) problems in the activity, that is, between the subject (employee) and the object (duties). Finally, I identified the main contradictions in these three groups.

I conducted the analysis process in three phases in sub-study 4 (the self-determination). First, I examined the original interviews from the point of view of self-determined adoption and institutional change theory. I used these theories as preliminary theoretical concepts to set a direction and boundaries for the description of the ICT adoption process (see Yin, 2003a). Second, I organized the data into categories that followed the Barley and Tolbert (1997) model of

institutional change. Finally, I further specified the categories and finalized them on the basis of the theoretical framework of the study. In the analysis I applied the systematic combining approach based on abductive logic conceptualized by Dubois and Gadde (2002): I continuously matched theoretical concepts with the empirical reality to form the emerging case description.

4 Findings and research contribution

In this section I describe the key findings and my interpretation of the contribution of each of the four sub-studies. I also answer the overall research question of the thesis.

4.1 Technology acceptance research dominates (sub-study 1)

In sub-study 1 I focused on examining the most cited publications (books and articles) and the most cited topics in management and business research published between 1999 and 2010 in ISI journals (the data consist of 1303 articles which refer to over 43,000 sources). The first research question in sub-study 1 is what theories and models are used by the most cited publications (articles and books) in order to analyze and understand ICT system implementation and adoption. The findings show that the implementation and adoption research focuses on the acceptance of technology by individuals in the frameworks of technology acceptance models. The four most focal theories or models applied in analyzing and understanding ICT adoption were: (1) the technology acceptance model (TAM); (2) the theory of reasoned actions (TRA); (3) diffusion of innovations (DOI), and (4) the theory of planned behavior (TPB) (Table 7; note that the numbers in the table refer to the citations each article or book received, and not to the number of articles). These results are in line with earlier findings in the ICT implementation and adoption literature (e.g., Gallivan, 2001; Jeyaraj et al., 2006). The most influential model was TAM, which is in line with earlier findings as well (Chuttur, 2009; Jeyaraj et al., 2006; Lee et al., 2003). The technology acceptance models seek to explain potential adopter attitudes and their innovation-related behavior. For example, TAM aims at predicting and explaining ICT usage behavior, that is, what causes potential adopters to accept or reject the use of information technology (Davis, 1989).

Table 7. Theories of the 20 most cited articles and books on ICT system implementation and adoption (note that the numbers refer to citations, not to articles).

Theory	Citations	Citations % of 2474
1. Technology acceptance model (TAM)	869	35.1
2. Theory of reasoned actions (TRA)	502	20.3
3. Diffusion of innovations (DOI)	497	20.1
4. Theory of planned behavior (TPB)	331	13.4
5. Unified theory of acceptance and use of technology (UTAUT)	109	4.4
6. Model of the ICT implementation process	85	3.4
7. Model of information systems success	81	3.3
In total	2474	100

The second research question in sub-study 1 is how the theories and models are applied and what themes are addressed in the most cited articles in the field of ICT system implementation and adoption research. The thematic groups in Table 8 depict the most cited topics in the management and business research (the data consist of 1303 articles). The three most studied topics were: (1) the acceptance and adoption of ICT by individuals; (2) changes in user beliefs and attitudes, and (3) organizational decision making on ICT adoption. The majority of these studies used TAM as their theoretical framework. The dominant research design was a field survey research design, with assumptions taken from the positivistic research tradition. The main contribution of the studies was a rich variety of different kinds of extensions of TAM.

Table 8. Most cited thematic groups (i.e., topics) concerning ICT system implementation and adoption.

Thematic group	No. of articles	Citations	Citations % of 1430
1. The acceptance and adoption of ICT by individuals	21	737	51.6
2. Changes in user beliefs and attitudes	4	182	12.7
3. Organizational decision making on ICT adoption	9	169	11.8
4. Organizational assimilation of ICT	6	149	10.4
5. Business impact and value of ICT implementation	7	108	7.6
6. Critical success factors of the implementation process	3	43	3
7. Role of ICT systems	2	42	2.9
In total	52	1430	100

I stated an additional research aim for sub-study 1, because no learning theories or models were detected in the first two analyses. My presumption was that a learning approach is a useful way of analyzing and understanding ICT adoption, and therefore I was curious to examine

whether learning has any role in the articles under study. Thus, an additional research aim was to find out how learning theories and concepts were applied in the most cited articles in management and business research. Seven articles out of 52 applied learning-related concepts. I categorized the findings into three groups based on the role of learning: (1) user training; (2) learning in a change process, and (3) beliefs as learned responses. These articles applied learning concepts only marginally, and learning had an assisting role, while other theories, especially TAM, were more focal. In these articles, the examination of learning theories and concepts was on a general and descriptive level, and they did not, for example, try to develop existing learning theories.

Sub-study 1 reveals limitations in the previous ICT adoption research. First, the main theories applied in ICT adoption research (TAM, DOI, TRA, TPB) can be argued to pay rather limited attention to organizational and social factors. Such assessments of these theories have been presented by several researchers (e.g., Attewell, 1992; Bagozzi, 2007; Fichman, 1992; Legris et al., 2003; Lyytinen & Damsgaard, 2001; Salovaara & Tamminen, 2009). For example, Bagozzi (2007, p. 244) argues that the strength of the TAM model is its parsimonious nature, but at the same time it is the weakness of the model: it is too plain a model to explain the decisions and behavior of a wide range of “technologies, adoption situations, and differences in decision making and decision makers”. However, contextual factors are the most relevant ones when studying ICT adoption (e.g., Kaptelinin et al., 1999), because social networks and interaction among groups have become an important issue along with the development of ICT systems. ICT systems used to be single-user systems, but now they are used in a process-oriented way by multiple users, and also in inter-organizational and global settings (e.g., Benbasat & Barki, 2007). Additionally, individuals cannot decide independently whether to use the system or not, but ICT implementations are harmonized and centrally coordinated in organizations. Thus, for example, it is important to pay attention to mandatory contexts of use. Second, the majority of the studies in the most cited thematic groups were conducted by using a single methodological approach. In the framework of technology acceptance models, the data were collected by field surveys with positivistic research assumptions. However, for example, Orlikowski and Baroudi (1991) suggest that ICT system research could gain more if a plurality of research perspectives were employed effectively. For example, if researchers go into research situations with open questions instead of testing theories, they may have opportunities to identify new topics coming out of the data (Rowan, 1973).

The main finding of sub-study 1 is that it showed that a single theoretical approach, the technology acceptance model, dominated the theoretical foundations in ICT implementation and

adoption in management and business research. It also showed that the most cited articles focused mainly on studying the acceptance and adoption of ICT by individuals by using a single methodological approach, that is, field survey methods with positivistic assumptions. Sub-study 1 also showed that the learning perspective is applied only marginally. Sub-study 1 contributes by showing the theoretical and methodological gaps and limitations of previous ICT adoption research. Sub-studies 2, 3, and 4 responded to these challenges by using alternative theoretical approaches and a qualitative interpretive research approach which would offer new and innovative insights and angles to analyze and understand the adoption of ICT by individuals.

4.2 Employees choose informal peer support (sub-study 2)

Sub-study 2 focused on ways of learning how to use ICT. The research question is what kinds of approaches to learning and what kinds of strategies for learning and problem solving employees choose when learning how to use ICT systems in work settings. This sub-study elaborated the elements of a learning activity in the context of ICT systems at work. The learning situation is created by the interaction between the context of learning, the object of learning, and the learner (Engeström, 1987; see also Ramsden, 1988 and Berings et al., 2005). Additionally, this study presented a matrix for classifying and analyzing learning strategies by means of organizational and social contexts (Figure 2). The organizational context of learning describes the degree of organizationally induced formality or informality present in learning (e.g., Hager, 1998; Malcolm et al., 2003). The social context of learning addresses whether learning is a solitary effort on the part of the learner, or whether it takes place by learning from others or together with others (e.g., Doornbos et al., 2004).

The case organizations gave their employees the freedom to choose the ways in which to learn how to use a new ICT system. Within such a context, the employees usually chose a strategic approach to learning. This approach refers to a practical and easy way to learn how to use ICT: employees wanted to learn how to use it quickly and without too much effort, for example, by asking for help from a peer. Employees choosing this approach did not necessarily exploit the support functions offered by the organization, such as user training or manuals. Such findings indicate that ICT systems should be easy to use and the technology should move quickly into the background, to the role of a tool.

The employees usually preferred informal strategies for learning and problem solving. For example, they sought help from a local expert or a peer who was easily available and shared the

same situation-specific knowledge and language. Some employees were reluctant to contact the Help Desk or other such support functions since they did not know the people working there. This observation and the interviewees' tendency to rely on local experts and peers indicate that it is important to organize Help Desk operations in such a way that employees have their own support persons, whom they can learn to know and trust and find it comfortable to contact.

The study suggests that there is a clear social element at play in learning how to use an ICT system; in addition to solitary learning, the interviewees learned through social interaction, and even sometimes collectively or jointly with others. This study shows that the employees used more collaborative (and some collective) strategies while learning in an ongoing manner about the use of the ICT system; i.e., they preferred to solve problems with the help of others or together, and more seldom alone. However, learning alone played a somewhat larger role when starting to learn how to use the ICT system. The study also indicates that those employees who engaged in collective learning were very satisfied with such learning strategies. Additionally, the employees learned most about the use of ICT while working. This finding shows that learning how to use ICT does not occur solely by participating in a user training session, but rather gradually while working and collaborating with peers, and receiving advice and guidance at the same time.

The interviewees did not usually rely on the formal user training available in the organizations. One reason was that the user training seemed not to meet employees' needs and preferences for ICT support. However, user training was experienced as being effective if interviewees had an opportunity to practice the use of the system in connection with their own work. The most important fact seems to be that employees have opportunities to gain knowledge and skills which immediately support their work tasks. However, user training can also be valuable, because it makes it possible to learn the necessary concepts and operational principles of the use of the system. The interviewees did not want to use manuals, but perhaps it should not be concluded that manuals are not needed. Manuals should be developed that offer simple and user-friendly help.

When supporting employees' learning, it is important to identify their approaches to learning: whether the aim is to deal with an occasional work task, or whether the system is a central tool with which to perform and organize one's work. In the organizations that were studied, the motivated employees with a deep approach to learning were clearly an asset to their organizations: they supported other employees and inspired them to use the ICT systems. But, on the other hand, a surface approach to learning also had its advantages as it allowed some employees to adopt a resource-effective way to perform minor work tasks with the system. The

study also indicates that those employees who chose a surface approach had a somewhat resistant attitude towards the ICT system.

The main contribution of sub-study 2 was that it connected the learning approach to ICT adoption research. My co-author and I formed a learning model to help to analyze learning related to ICT adoption, and which would take the object of learning into consideration (Engeström, 1987). Sub-study 2 contributes to the overall research question by showing the enablers concerning: (1) the possibilities of asking, e.g., employees asked for help from peers and colleagues; (2) a strategic learning approach in which employees wanted to learn how to use ICT fast and practically, and (3) informal on-the-job learning, that is, showing that learning how to use ICT occurs informally while employees work and collaborate with peers.

4.3 Social context is the main source of use-related problems in ICT adoption (sub-study 3)

Sub-study 3 focused on employees' use-related problems. The research question is what use-related problems employees experience when they adopt ICT systems at work. The problems were analyzed in the framework of the activity system model. The findings show that most of the problems in ICT system adoption were related to the social context (53%). The problems related to the tool formed the second largest group (35%) and the problems related to activity the third largest group (12%). All the problems were symptoms of three main contradictions resulting from the adoption of the ICT system. First, the problems in the social context originated from a contradiction which emerged when the rules of the organization, such as explicit and implicit regulations, norms, and conventions, clashed with the individual's intentions and ambitions. Second, the problems with the tool originated from a contradiction between the requirements of the tool and what the user was able to do. In other words, employees did not have the required skills and knowledge to use the systems technically or to integrate the use of the system into their work. Third, the problems in the activity originated from a contradiction between the familiar ways of working and the new ways of working dictated by the ICT system. The use of the ICT system changed the way of working, and some interviewees considered that the old and familiar ways of working were the "right" ways of working, collaborating, and learning, and the new and unknown ways were even experienced as the "wrong" ways.

Three observations were emphasized in the findings of this study. First, the social context is the main source of ICT adoption problems. This emphasizes the importance of the social

aspects when adopting new ICT systems in organizations: other actors have an impact on an individual employee's success in adopting an ICT system (cf. Grudin, 1994). ICT systems are socially constructed and learning-intensive (Lyytinen & Damsgaard, 2001), which means, for example, that employees have to learn how to integrate the use of the system into shared work practices (Ciborra, 1996), or develop totally different work practices (Orlikowski, 1993).

Second, only one fifth of the problems (22%) were related to the employees' experienced lack of skills and competences in using the ICT systems. This is a significant finding, since user training is a common plan of action to avoid user resistance and successfully adopt ICT systems in earlier studies of organizations. This study shows that a lack of skills and competences forms only one (albeit the single most commonly mentioned) source of the problems that were experienced. This means that when adoption problems arise, important though it is, simply training users is not enough. This sub-study indicates that the successful adoption of an ICT tool requires interventions and innovations that also address the socially mediated nature of its use.

Third, ICT adoption includes elements which change slowly. Although usability and technology problems are usually known in advance (e.g., Jokela et al., 2006), they were still related to 35% of the problems in this study. The interviewees experienced these problems as being the most frustrating and annoying. Thus, the usability and reliable functioning of the technology are worth paying attention to. Additionally, the employees themselves seemed to change slowly. Some of the interviewees wanted to keep on working and acting according to their habits, and they expressed difficulties in thinking about their own work processes in a new way. The new ways of working were met with uncertainty or even considered wrong. They still longed for their old working habits, and often compared the familiar and better ways of working with the new and inferior ways of working. Thus, the individual adoption process can be slow and new users may subconsciously resist the use of a new ICT system. This finding emphasizes that employees need enough time and support to learn and internalize the use of a new ICT system; it will not happen overnight.

The main contribution of sub-study 3 was that it connected analysis of the activity system model to ICT adoption research. The activity system model was used to bring forth new insights and analysis in the research area of ICT adoption problems. This sub-study showed that the social context was the main source of problems, and that user training is not enough when striving for successful adoption. One important notion is that employees themselves seemed to change slowly; it took time to internalize the use of ICT and make it a common and routine part of everyday work. The study showed that a great number of ICT adoption problems were similar in the three case organizations, and thus not dependent on the ICT system used or the context of

use. Sub-study 3 contributes to the overall research question by showing the enablers concerning: (1) management and organizational support; (2) joint rules: employees need joint rules to utilize the system effectively; (3) the time used: ICT system adoption can be a demanding process, which requires time to integrate its use into work tasks and internalize the new way of thinking, and finally (4) reliable technology: adoption requires a reliable technology or else the motivation to adopt and learn how to use it diminishes.

4.4 Successful yet unsystematic self-determined ICT adoption (sub-study 4)

Sub-study 4 focused on employees' experiences of a successful adoption process. The research question is what possibilities and problems the employees perceive in the self-determined adoption and use of an ICT system. The adoption process was analyzed in the framework of the model of institutionalization as a structuration process conceptualized by Barley and Tolbert (1997). The findings show that the ICT system adoption described in sub-study 4 cannot easily be fitted into the traditional step-wise ICT implementation process template (Table 2). A successful adoption refers to the employees' subjective experiences of a meaningful and smooth but effective way of adopting and learning how to use ICT systems at work. The employees were able to experience control over their work and freedom of choice in what and how to do their work, and in that way to experience autonomy and be intrinsically motivated. The interviewees' enthusiasm about the system points out that the self-determined adoption truly led to intrinsic motivation.

On the basis of the case study it can be concluded that the self-determined adoption of ICT systems can have benefits. As employees are able to discover the benefits of the system by themselves and decide whether to use the system or not, they become motivated and committed. Freedom, voluntariness, and control over one's own work make employees satisfied and reduce user resistance (Deci & Ryan, 2000). A self-determined employee may even transcend her or his work role and show features of organizational citizenship behavior (Organ et al., 2006). In the case study, some interviewees had turned into self-appointed advocates of the system and worried that other employees were not reaping the full benefit of the system. A self-determined implementation process may thus lead to a greater probability of success in the adoption and acceptance of an ICT system. Moreover, because the use of the system is based on the real needs of employees' work activities, the organization has invested in a meaningful and useful system.

However, the results show that self-determined adoption has problems as well. It is quite an unsystematic process, because there are no clear signs for employees that the company considers the system important and beneficial. Employees might not receive consistent information on the system, and therefore they start to wonder whether other employees use the system and what the official recommendations concerning its use are. A slow and unsystematic process may also appear too inefficient and risky from the point of view of management. Self-determined adoption may therefore work only when employees and managers are able to live with uncertainties.

The main contribution of sub-study 4 was that it depicted a successful ICT adoption process, which highlighted self-direction as a motivator in ICT adoption. It also applied the model of institutionalization as a structuration process conceptualized by Barley and Tolbert (1997) to ICT adoption research. Barley and Tolbert's model is an alternative model to the traditional stage models of ICT adoption. Structuration theory made it possible to detect and analyze how a dynamic ICT adoption process proceeds, and how employees are active actors who have an impact on their environment. Sub-study 4 contributes to the overall research question by showing the enablers concerning; (1) management and organizational support: management support is vital in ICT adoption; (2) autonomy: features of autonomy or self-determination in ICT adoption can enhance motivation and commitment, and finally (3) on-the-job learning: on-the-job learning is an effective and pleasant way of learning how to use ICT.

4.5 Perceived enablers for successful ICT adoption

In this section I answer the overall research question of the thesis on the basis of the three empirical sub-studies. The overall research question is what kinds of factors employees experience as enablers for the successful adoption of an ICT system at work. A successful adoption refers to the employees' subjective experiences of a meaningful and smooth but effective way of adopting and learning how to use ICT systems at work. I chose the learning model outlined in sub-study 2 to be used here as a comprehensive framework that makes it possible to include and organize various enablers of a successful ICT adoption process (Figure 5). The adoption and learning process is created by the interaction between the context, learner, and object of learning. The outcome of this dynamic process is the adoption of a new emerging work practice, which includes the ICT system and the dynamic and continuously developing skills needed to use the ICT system (cf. Engeström, 1978).

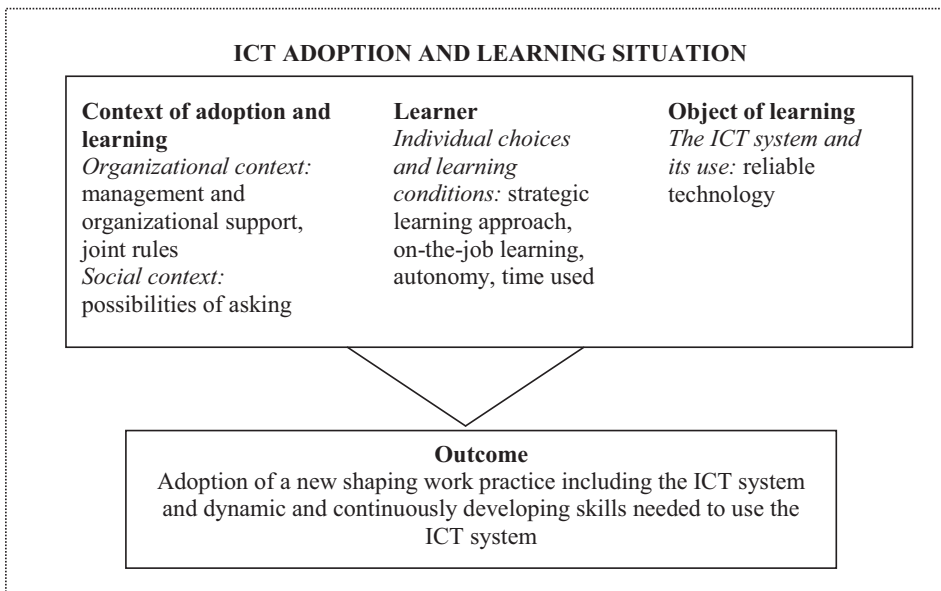


Figure 5. The enablers of a successful ICT adoption and learning activity at work.

Various factors in Figure 5 may take the role of an enabler or a disrupter in an ICT adoption process. For example, when employees have joint rules regarding the use of the ICT, the adoption and learning may proceed smoothly. On the contrary, if they do not have joint rules, it may be a disrupter and slow down or hinder the adoption and learning activity. Figure 5 portrays a situation where all factors operate as enablers in the ICT adoption. An enabler is a factor that the employees who were interviewed experienced as assisting and facilitating their ICT adoption and learning processes. These enablers show what is important for employees and where attention and support is needed when adopting and learning how to use ICT. The description of enablers below, therefore, is founded directly on the employees' experiences of such enablers.

I identified eight enablers for a successful adoption and formed three enabler categories based on the learning model outlined in sub-study 2: (I) *the context of adoption and learning* (organizational and social contexts) refers to the support and attention the employees expect from managers, support staff, and other end users and coworkers when they adopt and learn to use ICT; (II) *the learner's choices and the learning conditions at work in the adoption and learning processes* depict the processes with which the employees experience the adoption and learning as proceeding smoothly and easily, and (III) *the object of adoption and learning* refers to the expectations that employees have concerning the object, that is, the ICT system. The organizational context includes enablers concerning (1) management and organizational support

and (2) joint rules. The social context includes an enabler concerning (3) possibilities of asking. The learner's choices and the learning conditions in the adoption and learning process include enablers concerning (4) a strategic learning approach, (5) autonomy, (6) informal on-the-job learning, and (7) the time used. Finally, the object of adoption and learning includes an enabler concerning (8) reliable technology (Table 9). It has to be noted that the division of the enablers in each category is not clear-cut. For example, an employee is able to choose the learning strategy he or she is willing to apply, but autonomy, the possibilities for informal on-the-job learning, and the time used are not only individual choices, but organizations too have an impact by offering opportunities for autonomy and time for informal on-the-job learning.

Sub-studies 2, 3, and 4 all contribute to the eight enablers. In sub-study 2 I focused on the ways of learning how to use ICT systems, and more specifically on strategies for learning and problem solving. Thus, sub-study 2 contributes to the overall research question by providing enablers which concern the possibilities of asking, the strategic learning approach, and informal on-the-job learning. In sub-study 3 I focused on employees' use-related problems. With the help of Engeström's (1987) activity system model, I identified the problems that were broadly related to the social context, ICT systems as tools, and activities performed in the workplace. Thus, sub-study 3 contributes to the overall research question by providing enablers which concern management support, joint rules, the time used, and reliable technology. In sub-study 4 I focused on a special case of a self-determined ICT adoption, which examined employees' experiences of a successful ICT adoption process. With the help of the model of institutionalization as a structuration process conceptualized by Barley and Tolbert (1997), I identified possibilities and limitations in a self-determined ICT adoption process. Thus, sub-study 4 contributes to the overall research question by providing enablers which concern management support, autonomy, and informal on-the-job learning. Next, I consider the enablers in detail.

Table 9. Eight enablers for a successful ICT adoption detected in each empirical sub-study.

Enablers for ICT adoption	Sub-study 2	Sub-study 3	Sub-study 4
I Context of adoption and learning			
Organizational context			
1. Enablers concerning management and organizational support		X	X
2. Enablers concerning joint rules		X	
Social context			
3. Enablers concerning the possibilities of asking	X		
II Learner's choices and the learning conditions in work at the adoption and learning processes			
4. Enablers concerning the strategic learning approach	X		
5. Enablers concerning autonomy			X
6. Enablers concerning informal on-the-job learning	X		X
7. Enablers concerning the time used		X	
III Object of adoption and learning			
8. Enablers concerning reliable technology		X	

I Enablers relating to the context of adoption and learning

Organizational context

(1) Management and organizational support

Management and organizational support is an important enabler for ICT adoption (sub-studies 3 and 4). The managers play an essential role in providing conditions which facilitate and enhance the adoption and learning of ICT systems in an organizational environment (cf. Billett, 2001; Ellinger & Ches, 2007; Järvinen & Poikela, 2001). For example, it is important that the managers can convince the employees that ICT systems provide a proper way of working in the organization and that it is worth learning how to use the ICT system in question. Managers also need to show an example by using the ICT system actively.

When it comes to organizational support, certain formal support functions, such as training, IT support, and manuals, provide the basic support for adopting and using ICT. However, not all the employees who were interviewed were satisfied with the support offered and did not want to utilize it. On the basis of these results, support staff should develop formal support mechanisms to meet the needs and preferences of the employees regarding adopting and learning how to use ICT systems. It is also notable that end users do not become independent with time, but as their sophistication increases, “they increasingly demand better equipment, more training, coaching, consulting, and technical support” (Guimaraes et al., 1999, p. 394). Additionally, some teachers and trainers who were interviewed hoped for feedback from their

teaching or training sessions performed via the ICT system. Thus, a qualified ICT teacher or trainer could give feedback on the teaching or training sessions and propose how to improve sessions pedagogically.

(2) Joint rules

The use of ICT systems is a collective action and the users have a joint impact on the way ICT systems are used in an organization. Thus, the existence of joint rules in the community is an important enabler of ICT adoption and learning (sub-study 3). Joint rules refer to commonly shared ways of working with the ICT system, which thus provide the basis for efficient use of the system. For example, a joint rule may refer to a common way of putting information onto the system pages, such as how to form the title, where the most suitable place for the information is, and when the information is supposed to be on the pages.

Social context

(3) Possibilities of asking

The possibility of asking for help and guidance from peers, local experts, and next-door support persons is an important enabler for ICT adoption (sub-study 2). It is essential that the adviser is familiar from before and therefore easy to contact, and shares the same situation-specific knowledge and language. Peer support is a convenient and easy way of receiving help when needed.

II Enablers relating to the learner's choices and the learning conditions at work in the adoption and learning processes

(4) A strategic learning approach

The possibility of learning how to use the system fast and easily, and without investing too much effort or working time, is an important enabler for ICT adoption (sub-study 2). This kind of learning approach can be described as strategic and practical (see more in Section 4.2). It refers to learning in which the learner's intention is to learn thoroughly but rapidly the most essential things needed. It is also important that employees have opportunities to gain knowledge and skills in using the ICT system in such a way that it immediately supports their own work tasks. However, in cases where the system played an essential role in the employees' work (e.g., teachers), more thorough training was preferred.

(5) Autonomy

Autonomy or self-determination is an important enabler when adopting ICT (sub-study 4). Employees experienced autonomy as providing motivation, such as commitment and engagement, and that being unforced by outside compulsions was comfortable (cf. Illeris, 2011). Additionally, employees who adopt ICT autonomously may also find new and unexpected ways of using the system, and they may consequently shape or modify the use of the system to better support their working practices and needs. Thus, employees considered that the adoption of ICT systems proceeded efficiently when they had an opportunity to influence what they learned, and when and how they learned. Therefore, employees need opportunities to learn how to use ICT in informal ways and a chance to adopt the system according to the situation and their personal preferences.

(6) Informal on-the-job learning

ICT adoption proceeds effectively when it takes place informally in a work situation (sub-studies 2 and 4). Essential informal ways of learning how to use ICT were, for example, trying things out by trial and error, exploring, asking for help from local experts or peers, or working together and assisting each other. Such informal ways of learning anchor the adoption process into the employees' real-life work tasks. Thus, ICT adoption may proceed efficiently when it occurs gradually while employees work and collaborate with peers and receive advice and guidance at the same time.

(7) Time used

Enough time for learning and internalizing the use of an ICT system is an important enabler for ICT adoption (sub-study 3). The use of ICT systems makes significant changes to how the work processes are carried out in organizations (Kuutti, 1999), and managing these changes may require a lot of energy from the employees. Some employees who were interviewed experienced new and unfamiliar ways of working as being unpleasant, wrong, or even frightening. Thus, adopting and learning how to use an ICT system may be a slow and demanding task for the employees and it may require some time before the employees are willing to change not only their ways of working and learning but also their ways of thinking.

III Enabler relating to object of adoption and learning

(8) Reliable technology

In the context of the eight enablers, the object of adoption and learning refers to the ICT system and its use (see more in Sections 2.2.1 and 5.1.2). Reliable technology is an important enabler

when adopting and learning how to use the system (sub-study 3). Employees were usually impatient when dealing with technical problems in the system. Additionally, most of the employees who were interviewed were not particularly willing to solve technical problems and became frustrated if the problem was not solved quickly. Poor usability and failures in technology may be experienced as being extremely frustrating, and therefore diminish learning motivation. Therefore, it is important to make sure that the technology used is of good quality and that its usability is good.

Each of the three empirical sub-studies contributed to the formation of the eight enablers for ICT adoption. Therefore, I was able to form a multifaceted understanding of an individual's adoption of an ICT system. My research questions in sub-studies 2, 3, and 4 focused on the process of an individual's ICT adoption from diverse perspectives and the three theoretical approaches allowed different processes and elements related to ICT adoption to be focused on. Sub-study 2 (the learning model) studied ways in which employees chose to learn how to use ICT. This sub-study emphasized approaches to learning, and the learning and problem-solving strategies which the employees found most beneficial in the context of ICT adoption. However, the other two sub-studies did not identify enablers for asking or for a strategic learning approach in a similar way as sub-study 2 did. Sub-study 3, which focused on the employees' problems, contributed most to the overall research question by pointing out the enablers which were relevant to all three categories. Thus, sub-study 3 showed important aspects, such as the need for joint rules when practicing and working in a social environment, as well as time requirements, which are essential when learning new ways of working and thinking. The reliability of technology also became highlighted when employees' problems were studied, thus focusing attention on the object of adoption and learning. These three enablers did not come up, for example, in sub-study 2, which focused on the ways of learning. Finally, sub-study 4 brought up the importance of ICT learners' autonomy and management support as the study focused on a self-determined ICT adoption process.

The eight enablers for ICT adoption are a comprehensive and wide description of important elements and factors based on employees' experiences, such as employees' views, preferences, and ways of thinking. These enablers consider employees from a more comprehensive perspective than previous studies on individual adoption, for example the technology acceptance model, can offer. The enablers are general enough to be transferable to different ICT adoption contexts, but at the same time they are specific enough to capture the essence of an ICT adoption and learning process.

5 Discussion

In this section I first summarize the research results of each sub-study and discuss their contribution to the existing literature. Second, I discuss the theoretical implications for other theories regarding the eight enablers for ICT adoption, the activity system model and the model of institutionalization as a structuration process as alternative approaches when analyzing and understanding ICT adoption, and finally ICT adoption and learning research in the same research. Third, I discuss the practical implications for designers, managers, and support staff. Fourth, I consider the reliability and validity of the study and address the limitations. Finally, I recommend topics for further research.

5.1 Summary of the results

In this section, my objective is to summarize the research results (Table 10) and discuss their contribution to the existing literature. Sub-study 1 is a review showing the limitations and research gaps of the previous research. The three empirical field sub-studies make a contribution by tackling the limitations and gaps of the previous research. The empirical sub-studies focus on the processes, contextual factors, and consequences of ICT adoption by applying alternative theoretical and methodological approaches.

Table 10. Summary of the main findings.

Sub-study	Main findings			
1 (the review): What theories and models are used by the most cited publications (articles and books) in order to analyze and understand ICT system implementation and adoption? How are the theories and models applied and what themes are addressed in the most cited articles in the field of ICT system implementation and adoption research?				
	The technology acceptance model (TAM) was the most focal theory applied in ICT system adoption.	User acceptance and adoption research dominated the ICT adoption research.	The role of learning theories and concepts in ICT adoption research was marginal.	The research field lacked a plurality of research designs.
2 (the learning model): What kinds of approaches to learning and what kinds of strategies for learning and problem solving do employees choose when learning how to use ICT systems in work settings?				
	Most of the employees chose a strategic learning approach when learning how to use ICT systems.	Informal learning strategies and learning alone or from others dominated the initial learning of ICT systems.	Informal problem-solving strategies and asking for help from peers, local experts, or the Help Desk dominated during the ongoing use of ICT systems.	
3 (the problems): What use-related problems do employees experience when they adopt ICT systems at work?				
	The social context is the main source of ICT adoption problems.	User training is not enough when striving for successful ICT adoption.	Users need enough time and support to learn and internalize the use of a new ICT system; it will not happen overnight.	
4 (the self-determination): What possibilities and problems do the users perceive in the self-determined adoption and use of an ICT system?				
	Self-determination or self-direction is an efficient motivator, and may lead to a greater probability of success in the adoption and acceptance of an ICT system.		Self-determined adoption is an unsystematic process, and users may experience uncertainty regarding the organizational legitimization of the system and support for its use. A slow and unsystematic process may also appear too inefficient and risky from the point of view of management.	

5.1.1 Alternative theoretical approaches to technology acceptance models (sub-study 1)

Research gap: A wide, comprehensive, and structured review of the most influential theories and models, their research subjects, and contribution to ICT implementation and adoption studies seems to be lacking.

Research question 1a: What theories and models are used by the most cited publications (articles and books) in order to analyze and understand ICT system implementation and adoption?

Main findings: Technology acceptance models, that is, the technology acceptance model (TAM), the theory of reasoned actions (TRA), diffusions of innovations (DOI), the theory of planned behavior (TPB), and the unified theory of acceptance and use of technology (UTAUT), dominated the research field. The technology acceptance model (TAM) was the most focal theory applied in ICT system adoption.

Research question 1b: How are the theories and models applied and what themes are addressed in the most cited articles in the field of ICT system implementation and adoption research?

Main findings: The TAM model has inspired a lot of research, which mainly aims at developing the TAM model by adding different variables. The whole research field in implementation and adoption is heavily dominated by quantitative and positivistic research, which uses technology acceptance models to explain and understand the adoption and acceptance of ICT by individuals. However, the technology acceptance model research has some limitations: first, the technology acceptance models have not succeeded in capturing social and organizational factors when analyzing and understanding the adoption of ICT systems by an individual, and they do not focus on the adoption as a process or on the consequences of the adoption; second, the ICT implementation and adoption research lacked a variety of research methodologies. For the most part ISI journals published quantitative and positivistic research on ICT implementation and adoption.

Additional research aim: What is the role of learning theories and concepts in the most cited articles in ICT system implementation and adoption research?

Main findings: Learning theories and concepts were applied only marginally in ICT implementation and adoption research in the field of management and business research.

Main contribution to the research field: Sub-study 1 contributes to the existing ICT implementation and adoption research by structuring and analyzing previous research and by showing that it has been conducted according to the same methodological approaches as the mainstream of ICT research does. Sub-study 1 supports previous findings in three ways: first, the technology acceptance models dominate the ICT adoption research (Gallivan, 2001; Jeyaraj et al., 2006); second, the most influential theory is the technology acceptance model (TAM, Chuttur, 2009; Jeyaraj et al., 2006; Lee et al., 2003), and third, the sample articles on ICT implementation and adoption were conducted according to the positivistic approach and survey research design (Chen & Hirschheim, 2004; Orlikowski & Baroudi, 1991; Palvia et al., 2004). One significant finding in sub-study 1 was that the most cited previous research considered learning theories and concepts only marginally. This is an important finding, since several influential researchers view learning theories and concepts as beneficial in explaining and understanding ICT implementation

and adoption (e.g., Attewell, 1992; Auer, 1998; Bagozzi et al., 1992; Boudreau & Robey, 2005; Fickman, 1992; Gallivan, 2001). Thus, ICT implementation and adoption research would benefit from alternative theoretical approaches and a variety of research designs in order to disclose new insights. The empirical field sub-studies 2, 3, and 4 contribute by applying alternative theoretical frameworks paying attention to social and organizational contexts and applying a qualitative interpretive research design. Sub-study 2 applies learning theories, sub-study 3 applies the activity system model, and sub-study 4 the model of institutionalization as a structuration process.

5.1.2 Learning model combining learning theories and models of ICT adoption context (sub-study 2)

Research gap: Lack of understanding of the ways in which employees prefer to learn how to use ICT systems.

Research question 2: What kinds of approaches to learning and what kinds of strategies for learning and problem solving do employees choose when learning how to use ICT systems in work settings?

Main findings: Employees mainly chose to learn how to use ICT systems quickly and without investing too much effort. They chose to exploit the social environment and use informal ways of learning, such as asking from peers and on-the-job learning. They solved problems related to ICT use alone or together with peers and colleagues while working. Employees often overlooked formal support provided by the organizations, for example, user training, manuals and the Help Desk. These findings are important, because they illustrate the employees' preferences concerning how to learn how to use ICT in an organizational setting. This sub-study also shows that the object of learning, that is, the ICT system, is essential when analyzing ICT adoption and learning.

Main contribution to the research field: Sub-study 2 contributes to the previous ICT research by combining learning theories and concepts into ICT adoption contexts. Sub-study 2 supports previous findings regarding employees' preferences concerning informal ways to use ICT, for example, asking for help from peers or local experts (e.g., Barki & al., 2007; Spitler, 2005; Twidale, 2005; Sein et al., 1987; Winter et al., 1997) or on-the-job learning (e.g., Barki & al., 2007; George et al., 1995; Spitler, 2005). The contribution of sub-study 2 to ICT learning research is that it examines strategies for learning and problem solving and approaches to learning in organizational settings. Learning strategies (Holman & Epitropaki, 2001) and

approaches to learning at work (Kirby et al., 2003) have been studied on a general level, but not in the context of ICT adoption. Additionally, there is a lot of learning research, for example, on informal learning practices at work (Cheetham & Chivers, 2001; Eraut et al., 1998), and self-directed learning at work (Gerber & al., 1995) but it has not been applied to the context of ICT adoption.

Sub-study 2 also contributes to previous research by pointing out that the object of learning is essential when analyzing ICT adoption and learning at work. My co-author and I formed a new conceptualization of a learning situation in the ICT adoption context at work based on educational learning literature (Ramsden, 1988), workplace learning literature (Berings et al., 2005), and the activity system model conceptualized by Engeström (1987). The new model of a learning situation was comprehensive, practice-based, and, most importantly, paid attention to the object of learning. I found that existing workplace learning models (e.g. Billett, 2001; Illeris, 2007, 2011) were not applicable in the context of ICT adoption and learning, primarily because of their limited focus on the object of learning. Another reason for forming a new model was that existing learning models were not sufficiently based on the ordinary learning processes related to ICT adoption in organizational settings. For example, Engeström's (1987) expansive learning examines learning as a process in which the learner deals with an urgent and critical challenge leading to profound personal changes, which was not the usual case in my data. The new model made it possible to analyze and understand an ICT learning process in its context (organizational and social) with all the relevant elements, such as the learner, the object of learning (the ICT system and its use), learning activities (approaches and strategies), and outcome. Thus, sub-study 2 contributes to the ICT adoption research by proposing a new conceptualization of the learning situation in the ICT adoption process.

Contribution to the overall research question: Sub-study 2 contributes to the overall research question by emphasizing the enablers for ICT adoption, which concern the possibilities of asking, the strategic learning approach, and informal on-the-job learning.

5.1.3 From user resistance to adoption problems in social context (sub-study 3)

Research gap: Lack of understanding of employees' use-related problems that emerge when new ICT systems are adopted in organizations.

Research question 3: What use-related problems do employees experience when they adopt ICT systems at work?

Main findings: This study showed that the social context was the main source of problems, and that user training is not enough when striving for successful adoption. One important finding is that employees themselves seemed to change slowly; it took time to internalize the use of ICT and make it a common and routine part of everyday work. The study showed that a great number of ICT adoption problems were similar in the three case organizations, and, thus, not dependent on the ICT system used. The findings of sub-study 3 are important, because they reflect employees' experiences of problems when they adopt and learn how to use ICT systems.

Main contribution to the research field: The main finding in sub-study 3 was that the social context is the main source of ICT adoption problems. There is a lot of previous literature examining employees' problems related to ICT adoption and acceptance, but it does not pay attention to the social factors involved in ICT adoption problems. First, the previous research on ICT adoption problems focuses on user resistance, which has been studied theoretically, empirically, and by analyzing existing studies. For example, studies focusing on user resistance identify factors leading to user resistance (e.g., Kim & Kankanhalli, 2009), resistance behaviors (Lapointe & Rivard, 2005), and reasons for user resistance and principles for reducing it (Adams et al., 2004), but these studies do not identify the social context as a source of ICT adoption problems. Second, the previous research focuses on other ICT-related problems, such as instructors' technical challenges and challenges with integrating the tool into their teaching (West et al., 2007), salespersons' perceptions associated with technology rejection (Speier & Venkatesh, 2002), and challenges in using online ICT systems, such as unwillingness to use the system because of the new communication patterns required by the system (Olson & Olson, 2000; Suggs et al, 2002). These studies do not identify the social context as a source of problems, either. Thus, the previous literature about ICT adoption problems examines employees' problems from a tightly focused perspective, for example, user resistance or challenges related to interaction when using online ICT systems. However, none of the studies examined use-related problems broadly or in such a wide and comprehensive framework as I did in sub-study 3. Thus, the results of sub-study 3 contribute to the existing literature by providing an insight into the employees' experiences of ICT adoption problems in three different organizations with three distinctive ICT systems, and by considering the organizational and social contexts in which the employees adopted and used the systems. Sub-study 3 also considered the relationships between different elements and the reasons for the problems and contradictions they were related to. In that way I was able to detect employees' use-related problems widely and identify the social context as the main source of ICT problems. The findings of sub-study 3 also contribute to user resistance

research by showing that the social context is an important source of user problems in ICT adoption, and thus, user resistance may be a wider and more social phenomenon than previous user resistance research suggests.

Another finding in sub-study 3 was that mere user training was not sufficient in order to overcome the employees' problems related to ICT adoption and use. This is a somewhat surprising finding, since many earlier studies (e.g., Adams et al., 2004; Compeau et al., 1995; Gallivan et al., 2005; Lee et al., 1995; Nelson & Cheney, 1987; Thong et al., 1994; Venkatesh & Smith, 1999; Venkatesh, 1999) suggest that overcoming problems and challenges in the adoption of ICT depends primarily on providing user training. However, researchers also agree – by implication – with the finding by showing other important factors affecting the adoption and use of ICT by individuals. For example, they emphasize that employees' mental models and the structure and culture of organizations are significant influences on how ICT is adopted and used (Orlikowski, 1993) or by showing a variety of success factors influencing the implementation of ICT systems (e.g., Fowler & Horan, 2007; DeLone & McLean, 1992). Thus, these studies report other important factors related to ICT adoption than user training. Though Gallivan et al. (2005, p. 154) argue that “training is only one of many factors that influence users' IT skills and level of usage”, and that the effects of user training are exaggerated, because there are other contextual and organizational factors shaping users' skills and use of ICT, they do not address the social context as a source of problems in the adoption of ICT. Sub-study 3 connects analysis of the activity system model to the ICT adoption context. The activity system model approach enabled use-related ICT adoption problems and their consequences to be identified and analyzed within a social and dynamic environment. This study emphasizes that it is important to pay attention to adoption processes, including their various elements, interactions, contexts, and consequences.

Contribution to the overall research question: Sub-study 3 contributes to the overall research question by emphasizing the enablers for ICT adoption concerning management support, joint rules, the time used, and reliable technology.

5.1.4 Self-determined adoption process (sub-study 4)

Research gap: Lack of understanding of the possibilities and problems of a self-determined ICT system adoption process, which does not follow the course of a traditional stage model (see Table 2).

Research question 4: What possibilities and problems do the users perceive in the self-determined adoption and use of an ICT system?

Main findings: Employees experienced the self-determined or self-directed ICT adoption process as pleasant and motivating. Thus an ICT adoption which includes autonomy and the possibility of choice may lead to a greater probability of success in the adoption and acceptance of an ICT system. However, self-determined adoption is an unsystematic process, and users may experience uncertainty regarding the organizational legitimization of the system and support for its use. The findings of sub-study 4 are important, because they show that an ICT adoption process is a dynamic and evolving process in which individuals actively shape the process and its outcome.

Main contribution to the research field: Other ICT adoption studies have also identified self-determination as an important motivating factor in the adoption of ICT systems by individuals. For example, the technology acceptance models address individual motivation to use ICT systems. The most influential theory, TAM (e.g., Davis, 1989), includes two motivational factors (cf. Deci and Ryan, 2000): ease of use, referring to competence (“is it easy for me to use this tool?”), and usefulness, referring to autonomy (“is it beneficial for me to use this tool for this work task?”). Usefulness is considered to be the major motivating factor in measuring users’ motivation to adopt, while it also measures control over work, the user’s needs, and time saving. Another example in TAM research is the motivational model (e.g., Igbaria et al., 1996; Venkates et al., 2003). For example, Igbaria et al. (1996, p. 130) identified three motivators: perceived usefulness (reinforcement value of outcomes), perceived fun/enjoyment (“represents an intrinsic motivation for the use” of ICT systems), and social pressure (referring to an individual’s perceptions of normatively appropriate behavior regarding ICT use). Thus, there are a lot of TAM applications studying employees’ motivation and autonomy. However, their focus is on the motivational intention and decision to use ICT systems, which is different when compared to the focus of sub-study 4: it identifies self-determination in adoption processes and social interaction. Additionally, technology acceptance models focus in only a limited manner on social or organizational factors, as stated many times before in this thesis. Thus, sub-study 4 brings new knowledge by showing that self-determination as a motivator in an ICT adoption may manifest itself in many ways. For example, employees may behave in a self-determined way when they freely introduce a new and practical ICT system to colleagues and learn how to use the system together while working. Sub-study 4 contributes to TAM research by showing that self-determination is an important motivational factor in ICT adoption.

Sub-study 4 examines ICT adoption as an evolving and dynamic process in which individuals interact and actively shape the adoption process. I was able to examine this process by applying the model of institutionalization as a structuration process conceptualized by Barley

and Tolbert (1997). Previous literature has examined ICT adoption by applying structuration theory or approaches based on structuration theory (e.g., DeSanctis et al., 1993; Kouroubali, 2002; Walsham & Han, 1993). However, the existing literature usually focuses on examining and explaining how social actions and structures affect the introduction and adoption of information technology in organizations. None of these studies address the dynamic process in which individuals actively adopt, enact, replicate, revise, and/or reject the institutionally grounded meanings and purposes of ICT systems. In sub-study 4 the model of institutionalization as a structuration process is used to describe how people – through their daily actions and choices – can change scripts and institutionalized assumptions rather than reinforce them. And thus sub-study 4 is an example of how the model of institutionalization as a structuration process conceptualized by Barley and Tolbert can be applied.

Contribution to the overall research question: Sub-study 4 contributes to the overall research question by emphasizing the enablers for ICT adoption concerning management support, autonomy, and on-the-job learning.

5.2 Theoretical implications

In this section, I discuss the ways in which this thesis may help to perceive the adoption of ICT by individuals in a new way and what implications this thesis creates for existing theories. First, I discuss the theoretical implications the eight enablers reset for existing ICT adoption theories. Then I discuss the activity system model and the model of institutionalization as a structuration process as alternative theoretical frameworks, and how they can contribute to the analysis and understanding of ICT adoption in organizational settings. Finally, I discuss the integration of ICT adoption and learning research in one study.

5.2.1 Eight enablers: Implications for other theories

Implications for ICT system implementation and adoption stage models. The eight enablers have a theoretical impact on ICT system implementation stage models. Table 2 depicts a stage model for organizational ICT system implementation (Cooper & Zmud, 1990; Kwon & Zmud, 1987). The model covers an implementation process from the scanning of organizational needs to a full and effective use of the technology in daily practice. The strength of the model is that it helps to

provide a comprehensive understanding of the different stages, the activities connected to each stage, and the prominence of each stage in an ICT implementation process. The eight enablers contribute to ICT system implementation and adoption process models by defining and expanding the volume of end user support functions and training. For example, the process model in Table 2 includes user training only in stage 3. However, it is beneficial to stress that end users also need support in stages 4, 5, and 6. In these stages end users need continuous technical support, formal training, next-door support, management support, and opportunities and time to ask and learn how to use the technology together with colleagues. The need for support does not end when the last stage, the effective use of the technology, is realized in the organization, because there are always new employees and new system functions for employees to learn, and experienced users also need to advance their skills in order to develop the use of the system. By adding these factors into the process model, researchers and practitioners are able to comprehend the activities needed for end user support and motivation, and their prominence in each stage.

Implications for the technology acceptance models. The eight enablers contribute to the technology acceptance research by showing new essential factors which have an impact on employees' intention to adopt, accept, and continue to use an ICT system. First, the enablers contribute by showing that social interaction is an essential and motivating factor when adopting new ICT systems. Thus, technology acceptance research could investigate, for example, the possibilities that exist for employees to ask for help from more experienced peers and colleagues, learn together with peers while working, and receive managerial support. Second, the enablers contribute by showing that informal ways of learning are motivating. Thus acceptance models could investigate the possibilities that exist for employees to learn on the job or choose the ways in which they adopt and learn how to use ICT systems. They could also investigate employees' approaches to adoption and learning and also in that way identify their motivation to adopt and learn how to use ICT and to discover whether the employees' motivation and intention to use the system is only for small and occasional work tasks or their intention to use the system is more profound and versatile. Finally, technology acceptance research could focus more clearly on the object of adoption, investigating what the features, possibilities, and challenges of the ICT system in question for the employees' work are. This would anchor the research more in contextual elements.

Implications for learning research. The eight enablers have theoretical implications for workplace learning research. The enablers depict an example of practice-based workplace learning in which many different factors form an entity related to a specific learning context. It is a combination of learning enablers which takes into account the social and organizational

contexts, the adoption and learning process, and the object of learning. If we compare the eight enablers, for example, to the learning model of Illeris (2007; 2011, see Section 2.1.2), we can observe what ICT adoption stresses in a learning process. First, ICT adoption and learning conditions stress the significance of joint rules in the context of social interaction, and this highlights the collaborative nature of ICT system use. Second, the adoption and learning process pay attention to the approaches to learning, which is not often the case in learning models (e.g., Illeris, 2007, 2011). This highlights the multiform purpose of system use and that it is beneficial to identify employees' approaches to learning and to whether the aim is to deal with an occasional work task, or whether the system is a central tool with which to perform and organize one's work. For example, motivated employees with a deep approach to learning may be an asset to their organizations, because they may seek to support other employees and inspire them to use ICT systems. But, on the other hand, a surface approach also had its advantages as it allowed employees to adopt a resource-effective way to perform minor work tasks with the system. Third, the learning process in the eight enablers stressed that employees need time to adopt and learn how to use the system. It may be challenging to learn how to use an ICT system as well as to internalize a new way of thinking and acting. Thus, ICT adoption and learning may include aspects of transformative learning (e.g., Illeris, 2007), which influences individuals at different levels; besides cognition, emotional and social aspects of an individual may also change. Fourth, the eight enablers stress the object of adoption and learning, that is, the ICT system. This means that the ICT system and its characteristics have an impact on the learning process. For example, unreliable technology may cause reluctance to learn, while reliability and good connections support learning. Thus, the eight enablers contribute to the learning research by showing an example of a practice-based learning process in an organizational setting and by highlighting the important learning elements and conditions in such a learning situation.

Implications for activity system model and the model of institutionalization as a structuration process research. In sub-study 3 I applied Engeström's (1987) activity system model in the context of ICT adoption in an organization. This thesis contributes to activity system model research by showing a new research area in which the model can be applied successfully. It also depicts the elements of an activity system model related to an ICT system adoption in detail. In sub-study 4 I applied the model of institutionalization as a structuration process, which was conceptualized by Barley and Tolbert (1997) in the context of a self-determined ICT adoption process. Thus, sub-study 4 contributes to the model of institutionalization as a structuration process research by providing a practical and useful example of how Barley and Tolbert's model can be applied in ICT implementation and adoption contexts.

Implications for research in the field of End User Development (EUD). In sub-study 4 my co-authors and I focused on the impact of self-determination or self-directedness in an adoption process. The research field called ‘end user development’ (EUD) focuses on end user self-determination in the way that end users are allowed to configure, adapt, and evolve software themselves (Sutcliffe & Mehandjie, 2005). EUD refers to a set of methods, techniques, and tools that allow end users acting as non-professional software developers to create, modify, or extend a software artifact (Lieberman et al., 2006). Sub-study 4 differs from EUD research, since it includes empirical observations on how self-determination can be detected. Since EUD research focuses on end user activity and motivation in software development (e.g., Kierkegaard & Markopoulous, 2011; Syrjänen & Kuutti, 2011), it might be beneficial to apply self-determination and learning in such research. Thus, sub-study 4 contributes to EUD research by showing how self-determination can be observed in social systems. It would increase a comprehensive understanding of end user development and design when combined with self-determination and learning.

5.2.2 Two alternative approaches to analyzing ICT adoption

I applied two alternative models in order to analyze ICT adoption. They offered distinct perspectives for analyzing ICT adoption compared to the traditional ICT adoption models. I found that dynamics, social interaction, and organizational contexts were essential in the process of the adoption of ICT by an individual, and that the traditional approaches, technology acceptance models or stage models for ICT implementation and adoption, could not explain these ICT adoptions in an exhaustive manner. Traditional approaches to ICT system adoption and implementation have been criticized for being quite context-neutral (e.g., Bagozzi, 2007; Legris et al., 2003) and static frameworks (Orlikowski & Hofman, 1997), and they were not able to offer answers to my research questions in sub-studies 3 and 4. Therefore, I applied Engeström’s (1978) activity system model and Barley and Tolbert’s (1997) model of institutionalization as a structuration process. These frameworks consider human actions as dynamic processes and take into account social and organizational contexts. However, they differ from each other in their emphasis: the activity system model stresses disturbances as potential learning situations in the system, while the model of institutionalization as a structuration process examines change as an interaction process between the employees’ daily activities and the organization’s established rules and values, and how these daily practices may become institutionalized.

I applied the activity system model (Engeström, 1978) in sub-study 3 in order to analyze the employees' problems when they adopted ICT systems. Traditional adoption models focus on individuals' intentions and decisions to adopt or not adopt an ICT system (e.g., Davis, 1989; Venkatesh & Davis, 2000), and it has been argued that they pay rather limited attention to social and organizational contexts (e.g., Attewell, 1992; Bagozzi, 2007; Fichman, 1992; Legris et al., 2003; Lyytinen & Damsgaard, 2001; Salovaara & Tamminen, 2009). The activity system model offers a holistic and dynamic framework for a deeper understanding of ICT adoption processes and their problems and consequences. With the help of the activity system model, it is possible to connect individuals to the tools used, objects striven towards, outcomes transformed, and the social environment, which has an impact on the whole activity. It is also possible to detect relationships between elements, and to consider processes and their consequences. Additionally, with the help of the model, it is possible to regard the individual as an essential part of the social system, in which all elements influence each other.

I applied the model of institutionalization as a structuration process (Barley & Tolbert, 1997) in sub-study 4 (the self-determination) to analyze and understand a self-determined ICT adoption in an organization. The model of institutionalization as a structuration process offers an alternative view to the traditional stage models, such as Cooper and Zmud's (1990) model of an ICT system implementation process (see Figure 4 for the model of institutionalization as a structuration process and Table 2 for the stage model). By applying the model of institutionalization as a structuration process I was able to depict a dynamic adoption process in which individuals actively adopted, enacted, replicated, revised, or rejected the institutionally grounded meanings and purposes of an ICT system and its adoption and use. This model focused more on the structures and changes of organizational ICT adoption than on the individual adoption process of ICT. This kind of framework can help us understand how change processes occur in an organization, and, for example, how an unexpected or unwanted change in work practice may emerge. Realizing how a change process develops may also help support persons and managers in understanding how they could better support change processes in organizations.

5.2.3 Integrating ICT adoption and learning research into one study

This thesis contributes by combining research in two distinctive research areas, namely ICT adoption research and individual learning research. In sub-study 2, my co-author and I formed a learning model based on the previous research. A learning approach can be beneficial, because learning, similarly to an ICT adoption, is a change process (e.g., Illeris, 2007; Schoenfeld, 1999).

Thus, learning theories and concepts can offer tools for identifying, analyzing, and understanding changes and their consequences both in the individual's cognitive processes and in interaction in the social environment in which individuals act (e.g., Illeris, 2004; 2011). However, sub-study 1 and other reviews (Fichman, 1992; Jeyaraj et al., 2006; Lee et al., 2003; Legris et al., 2003; Venkates et al., 2003) show that ICT adoption research focuses on other theoretical approaches. Although some distinguished researchers argue that learning theories are beneficial when studying ICT adoption (e.g., Attewell, 1992; Bagozzi et al., 1992; Benbasat & Barki, 2007; Papa & Papa, 1992; Vandenbosch & Higgins, 1996.), ICT adoption research and learning research have remained quite separate. Could one reason for this separation be the differences in the ontological and epistemological approaches of the research fields? Learning researchers comprehend the world as socially constructed, while I would argue that there is a tendency in the ICT implementation and adoption research to approach the world in terms of objective realities. This tendency can be detected in sub-study 1 (the review), while other ICT reviews have come to the same conclusion (Chen & Hirschheim, 2004; Orlikowski & Baroudi, 1991; Palvia et al., 2004). Additionally, the learning theories that have been developed might be rather abstract and complex (cf. Hager, 1999) and the learning research field has its own disciplinary vocabulary, which may make it difficult for researchers from other disciplines to apply learning theories and models in their research projects. Workplace learning research focuses on more practical phenomena, but researchers in that field do not seem to be particularly interested in studying ICT adoption and implementation. However, I have addressed and applied learning theories and concepts in sub-study 2, and shown that it is beneficial for ICT adoption and implementation research to consider individual learning processes when analyzing and understanding the implementation and adoption of ICT systems. Learning theories and concepts help researchers to focus on how people actually behave and think while adopting an ICT system, what elements and processes are included and have an impact on an adoption process, how the adoption (or learning) process proceeds, and what the outcomes and consequences are.

5.3 Practical implications

This thesis explores employees' experiences of how to adopt ICT systems, which I believe have practical implications for designers, managers, and support staff. I detected four implications for

practice, and they are related to support functions, shared rules, self-directed workplace learning, and management support.

First, sub-study 3 (the problems) showed that employees need organizational support which corresponds to their needs. These findings emphasize that the organization's support functions for ICT adoption need to be well considered and adequately resourced. Many interviewees in this study had experienced the support functions available in the organizations as not being useful, and they did not want to utilize them. Therefore, it can be concluded that the support functions and employees' needs and desires for adopting the use of ICT systems did not coincide. There is disagreement, because on the one hand some employees said that they did not use manuals or participate in formal end user training and on the other hand they said that manuals and formal user training are needed. Thus, manuals should be developed in such a way that they offer simple and user-friendly help. Likewise, formal user training is needed, because it makes it possible to learn the necessary concepts and operational principles of the use of the system and shared rules. Training should be developed in such a way that the employees can apply the ICT system within their work tasks.

Second, sub-studies 2, 3, and 4 (Table 9) showed that the most popular type of support was informal peer support and that time was essential when learning to use ICT. Employees considered that learning proceeded fast and easily when they were able to ask for advice from peers, colleagues, or next-door support persons, and when they learned and practiced the use of the ICT system while working and collaborating with peers. Sub-study 4 showed that features of self-determination or self-direction provide opportunities for self-directed workplace learning. Self-directedness can be organized and supported by, for example, providing time and space for informal learning guided by the learners themselves. For example, employees are provided with opportunities for learning with peers and colleagues while working, or asking for advice from an experienced peer or next-door support person. Such support would provide practice and transfer contextualized knowledge about common ways of working from one employee to another.

Third, sub-study 3 showed that employees did not find the information they needed on the system's pages, which was experienced as being extremely annoying and frustrating, or they did not know how to behave in an online session. Thus, it is important to develop shared common ways of working with the ICT system in the organization. Such joint rules help the employees to understand the social norms and how tools are to be used.

Fourth, sub-studies 3 and 4 showed the importance of management support, as so many ICT studies have done before (e.g., Fowler & Horan, 2007; Jarvenpaa & Ives, 1991). Thus, organizations may succeed better in ICT adoption if they provide concrete management support and emphasize that this is the way we work in this organization, and it is well worth the effort to

invest in learning how to use the ICT system. One visible sign of management support for employees could be that the organization invests – besides formal user training and constant technical support – in informal ways of learning and gives employees enough time to learn and internalize the use of ICT systems. One practical idea is to allocate time for learning and digesting in the organization's implementation schedule.

5.4 Evaluation of the study

5.4.1 Reliability and validity

Sub-study 1 (the review) was conducted as a combination of quantitative and qualitative methods. In sub-study 1, I improved the quality of the study by paying special attention to one validity criterion and two reliability criteria. To ensure validity, I chose the search terms carefully (Raghuram et al., 2006) by scanning previous ICT studies, and then identified and delimited the suitable terms. To ensure reliability, I first checked and corrected all the citation information in the Microsoft Access database. Second, I discussed the emerging categories and contents of the topics of the 20 most cited previous publications, the most cited thematic groups, and the role of learning in the qualitative analysis with another researcher, and she challenged me and asked for justification of the categories that had been formed until the categorization was final (Miles & Huberman, 1994).

To improve the quality of sub-studies 2 (the learning model), 3 (the problems), and 4 (the self-determination), I followed the criteria of qualitative research (Creswell, 1998; Kvale, 1989; Merriam, 2009; Miles & Huberman, 1994; Sandberg, 2005; Silverman, 2006). I paid special attention to four quality criteria: external validity, internal validity, pragmatic validity, and reliability. External validity or transferability refers to the applicability of the findings of the study to other situations (Merriam, 2009). Thus, I selected the organizations and interviewees purposefully in order to gain some variation in the sample; that is, the cases and interviewees differ from each other in order to gain heterogeneity (Merriam, 2009). I have depicted the selection criteria in detail in the methods section. The findings from the different organizations and interviewees were not compared to each other, but used to formulate a deep understanding of the phenomenon being studied on the basis of analytic generalizations (Creswell, 1998; Herriot & Firestone, 1983; Merriam, 2009; Yin, 2003b).

Internal validity (Merriam, 2009) or communicative validity refers to the coherence of interpretations (Sandberg, 2005) or to an understanding between the researcher and research participants about what both parties are doing (Apel, 1972). Internal validity was ensured in three ways: (1) the interviews were conducted in the form of a dialogue, and I explained to the interviewees at the beginning of the interview that I was interested in the interviewee's personal experiences. I elaborated the questions with follow-up questions, such as "Can you give me an example?"; (2) I observed and participated in various events in the organizations, such as online and face-to-face training sessions and seminars, and I also met and spoke with other employees besides the interviewees; (3) in the analysis I aimed for coherent interpretations, meaning that the parts of the phenomenon being studied must fit the whole and the whole must fit the parts (Creswell, 1998; Sandberg, 2005; Silverman, 2006).

Pragmatic validity refers to testing the knowledge produced in action (Kvale, 1989). It focuses on "discrepancies between what people say they do and what they actually do" (Sandberg, 2005). I ensured pragmatic validity by asking follow-up questions in the interviews, which constantly embedded the statements into actual situations.

Reliability concerns the procedure for achieving the truthfulness of interpretations (Sandberg, 2005), or the consistency of the results with the data collected (Merriam, 2009). Reliability was secured in four ways: (1) I described the research and analysis processes, and I expressed the theoretical stance upon which the interpretation of the results was based (Silverman, 2006); (2) I recorded the interviews and they were professionally transcribed word by word (Seale, 1999); (3) I discussed the research findings with other researchers in the research group. The other researchers challenged me and asked for justification on the emerging categories in the analysis until the categorization was final (Miles & Huberman, 1994); (4) I was in contact with the case organizations, and checked the findings with the key informants (Merriam, 2009; Miles & Huberman, 1994); (5) additionally, sub-studies 3 and 4 were examined by blind check-coding (Miles & Huberman 1994, p. 64; Strijbos et al., 2006): another researcher and I classified a part of the data. In sub-study 3, 10% of the data were classified, and a 78% agreement in the analyses was found. In sub-study 4, 18% of the data were classified, and an 82% agreement was found.

In sub-study 4 (the self-determination), the original research questions were different from the ones I finally addressed in the sub-study, and therefore I reanalyzed the data. In order to be able to make a credible secondary analysis, I paid attention to four validity criteria (e.g., Heaton, 1998; Hinds et al., 1997; Thorne, 1994). First, I reanalyzed my own data, which were recorded and transcribed, and thus I had direct access to the data and I was familiar with them (e.g., Gladstone et al., 2007). Second, the original research questions and the new research

questions focused on the same phenomenon, which is how employees adopt new ICT systems at work, and the new, focused research questions were formulated on the basis of the findings in the primary analysis (e.g., Gladstone et al., 2007; Hinds et al., 1997). Third, all the interviewees described their experiences of the phenomenon being studied, and consequently there were no missing data (Hinds et al., 1997; Thorne, 1994). Fourth, I reported the main methodological issues regarding the original study, together with the description of the processes in the secondary data (Heaton, 1998).

5.4.2 Limitations of the research

I address four limitations in the collection of the data and one limitation in the analysis of the data. First, I have applied existing theories in a new research context in order to find different and fresh insights and analysis from the adoption of ICT systems by individuals. However, I collected the data before I decided which theory or model I would apply in my sub-studies. Thus, the limitation from this perspective is that I was not able to modify the data collection procedures according to the theory or model I applied, for example, the choices of informants, definitions of relevant concepts, and specific questions to be investigated (Merriam, 2009; Miles & Huberman, 1994, p. 18). If I had applied the theory from the very beginning, I could have improved the credibility of the study by collecting more specific data and paying more attention to the essential elements of the theory and their relationships, and in this way I would have better analyzed, interpreted, and understood the phenomenon studied in its theoretical framework (cf. Merriam, 2009).

Second, data collection can be said to be closed when the data are saturated (Eskola & Suoranta, 1998; Merriam, 2009), that is, the researcher finds no more additional data in order to develop the properties of the category (Glaser & Strauss, 1967, p. 65). The limitation or challenge of my research from this perspective was that I was unable to be sure of the point of saturation of the data, because I decided on the theory or model of the sub-studies after the data collection. For example, Eskola and Suoranta (1998) suggest that 15 interviewees is an adequate sample for one case. In sub-studies 2 and 3, I interviewed 12 to 15 employees in each of three organizations, which equaled 39 interviews altogether. However, in my opinion, in some qualitative research cases, a larger sample of interviewees would highlight the relationship between the emerging categories even more, and put less weight on the researcher's interpretations and choices. A larger sample of interviewees means that the data collection continues after saturation, and more cases can be categorized into each of the groups formed. In a large sample of interviewees, the

researcher is able to count, for example, frequencies, which helps the researcher to assess the weighting of each category, for example by assessing which category is most common and which category is more uncommon (cf. Miles & Huberman, 1994, p. 253). Thus, a larger sample of interviewees would improve the internal (communicative) validity and the generalizability of the results (Merriam, 2009).

Third, I interviewed each interviewee once; that is, my study was a cross-sectional study. My focus was on studying the changes in employees' behaviors, that is, how they adopted ICT systems. Thus, the limitation is a lack of longitudinal data. Longitudinal data would offer a more holistic view of the phenomenon and improve the internal validity of the study, especially when a change (learning) process is being studied. Thus, in order to study the changes in the behaviors and individuals' thinking in more detail, interviews should be conducted on at least two separate occasions.

Fourth, my primary data collection method was semi-structured interviews. I also participated in the organizations' user training sessions and seminars, and collected organizational documents such as manuals and user instructions, reports on user studies, statistics on the use of the ICT systems, and examined the use of each ICT system. These data were not analyzed, but they provided a better understanding of the organizational contexts (Creswell & Maietta, 2002; Yin, 2003b) and, thus, supported a more accurate analysis of the interview data. However, the lack of triangulation can be considered a limitation, because triangulation may improve the internal validity and reliability of the research (Merriam, 2009). Triangulation, which consists of participant observation as a mixture of observation and interviewing (i.e., interacting with those being observed, Delamont, 2004), as well as accurate notes or recordings, would have improved the internal validity and reliability of my research.

I analyzed the data primarily alone, and other researchers discussed the categories and their contents with me. In sub-study 3 (the problems) and 4 (the self-determination) reliability was secured by blind check-coding, in which another researcher and I classified about 10% to 20% of the data independently (Miles & Huberman, 1994, p. 64). Thus, the limitation from this perspective was the lack of validation and reliability of data analysis. Data analysis is the most challenging part of the qualitative research process, and its impact is crucial, because it is "the process of making sense of the data" (Merriam, 2009, p. 172). However, the internal (communicative) validity (Sandberg, 2005) and reliability of the research would have increased if at least two researchers familiar with the research topic had formed the categories in collaboration from the beginning, especially in less studied areas in which no previous examples are available, as in my sub-studies 3 and 4.

5.5 Recommended topics for further research

I recommend three future research topics. First, this thesis does not focus on the learning outcomes of employees adopting ICT systems: none of the sub-studies explore whether and to what extent employees learned to use the systems. Nor does this thesis explain how the approaches to learning and the actualized learning strategies are connected to the outcomes of learning, or how the problems employees experienced and their consequences affect the outcomes of learning. Future research should study how the elements of a learning activity in the context of ICT systems at work interact in order to best promote the desired learning outcomes. Future research should also study whether and how problematic situations experienced by employees may promote individual, group, and organizational learning. For example, all the problems detected in sub-study 3 present either a challenge or an opportunity for learning (cf. Engeström, 2001). The analysis with the help of the activity system model makes such challenges more concrete by showing the problematic areas in employees' work, communication, and learning. Future research should study how individuals, groups, and organizations take advantage of these learning opportunities (e.g., ICT adoption problems), what kind of learning occurs, if any, and what the outcomes of possible learning are. This kind of research would elicit valuable knowledge on ICT adoption and learning processes and their outcomes.

Second, the eight enablers for ICT adoption and learning (see Section 4.5) addressed feedback in the adoption and learning processes only marginally. However, feedback is considered to be a necessary condition for learning, because it gives information about the results of actions (Ellström, 2001; Frese & Altmann, 1989; Mezirow, 1991). Future research should explore in greater detail what kind of feedback supports or hinders ICT adoption and learning.

Third, this study showed that employees were not satisfied with the support offered in the organizations, and usually did not utilize it. Future research could investigate the support persons' perceptions and conceptions concerning their work, focusing on the intention of developing their work. Sandberg (2000, p. 23) argues that "understanding what constitutes competence is crucial to managing competence development effectively in organizations". Thus, by investigating the support persons' conceptions of their work (i.e., their ways of experiencing or making sense of their world), it is possible to make the support persons' work more context-dependent, as well as to identify the tacit dimensions of competences. Sandberg (2000) suggests an interpretive method for identifying and describing competences at work. The method includes

observations and interviews in order to capture variations in employees' conceptions. This kind of study would contribute to the understanding of the support persons' actual ways of working instead of the ways organizations describe in manuals, training programs, and job descriptions (Brown & Duguid, 1991, p. 40), and could therefore provide valuable insights for the future development of their work.

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Appendices

Appendix 1. The interview protocols

Sub-studies 2 and 3

- 1) Briefly describe your work and its content.
- 2) Briefly describe when, how, and for how long you have used the ICT system. Please evaluate the support the ICT gives to your work.
- 3) Describe your skills in using the system.
- 4) Describe how you initially learned how to use the system. Please evaluate your ways of learning.
- 5) Describe some problems you have confronted while learning how to use the ICT system, and while working with the help of the system.
- 6) Do you help others to use the system? If yes, please describe how.
- 7) How do other employees take the use of the system?
- 8) Describe the user training and support functions you have utilised. Please evaluate their effectiveness.
- 9) Describe how you solved problems related to the use of the system. Please evaluate your ways of solving problems.

Sub-study 4

- 1) Briefly describe your work and its content.
- 2) Describe when, how, and for how long you have used the ICT system. Describe whether and how the system has changed your ways of working. Please evaluate the support the ICT gives to your work.
- 3) Describe how and for how long the ICT system has been used in the company.
- 4) Describe why and how the ICT system was put into use in the company. Describe what kind of user support is available.
- 5) Describe what problems and benefits the system brings along with it. Has your understanding about the use of the system changed during the course of its use?
- 6) Describe how the system assists learning at work in the company.

Information and communication technologies (ICTs) offer organizations new opportunities to increase the effectiveness of interaction and collaboration, workplace learning, and work performance. Therefore, contemporary organizations invest actively in new and more advanced ICT systems in order to maintain and improve their performance capacity and competitiveness. However, new implementation projects often face problems and failures, and the literature has recognized end users as the most common source of implementation problems. This thesis focuses on employees' experiences of a successful adoption of ICT systems at work. The main findings show that employees prefer informal ways of learning how to use ICT, e.g., they ask for help from peers; the social context was the main source of use-related problems in ICT adoption, and self-determination in ICT adoption was experienced as a successful yet unsystematic way of adopting ICT.



ISBN 978-952-60-4385-2
ISBN 978-952-60-4386-9 (pdf)
ISSN-L 1799-4934
ISSN 1799-4934
ISSN 1799-4942 (pdf)

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