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ABSTRACT

The purpose of this paper is to map and examine what theories and models of ICT system implementation and adoption are used in management and business research. The focus is on the most influential theories and models, and how they are applied in the research papers. For this purpose, a comprehensive sample of the articles (N=1303) on this topic published between 1999 and 2010 in high-quality management and business journals was analyzed using citation analysis and qualitative content analysis. The results show that during this time the research field provided theories and models to examine the adoption and acceptance of ICT by individuals. The articles focused on a variety of extensions of the Technology Acceptance Model (TAM). The advantage of focusing on TAM is that it is a simple and parsimonious model, which has encouraged researchers to apply it widely. The weaknesses were that previous studies have not been able to integrate contextual factors into TAM, and the research field applied a single and unnecessarily restrictive methodological approach. Future research might benefit from studies which would focus on the implementation and adoption processes and their consequences by drawing on the learning and change management literatures. Additionally, research could also exploit more qualitative and interpretive approaches generating new and unexpected knowledge.

Keywords adoption, citation analysis, implementation, information systems, information technology, information and communication technology, learning, management and business research, technology acceptance models.

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1 INTRODUCTION

Information and communication technology (ICT) systems are widely used in organizations. Their use has many favorable consequences, because they support interaction and collaboration, workplace learning (Andriessen, 2003), and work performance (Ciborra and Patriotta, 1996; Jones and Kochtanek, 2004; Nunamaker, 1997; Orlikowski, 1996). Several studies demonstrate that ICT investments are beneficial for performance and productivity (e.g., Bharadwaj et al., 1999; Hitt and Brynjolfsson, 1996). However, the implementation of an ICT system always entails both organizational and individual changes (e.g., Rogers, 1995, 395; Van de Ven, 1986), and therefore user adoption and establishing the use of ICT systems have proven challenging in organizations (Bullen and Bennet, 1990; Burns et al., 1991; Grudin, 1989; Kwon and Zmud, 1987; Orlikowski,1993). The challenges and problems associated with the implementation and adoption of ICT systems have led scholars and practitioners to seek to understand and manage the processes and phenomena related to the topic, spawning an extensive literature on the field (e.g., Jeyaraj et al., 2006).

Many reviews have been conducted addressing ICT implementation and adoption in organizations. Jeyaraj et al. (2006) reviewed 115 empirical studies focusing on the coding of dependent and independent variables affecting ICT adoption. Venkates et al. (2003) reviewed user acceptance literature and discussed eight prominent models in order to propose a unified theory of the acceptance and use of technology. The Technology Acceptance Model (TAM) in particular has given rise to many reviews. Lee et al. (2003) made a meta-analysis and survey on 101 TAM studies. They focused on the progress, limitations, and future directions of TAM. Legris et al. (2003) reviewed 22 TAM articles. Their meta-analysis focused on the incremental development of TAM, and addressed the strengths and limitations of the model. Turner et al. (2010, analyzing 73 publications), King and He (2006, analyzing 88 papers) and Ma and Liu (2004, analyzing 26 studies) also performed meta-analyses of the results of TAM studies. Yousafzai et al. (2007) made a narrative literature review of 145 TAM papers to progress towards a unified view of TAM. Somewhat earlier reviews focus on Diffusion of Innovations (DOI). For example, Fickman (1992) performed a critical review of 18 empirical DOI studies.

The review focuses on different adoption contexts and their match with the context in which the classical diffusion theory was developed. Prescott and Conger (1995) reviewed 70 DOI studies. They focused on the comparison of the research results in order to evaluate the appropriateness of using DOI theory. To sum up, previous 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. Thus, they do not provide a comprehensive state-of-the-art overview of the most influential theories and their applications that are used in implementation and adoption research. Thus, 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. I formulated three research questions concerning the literature on the implementation and adoption of ICT systems in management and business research.

1. What theories and models are used by the most cited publications (articles and books) to analyze and understand ICT system implementation and adoption?
2. How are the theories and models applied and what themes are addressed in the most cited articles in ICT system implementation and adoption research?
3. What is the role of learning theories and concepts in the most cited articles in ICT system implementation and adoption research?

I formulated the first research question in order to identify the most influential theories and models used in the research into ICT implementation and adoption during the years 1999-2010. In other words, I focused on the theoretical history of the current studies. It is important to know the basis and background of the current research in order to position one's own research there (Palvia et al., 2004). In the second research question, I investigated in detail the contents of the most cited articles; that is, I identified their research subject or research questions, the main theory and theoretical concepts used, and the main contributions. The analysis of research contents is important in order to identify well-studied areas and to find out where research is still needed (Palvia et al., 2004; Webster and Watson, 2002). I formulated the third research question because previous research stresses the role of learning processes in understanding ICT system implementation and adoption (e.g., Attewell, 1992; Bagozzi et al., 1992; Benbasat and Barki, 2007; Korpelainen and Kira, 2010; Papa and Papa, 1992; Vandenbosch and Higgins, 1996). Many ICT systems are socially constructed and learning-intensive (Lyytinen and Damsgaard,

2001), and they often require considerable skills and know-how if they are to be implemented, operated, and adopted (e.g., Andriessen, 2003; Attewell, 1992; Lyytinen and Damsgaard, 2001; West et al., 2007). Indeed, Bagozzi et al. (1992) argue that the role of learning to use ICT systems needs to be better understood in the whole adoption process, because inadequate learning can restrict the adoption and use of a potentially productive system (see also Attewell, 1992). Thus, it is interesting to have a closer look at how previous ICT implementation and adoption research has applied learning theories and concepts in the management and business research field. The research questions were answered by reviewing 1303 articles published during the last ten years in leading journals with ICT implementation and adoption-related content. The results of this study are valuable for researchers engaged in the field of ICT implementation and adoption. They can get a coherent and updated state-of-the-art picture of the research in order to position their ongoing studies. Additionally, researchers can identify unexamined areas for designing new research projects, and areas that may be vital for practitioners.

The article is organized as follows. First, I present the methodology employed in this study, namely citation analysis and qualitative content analysis. I also discuss the limitations of citation analysis in relation to the present study. Second, I present the findings; that is, I describe the research field, and the most influential theories and models and their applications. I also describe the role of learning theories and concepts in the most cited articles. Finally, I discuss the strengths and limitations of the previous research and recommend topics for further study.

2 METHODS AND DATA

I conducted this research as a combination of citation analysis (Small, 1973) and qualitative content analysis (Elo and Kyngäs, 2008; Miles and Huberman, 1994). A citation rate counts for the contribution made by an individual's work "in terms of the utility and interest the rest of the scientific community finds in it" (Garfield, 1979, 372). Citation analysis is one form of bibliometric methods, which involve counting citations to other publications in a body of literature, and these counts are used to develop statistical distributions (e.g., Culnan, 1987; Small, 1973). Citation analysis measures the individual and group performance of a scientific community (Garfield, 1979, 372). Additionally, citation analysis provides a search method for articles which is not limited by the researcher's prior assumptions concerning the literature (Raghuram et al. 2009). I chose the citation analysis approach in order to systematically and objectively examine relevant literature on ICT implementation and adoption, and to identify the most cited publications. However, citation analysis has a limitation, because it cannot offer readers an in-depth understanding of the field being studied (Raghuram et al. 2009). Therefore, I chose the qualitative content analysis approach to organize and describe the contents of the most cited articles and articles with learning related content in more detail (Elo and Kyngäs, 2008; Miles and Huberman, 1994).

The data set of this study 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 and Watson, 2002). The data collection and analysis both have two main stages (Table 1), which I describe next.

Table 1: 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 of 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

2.1 Data Collection

I limited my search to articles published in 1999-2010 in the management and business fields. 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 (Stage 1 in Table 1) by combining two search terms in the ISI Web of Science in each search. The search engine searched these words in journal titles, abstracts and key words. I used three search terms for the technology, which were "information technolog*", "information system*", and "information and communication technolog*". Researchers in the field of management and business use also other terminology for similar technologies, for example, "groupware technology" (e.g. Orlikowski and Hofman, 1997), "collaboration technology", "telematics" (review by Andriessen, 2003), "new technology" (Majchrzak et al., 2000), or advanced technology (DeSanctis and Poole, 1994). To cover all articles, I made test searches with these terms but the test searches did not result in any new hits. I used also three search terms

for the activities, and they were “adopt*”, “adaptation”, and “implement*”. The final data set consists of 1303 sample articles in 122 different management and business journals with references to 43,320 sources. This kind of systematic way of searching the articles assures that the data “covers relevant literature on the topic and is not confined to one research methodology, one set of journals, or one geographic region” (Webster and Watson, 2002, p. XV).

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 Sitkis (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 (Stage 2 in Table 1). 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.

2.2 Data Analysis

To describe the data set I classified the studies according to their epistemological choices and research designs. Philosophical assumptions are interesting to examine, because they provide directions for the design of research studies (Creswell, 1994). Epistemological choices refer to the assumptions about knowledge and how it can be obtained (Hirscheim, 1992). Different epistemological choices and research designs provide diverse dimensions for research investigations, and thus, they are all necessary and of equal value in order to get a versatile picture of the studied phenomena in the research field (e.g. Orlikowski and Baroudi, 1991). I classified the sample articles according to their underlying research epistemology into three categories, as Orlikowski and Baroudi (1991) suggest, following Chua (1986): positivist, interpretive, and critical studies. As the authors expressed their philosophical perspective in only one article, the categorized epistemology used in each study is my interpretation based on

Orlikowski and Baroudi's criteria. However, I did not classify review papers and theoretical papers, because their philosophical perspectives are more complicated to evaluate as they did not use any empirical data.

Orlikowski and Baroudi's (1991) criteria for positivist studies are "evidence of formal propositions, quantifiable measures of variables, hypothesis testing, and the drawing of inferences about a phenomenon from the sample to a stated population" (ibid. 5). "Descriptive" studies are exceptions because these studies do not intend to work with theoretical tradition, but their research intentions are descriptive. These studies are often case studies, with or without simple descriptive statistics. The criteria for interpretive studies are "evidence of a nondeterministic perspective where the intent of the research was to increase understanding of the phenomenon within cultural and contextual situations; where the phenomenon of interest was examined in its natural setting and from the perspective of the participants, and where researchers did not impose their outsiders' a priori understanding on the situation" (ibid., 5) Finally, the criteria for critical studies are "evidence of a critical stance towards taken-for-granted assumptions about organizations and information systems, and dialectical analysis which attempted to show the historical, ideological, and contradictory nature of existing social practices" (ibid., 6).

To answer the first research question, I chose the 20 most influential publications (articles and books), in other words, those publications which received most citations in the sample articles. I included only theory-building or empirical articles and books, and excluded the five methodology publications which came up in the search. I analyzed theories and models used in the articles and books using a qualitative content analysis approach (Table 1, stage 3). Thus, these 20 most cited publications show the dominant theories and models applied or addressed by the sample articles. As a result, I formed seven groups addressing the theories and models employed (see Table 4).

To answer the second research question, I found out the most influential groups of literature among sample articles. I chose articles which received 12 or more citations, and got 60 articles altogether. 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. I identified the theory or model used by defining whether the theory was one of the most focal theories in Table 5. If some other theory was used, I categorized it under the category "other theory, model, or construction". If I was able to identify no theory, and often in these cases the authors stated that they used the relevant literature as the theoretical background, I categorized them under "literature as the theoretical framework". I identified the main contribution of each study from a general perspective. I identified, for example, whether the article developed an existing theory (e.g., an extension of TAM, called TAM2), generated a new model or construction (e.g., the electronic data interchange (EDI) adoption model), generated descriptive statements (e.g., important determinants of adoption, factors that help to overcome adoption barriers; see, e.g., Seidel et al., 2010 on descriptive statements), or evaluated an existing theory (e.g., a literature review of TAM evaluating its ability to predict intentions) (see more in Appendix 4).

During the qualitative analysis I eliminated four articles because their research context was not ICT implementation or adoption. This problem resulted from my search for articles in the ISI Web of Science: these articles did include the correct search terms, but, regardless of that, the research context was different, that is, they did not handle ICT implementation or adoption. Thus, the data included 56 articles. I generated initial codes of the contents of the studies, and finally defined and named the contents by using the qualitative content analysis approach. I generated groups, which I here call "thematic groups" (e.g., individual acceptance and adoption of ICT, changes in user beliefs and attitudes, organizational decision making on ICT adoption). Thus, thematic groups refer to the sample articles, which form groups based on the subject or theme that was studied. Finally, I formed seven thematic groups including 52 articles. Four articles studied isolated and seldom-cited themes, which are not discussed in this article. The thematic groups are organized on the basis of each article's combined citation counts, from the most cited group to the least cited group (see Table 5). 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.

To answer the third research question, I found out the role of 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. They formed three themes of the role of learning (see, e.g., Appendix 5).

2.3 Limitations of Citation Analysis in this Study

Citation analysis causes limitations in the data collection in this study. First, citation analysis counts citations, but does not consider the year in which the article was published. This means that the oldest articles have had more time to be cited than the newest ones. I identified the most cited thematic groups (Table 5) from the most cited articles. The data set consists of articles published from 1999 to 2010. I could have left, for example, the two latest years out of the data set, but I decided to include them in order to examine the whole field. Thus, the results of the thematic groups focus more on history than the very latest research streams. Because of this limitation, I checked more articles to see if the newest articles focused on other theories or research subjects than the sample articles. Therefore, I checked the subjects of sample articles which received 8 or more citations (the thematic groups were formed from articles which received 12 or more citations). The six newest articles were published in 2005 and 2006. They studied very similar subjects to the thematic groups in Table 5: individual adoption intentions in e-commerce and households. There was also a meta-analysis of TAM (King and He, 2006) and a review of ICT innovation adoption research (Jeyaraj et al., 2006). Thus, this check indicates that the focus seems to be on technology acceptance models and on quite similar research subjects when analyzing recently published articles in the data set.

The second limitation is that it was only possible to gather the data in the ISI Web of Science, and Sitkis was also developed to process data from the ISI. The problem is that 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 and Computer Supported Cooperative Work are not represented in this study.

The third limitation is the number of outliers in the data set. I eliminated four outlier articles out of 60, which is 6.7%. Thus, it can be concluded that the data set (N=1 303) included 87 outlier articles. This problem is characteristic of bibliometric methods and can only be corrected by examining the contents of the selected articles manually. Thus, it potentially weakens the validity of the data set in those parts where the manual content evaluation was not performed.

Despite these limitations the citation analysis approach permitted a systematic and objective data collection and analysis from a broad sample of articles (N=1 303) compared to the alternative method of intuitively scanning through databases (Raghuram et al., 2009). This research method also made it possible to find out relationships between the sample articles, to identify the most cited previous publications and most cited thematic groups inside this sample of articles, and to examine their contents with a qualitative method. As a contribution this paper generates new knowledge and understanding of the structure and content of ICT system implementation and adoption literature in the management and business research.

3 RESULTS

3.1 Description of the Research Field

Figure 1 shows the articles published yearly on ICT system implementation and adoption during the period 1999-2010. As the figure shows, the research in the field has been growing in terms of numbers.

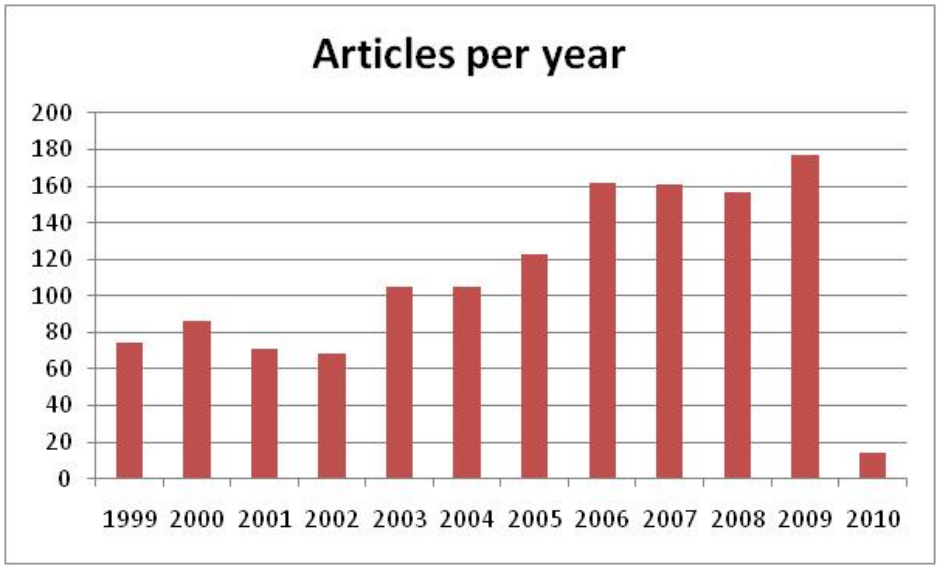

Figure 1: Articles published on ICT system implementation and adoption in management and business research from SSCI during 1999-2010 (N=1 303). The year 2010 includes only articles published before March 2010.

The five leading journals which publish articles with ICT implementation- and adoption-related content were Information & Management (166 articles, 12.7%), MIS Quarterly (102 articles, 7.8%), the Journal of Information Technology (87 articles, 6.7%), the Journal of Management Information Systems (83 articles, 6.4%), and IEEE Transactions on Engineering Management (58 articles, 4.4%) (see Appendix 1). The data set consists in total of 122 different high-impact science journals. The research on ICT implementation was concentrated in North America (the U.S.A and Canada), and Europe and Asia also published research on this topic (see Appendix 2).

I paid attention to the philosophical perspectives (i.e., epistemology) of each article, because they describe the underlying research assumptions regarding the nature of the phenomena being studied. The results show that positivism was the dominant epistemology, accounting for 90.4% of the studies. There are four "descriptive" studies. One study represents interpretive studies (1.9%), and critical studies are not represented (see Table 2). In sum, the sample articles on ICT implementation and adoption exhibit a single set of philosophical assumptions, that is, positivism. This finding is in line with earlier studies on ICT research (e.g., Orlikowski and Baroudi, 1991).

Table 2: Articles Classified by Epistemology

Epistemology	Frequency	% of 52
Positivist	47	90.4
Theoretically grounded	*43*	*82.7*
"Descriptive"	*4*	*7.7*
Interpretive	1	1.9
Critical	-	-
(Not evaluated: Review and conceptual papers)	*4*	*7.7*
In total	52	100

I also paid attention to research design in order to examine the research methods used to study ICT implementation and adoption. The majority of these studies were field survey research designs, that is, 39 studies out of 52 (75%). There were also four case studies, three reviews, two meta-analyses, two statistical analyses of existing data, one conceptual paper, and one mixed-method study (see Table 3). Thus, survey research design dominates the studies of the sample articles, which is in line with earlier studies (e.g., Lee et al., 2003; Orlikowski and Baroudi, 1991). Most of the studies were executed in organizational contexts, and the subjects were organizational members. Only two studies examined students and one households (see Appendix 3 for more details). Most of the studies were conducted in organizations and members of organizations were the subjects. This finding of using authentic business contexts is somewhat contradictory to prior research, because especially reviews of TAM report that students are commonly used as subjects. These reviews often criticize studies involving students as a limitation, because students may weaken the generalizability of results into organizational

contexts (e.g., Chuttur, 2009; Legris et al., 2006; Yousafzai et al., 2007). Thus, the use of members of organizations can be seen as a strength of these studies.

Table 3: Articles Classified by Research Design		
Research design	Frequency	% of 52
Field survey	39	75.0
Case study	4	7.7
Review	3	5.9
Meta-analysis	2	3.8
Statistical analysis of existing databases	2	3.8
Conceptual paper	1	1.9
Mixed-method	1	1.9
In total	52	100

3.2 Most Cited Theories on ICT System Implementation and Adoption

The 20 most cited previous publications consist of articles and books to which the sample articles (N=1 303) referred most during the years 1999-2010. In all, the sample articles cited 43,320 times altogether. These results can be seen to stand for the theoretical history of the current studies, as they depict the most influential theories and models used in this research field. These 20 previous publications formed seven topics, which are presented in Table 4. The table presents the authors of each most cited article or book and their citation numbers and relational percentages. Note that in Table 4 the citations of each article or book have been counted as many times as there are different theories in the article. For example, Davis et al. compared TRA and TAM, and their article is categorized into two groups, namely “1. Technology Acceptance Model (TAM)” and “2. Theory of Reasoned Actions (TRA)”. Next, these groups of topics are examined briefly.

Table 4: Theories of the 20 Most Cited Articles and Books on ICT System Implementation and Adoption				
	Theory	Author(s), year	Citations	% of 2474
1. **Technology Acceptance Model** (TAM)			869	35.1
	TAM	Davis, 1989	*237*	
	TRA and TAM (comparison)	Davis et al., 1989	*195*	
	TAM, TPB, and the decomposed Theory of Planned Behavior (comparison)	Taylor and Todd, 1995	*144*	
	Extension called TAM2	Venkatesh and Davis, 2000	*129*	
	TAM and TPB (comparison)	Mathieson, 1991	*90*	
	TAM (replication)	Adams et al., 1992	*74*	
2. **Theory of Reasoned Actions** (TRA)			502	20.3
	TRA and TAM (comparison)	Davis et al., 1989	*195*	
	TRA	Fishbein and Ajzen, 1975	*130*	
	TRA and DOI (combination)	Karahanna et al., 1999	*100*	
	TRA	Ajzen and Fishbein, 1980	*77*	
3. **Diffusion of Innovations** (DOI)			497	20.1
	DOI	Rogers, 1983 (different editions)	*286*	
	DOI	Moore and Benbasat, 1991	*111*	
	TRA and DOI (combination)	Karahanna et al., 1999	*100*	
4. **Theory of Planned Behavior** (TPB)			331	13.4
	TAM, TPB, and the decomposed Theory of Planned Behavior (comparison)	Taylor and Todd, 1995	*144*	
	TBP	Ajzen, 1991	*97*	
	TAM and TPB (comparison)	Mathieson, 1991	*90*	
5. **Unified Theory of Acceptance and Use of Technology** (UTAUT)			109	4.4
	UTAUT combines eight models: TRA, TAM, and TPB	Venkatesh et al., 2003		
6. **Model of the ICT Implementation Process**		Cooper and Zmud, 1990	85	3.4
7. **Information Systems Success Model**		Delone and McLean, 1992	81	3.3
		In total	*2474*	100

(1) Technology Acceptance Model (TAM)

The most cited theory was the Technology Acceptance Model (TAM). Davis (1989) presented a theoretical model aiming to predict and explain ICT usage behavior, that is, what causes potential adopters to accept or reject the use of information technology. Theoretically, TAM is based on the Theory of Reasoned Action (TRA). In TAM, two theoretical constructs, perceived usefulness and perceived ease of use, are the fundamental determinants of system use, and

predict attitudes toward the use of the system, that is, the user's willingness to use the system. Perceived usefulness refers to "the degree to which a person believes that using a particular system would enhance his or her job performance", and perceived ease of use refers to "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, 320).

In these articles TAM was used in three different ways, namely to compare different adoption models, develop extensions of TAM, or replicate the model. For example, Davis et al. (1989) empirically compared the ability of TRA and TAM to predict and explain the acceptance and rejection by users of the voluntary usage of computer-based technology; Venkatesh and Davis (2000) developed and tested a theoretical extension of TAM, referred to as TAM2, which explains perceived usefulness and usage intentions with the help of social influence and cognitive instrumental processes, and Adams et al. (1992) replicated Davis' (1989) study.

(2) Theory of Reasoned Actions (TRA)

The second most cited theory was the Theory of Reasoned Actions (TRA). The theory originates from social psychology, and it is a special case of the Theory of Planned Behavior (TPB) (Ajzen, 2010). Fishbein and Ajzen (1975) developed TRA to define the links between the beliefs, attitudes, norms, intentions, and behaviors of individuals. The theory assumes that a person's behavior is determined by the person's behavioral intention to perform it, and the intention itself is determined by the person's attitudes and his or her subjective norms towards the behavior. The subjective norm refers to "the person's perception that most people who are important to him think he should or should not perform the behavior in question" (Fishbein and Ajzen, 1975, 302). Ajzen and Fishbein's (1980) book is focused on the prediction and understanding of human behavior to help in solving applied problems and making policy decisions. The authors state that TRA is applicable, for example, when studying consumer behavior, women's occupational orientations, or family planning behaviors. In these studies TRA was used to compare it with TAM (Davis et al., 1989, see above), or in combination with DOI (Karahanna et al., 1999). For example, Karahanna et al. (1999) examined users' pre-adoption and post-adoption beliefs and attitudes by combining aspects of TRA and DOI.

(3) Diffusion of Innovations (DOI)

The third most cited theory was the Diffusion of Innovations (DOI). Indeed, Rogers' (1983) book "Diffusion of innovations" was the single most cited individual work, receiving 286 citations. DOI is a general theory of how new ideas are spread and adopted in a community, and it seeks to explain how communication channels and opinion leaders shape adoption. Rogers (1983) proposed the first process model, a five-stage model of the implementation and adoption of innovation in organizations. Moore and Benbasat (1991, 192) used DOI to develop "an instrument designed to measure the various perceptions that an individual may have of adopting an information technology (IT) innovation". The instrument was intended to be a tool for the study of the initial adoption and subsequent diffusion of IT innovations within organizations.

(4) Theory of Planned Behavior (TPB)

The fourth most cited theory was the Theory of Planned Behavior (TPB). Ajzen (1991) presented a theoretical model, TPB, which focuses on cognitive self-regulation. It is very similar to the TRA model, but the difference is that it takes into account an additional construct, namely perceived behavioral control. Perceived behavioral control refers to the perception of control over the performance of a given behavior. In TRA rational considerations determine the choices and behaviors of individuals, and individual intentions determine behavior. Intentions refer to individuals' plans and motivations to commit a specific act. Intentions also reflect individual attitudes and the extent to which individuals perceive a specific act as desirable or favorable. The theory suggests that human behavior is governed by personal attitudes, but also by social pressures and a sense of control. Ajzen (1991) reviews that the theory was applied, for example, in studies examining problem drinking or leisure behavior, in which the theory provided useful information to understand these behaviors, or to implement effective interventions to change them. In their studies Taylor and Todd (1995) and Mathieson (1991) compared the ability of TPB and TAM to explain behavior and predict an individual's intention to use ICT, respectively.

(5) Unified Theory of Acceptance and Use of Technology (UTAUT)

The fifth most cited theory was the Unified Theory of Acceptance and Use of Technology (UTAUT). Venkatesh et al. (2003) developed the unified model through reviewing eight models

which explain ICT usage, namely TRA, TAM, the motivational model, TPB, a model combining TAM and TPB, the model of PC utilization, DOI, and the social cognitive theory. The purpose of UTAUT is to explain a user's intentions to use ICT and the subsequent user behavior. The model considers four constructs as direct determinants of user acceptance and usage behavior, namely performance expectancy, effort expectancy, social influence, and facilitating conditions. There are four key moderating variables: gender, age, experience, and voluntariness of use. The authors stated that UTAUT provides a tool for managers to assess the likelihood of success of technology introductions and to understand the drivers of acceptance in order to design interventions, which include, e.g., training or marketing. UTAUT focuses on users who may be less willing to adopt and use new systems.

(6) Model of the IT Implementation Process

The eighth most cited theory was the Model of the IT Implementation Process. Cooper and Zmud (1990) took Kwon and Zmud's (1978) model of the IT Implementation Process and developed it further. The model is based on the organizational change, innovation, and technological diffusion literature. The purpose of the model is to offer a directing and organizing framework for ICT implementation research. Kwon and Zmud's (ibid.) stage model comprises six stages, namely initiation, organizational adoption, adaptation, acceptance and adoption, routinization, and infusion. Thus, 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 model also identifies five contextual factors which impact on processes and products in each implementation stage: the characteristics of the user community, the organization, the technology being adopted, the task, and the organizational environment.

(7) Information Systems Success Model

The last most cited theory was the Information Systems Success Model. DeLone and McLean (1992) reviewed prior research and introduced a comprehensive taxonomy of factors contributing to the success of information systems. The authors examined the literature on IS success and categorized success measures into six major categories: system quality, information quality, use, user satisfaction, individual impact, and organizational impact. These categories are

interrelated and interdependent and provide a comprehensive view of IS success. The target of the model is to guide future research efforts.

In conclusion, the most cited theories of previous publications showed that the theory of the research area focused on the acceptance and adoption of technology. The most cited theories were TAM, TRA, DOI, and TPB. Most of the theories focus on the individual level (i.e., TAM, TRA, TPB, and UTAUT), but they may also focus on an organizational level (the Model of the IT Implementation Process) or on the level of a social system (e.g., DOI focuses on a group or an organizational level). In the Information Systems Success Model, the focus of the analysis is on critical success factors in ICT implementation in organizations.

These results are mostly in line with earlier research on the most influential theories used in ICT implementation and adoption studies. Gallivan (2001) distinguishes the same four most cited theories, namely TAM, TRA, DOI, and TPB, as the core theoretical frameworks (see also Jeyaraj et al., 2006). Previous literature has also distinguished TAM as the most influential model (Chuttur, 2009; Jeyaraj et al., 2006; Lee et al., 2003). There is one exception in the results compared with the previous literature, namely that Gallivan (2001) and Jeyaraj et al. (2006) include Social-Cognitive Theory (SCT, e.g., Compeau and Higgins, 1995) among the most influential theories. SCT is a learning theory based on the idea that people learn by observing others (Bandura, 1986). However, SCT was not represented in the most cited theories in this study.

3.3 Applications and Outcomes of the Influential Theories and Models

The most cited thematic groups depict the most studied research subjects in the sample articles (N=1 303). They also depict the most influential theories applied and what the main contributions are. The groups consist of the 52 most cited sample articles, which received 12 or more citations. They form seven thematic groups. Table 5 depicts the numbers of the applied theories in each group. The groups were organized from the largest total number of citations (i.e., 737 citations) to the smallest total number of citations (i.e., 43). The groups received 1430 citations altogether. More details from individual articles, such as the main theory, main

contribution, and research design, are provided in Appendix 3. The distribution of the main contribution categories in the articles is depicted in Appendix 4.

Table 5: Most Cited Thematic Groups on ICT System Implementation and Adoption

Thematic group	TAM	TRA	DOI	TPB	UTAUT	Imp. process	Systems success	Other theory, model, or construct	Literature as the theoretical framework	No. of articles	Citations	Citations % of 1430
1. Individual acceptance and adoption of ICT	18	1	2	7	-	-	-	8	2	21	737	51.6
2.Changes in user beliefs and attitudes	1	1	1	-	-	-	-	2	1	4	182	12.7
3. Organizational decision making on ICT adoption	1	-	2	-	-	-	-	3	9	9	169	11.8
4. Organizational assimilation of ICT	-	-	-	-	-	-	-	8	2	6	149	10.4
5. Business impact and value of ICT implementation	-	-	1	-	-	-	-	5	6	7	108	7.6
6. Critical success factors of the implementation process	-	-	-	-	-	-	-	-	4	3	43	3.0
7. Role of ICT systems	-	-	-	-	-	-	-	-	2	2	42	2.9
In total	20	2	5	7	-	-	-	26	25	52	1430	100

(1) Individual acceptance and adoption of ICT

This group was clearly the most extensive group, with 737 citations and 21 articles, covering 51.6% of the most cited articles. The studies in this thematic group focused on user acceptance and adoption of ICT systems. It was quite a coherent group, because most of the studies used TAM as the theoretical basis. TAM extensions added individual characteristics (gender, motivation, experience, age), organizational characteristics (subjective norms), or innovation characteristics (trialability, compatibility, complexity, fit to the task) into the model. For example, Venkatesh and Davis (2000) used TAM as a starting point, and added social influence processes and cognitive instrumental processes to develop an extension called TAM2. Venkatesh and Morris (2000) made an extension of TAM, and added independent variables such as subjective norm (social influence), gender, and experience. Only three studies did not use TAM at all, but another theory, TPB (e.g., Venkatesh and Brown, 2001; Morris and Venkatesh, 2000).

As a contribution, most of the studies, that is, 15 studies out of 21, developed an extension of TAM, and four studies evaluated the ability of TAM to predict the acceptance of ICT use as their contribution.

(2) Changes in user beliefs and attitudes

These studies examined how and why users' beliefs and attitudes change when they use ICT systems. The focus was on trying to understand why users continue or discontinue the use of ICT systems. For example, Karahanna et al. (1999, 184) compared users' pre-adoption and post-adoption beliefs in order to gain "a better theoretical understanding of the antecedents of user acceptance and user resistance to adoption and usage of information technology". Their theorerical framework consisted of TRA and DOI. Additionally, the authors argued that potential adopter intentions to adopt were determined by normative pressure, whereas user intentions were determined by attitude. These studies used traditional technology acceptance models and also expectation-disconfirmation theory (EDT). As a contribution, for example, a new model was generated, namely Jasperson et al.'s (2005) comprehensive research model of post-adoptive behaviors.

(3) Organizational decision making on ICT adoption

These studies examined organizations' intentions or decisions to adopt ICT systems. Various theoretical frameworks were applied, such as institutional theory (Teo et al., 2003) or a technology-organization-environment framework (Kuan and Chau, 2000), but DOI and TAM were also applied. Five studies did not use any specific theory or model, but based their study on the existing literature. The focus of the studies was on the factors affecting the organizational decision to adopt ICT systems. These factors were innovation characteristics (e.g., the complexity of the technology), organizational characteristics (e.g., top management support, perceived technological benefits), or environmental characteristics (e.g., external pressure). As a contribution, this group generated the most new models and concepts compared to the other thematic groups. For example, Chwelos et al. (2001) developed an electronic data interchange (EDI) adoption model with three determining factors: readiness, perceived benefit, and external pressure.

(4) Organizational assimilation of ICT

These studies examined how best to assimilate the use of ICT across organizational work processes, and how ICT use becomes routinized in the activities associated with those processes. The focus was on the actual usage of ICT in organizations. Assimilation refers to the extent to which the use of a technology diffuses across organizational work processes and becomes routinized (Cooper and Zmud, 1990; Fichman and Kemerer, 1997). The studies in this group did not follow a coherent theoretical basis, but examined assimilation from various theoretical perspectives. Organizational theories, models, and concepts, such as the information processing model of organization (Truman, 2000) and a resource-based view of the firm (Armstrong and Sambamurthy, 1999), were widely employed. As the main contribution, for example, Chatterjee et al. (2002) examined organizational factors (i.e., top management championship, the strategic investment rationale, and the extent of coordination) influencing the assimilation of Web technologies. They used institutional theory and the conceptual lens of structuring and metastructuring actions as the theoretical framework. The findings of their study stressed and reinforced that institutional factors are important.

(5) Business impact and value of ICT implementation

These studies focused on the benefits and business value of ICT use. For example, the focus was on the impact of ICT on successful business process redesign (BPR, Broadbent et al., 1999), the business value of ERP use (Hitt et al., 2002; Chircu and Kauffman, 2000), or the payoff of ICT (Zhu et al., 2004; Kohli and Devaraj, 2003). These studies based their research on various theories, for example, organizational theories of learning and action and transaction cost theory (Subramani, 2004), the technology-organization-environment theory (Zhu and Kramer, 2005), or DOI (Chircu and Kauffman, 2000). However, many studies based their frameworks on the existing literature. The results showed that, for example, all firms need a basic level of ICT infratstucture capability to implement business process redesign, ERP adopters show greater performance, or industry and organizational barriers need to be taken into account. Zhu et al. (2004) developed a research model for assessing the value of e-business at the firm level.

(8) Critical success factors of the implementation process

These studies examined success factors in ICT implementation, and proposed guidance for a successful implementation. These studies did not apply any specific theory or model; instead they made reviews of critical success factors in the literature. As a contribution, for example, Umble et al. (2002) made a synthesis from the previous literature and identified the success factors of ICT implementation, such as a clear understanding of strategic goals, commitment by top management, and excellent project management. They also identified a thirteen-step software selection process and eleven steps for ERP implementation.

(7) Role of ICT systems

These studies considered the role of ICT systems in organizational use. The focus was on the creation of new conceptualizations. These studies did not employ a specific theory or model, but they reviewed the literature. On the basis of prior research, Orlikowski and Iacono (2001) examined whether and how IS researchers conceptualized and dealt with information technology. The authors argue that ICT is taken for granted; that is, the conceptualization of ICT is relatively stable, discrete, independent, and fixed. However, they argue that ICT should be conceptualized as dynamic and changing. Boudreau and Robey (2005, 3) investigated "the role of human agency in shaping the enactments of an integrated computer-based, enterprise information system after its implementation". They explained the change in users' enactments with the concept of improvised learning. The authors stated that their study contributed to the theoretical understanding of the role of information technology in programs of planned organizational change, and thus their contribution took the form of descriptive statements. The other article generated new conceptualizations.

In conclusion, user acceptance and adoption studies using TAM dominated the studies in the most cited thematic groups. The main contribution of this first thematic group was a variety of extensions of TAM. The second group, 'Changes in user beliefs and attitudes', represented similar research, but the focus was more on predicting the continuing use of ICT. The third group, 'Organizational decision making on ICT adoption', also focused on predicting ICT system adoption, but from the organizational perspective. These studies used organizational theories or the existing literature as their frameworks. They did not usually share the same

theories as those studies focusing on the individual level. However, DOI was an exception, as it was applied on both the organizational and individual levels. As a contribution these studies generated a variety of adoption models, or descriptive statements, such as critical factors affecting ICT implementation and adoption from different points of view. These three groups formed the majority (76.1%) of the research, which makes the whole research in these thematic groups quite coherent. The rest of the studies focused on different subjects from various perspectives, and they applied several different theoretical frameworks.

The thematic groups were very uniform in their compliance with their epistemology and research designs: the studies in six groups comprehended the world objectively and in compliance with positivistic traditions. The studies were formulated to test theories or use meta-analyses. However, the last group, 'Role of ICT systems', can be mentioned as representing a diverse research approach. These studies used interpretive and qualitative approaches in order to understand phenomena related to the implementation and adoption of ICT systems.

3.4 Role of Learning

Seven articles out of 52 examined ICT implementation and adoption from the perspective of learning. I categorized them into three groups based on the role of learning: (1) user training; (2) learning in a change process, and (3) beliefs as learned responses (see Appendix 5). The first group examined learning from the perspective of user training, which was identified as one critical success factor in an ICT adoption process. User training referred to quite traditional classroom training. For example, Venkatesh and Smith (1999) and Venkatesh et al. (2002) focused on training methods that observed intrinsic motivation in classroom learning. Most of the studies in the first group applied TAM as the theoretical framework. The second group consists of two articles written by Robey and a group of colleagues. Both articles look at learning as a part of a change process. Boudreau and Robey (2005) examined organizational change, i.e., ERP system implementation, from a human agency perspective. The other article (Robey et al., 2002) looked at learning from an organizational learning perspective, in which organizational memory plays a part. The last group consisted of a single article, in which Agarwal and Prasad (1999) discerned beliefs as learned responses. They applied TAM to test individual differences

and extended the model with learning theories. They argued that learning theories provide a basis for understanding how variations between individuals might influence the development of beliefs.

In conclusion, the role of learning theories and concepts in the most cited articles (which examined learning) was marginal; learning theories and concepts 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.

4 DISCUSSION: THE STRENGTHS AND LIMITATIONS OF THE PREVIOUS RESEARCH

This study shows that the research in the sample articles focused on research into the adoption and acceptance of technology by individuals in the frameworks of the Technology Acceptance Model (TAM), Diffusion of Innovations (DOI), the Theory of Reasoned Actions (TRA), and the Theory of Planned Behavior (TPB). TAM was the most influential theoretical framework, which is in line with earlier findings in the ICT implementation and adoption literature (e.g. Chuttur, 2009; Lee et al., 2003; Venkatesh et al., 2007). All these theories seek to explain potential adopter attitudes and their innovation-related behavior. The majority of the studies used a field survey research design with the assumptions of the positivistic research tradition. The main contribution of the studies is a rich variety of different individual adoption and acceptance models. The data set of this study can be considered as representative, because it is large and was collected systematically from the most influential journals. Thus, the findings can be seen to cover the research field in a comprehensive manner. Next, the strengths and limitations of the previous ICT implementation and adoption research are discussed.

4.1 Strengths of Previous Research

The most influential adoption theories (TAM, DOI, TRA, TPB, UTAUT) offer several systematic models that are well grounded in theory to explain individuals' intentions to adopt ICT (see, e.g., Bagozzi (2007) on TAM). In addition, they provide managerial guidelines to encourage ICT adoption (see also Davis et al. 1989). It is important to study the attitudes of employees, because they influence organizational decision making about the acquisition of ICT infrastructure (see also Davis et al., 1989). The reasons for the popularity of TAM as the theoretical framework might be that, first, TAM is a theory specifically developed for ICT implementation and adoption research. It is "a theory 'owned' by the IS research community" in this field, in which theories are scarce (Lee et al., 2003, 765). Second, TAM provides a parsimonious, clear, and tested framework for ICT adoption and implementation research (Yousafzai, 2007). A closer examination of the applicability of these theories, especially TAM and DOI, shows that they seem to fit well with conditions in which individuals voluntarily decide

whether to use technology personally (see also the review by Gallivan, 2001), and when the targeted technology requires comparatively little effort to learn to use the system (see also Attewell, 1992; Fichman, 1992).

Another strength of the most influential theories is that they all focus jointly on the benefits of the use from the perspective of an individual. Individuals play an important and active role in making ICT systems work in organizational settings (McLaughlin and Skinner 2000). Understanding human motivation requires the consideration of innate psychological needs, namely competence (being effective in dealing with the environment), autonomy (a sense of volition, and the experience of the possibility of choice), and relatedness (the desire to feel connected to others) (Deci and Ryan, 2000). For example, the most influential theory, TAM, includes two of these needs: 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?"). In TAM theory, usefulness can be seen as the freedom and autonomy of an individual's decision as to whether to experience the use of an ICT system as useful and adopt the tool, or as useless and not adopt the tool. In other words, an individual decides him- or herself whether the tool is useful and then adopts it. However, the third need, relatedness, is not included in the focus of these studies, which is discussed in the limitations of the previous research.

4.2 Limitations of Previous Research

I distinguish three limitations in the previous literature: first, the main theories (TAM, DOI, TRA, TPB, UTAUT) pay only limited attention to organizational and social factors; second, learning theories or concepts are considered only marginally, and, third, studies are executed in compliance with a single and unnecessarily restrictive methodological approach. Next, I consider these limitations in detail.

Organizational and Social Factors

It can be argued that the main theories pay rather limited attention to contextual 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 and Damsgaard, 2001; Salovaara and Tamminen, 2009). The factors of power relations related to ICT system use in organizations are especially neglected. These theories, for example, assume that individuals may decide independently whether to use the system or not, but in contemporary organizations ICT implementations are harmonized and centrally coordinated, and individuals often have little to say about the organization-wide adoption of ICT (Gallivan, 2001; Lee et al., 2003). Additionally, 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 (see, e.g., Benbasat and Barki, 2007). Thus, as Benbasat and Barki (2007) state, the use of ICT systems has changed a lot from the early days of TAM (see also Lyytinen, 2010), and the model does not address social contexts, such as group interaction, and the coordinating of work tasks.

The management and business context differ from the contexts in which the theoretical basis of TAM was developed; TRA and TPB originate in the field of social psychology, and their original purposes were to explain other kinds of human behavior than ICT system adoption and implementation in management and business contexts. For example, Ajzen and Fishbein (1980) and their colleagues used TRA to explain, e.g., weight loss, women's occupational orientations, family planning behaviors, consumer behavior, voting in American elections, and changing the behavior of alcoholics. TPB was also applied in similar conditions, for example, in studies examining problem drinking or leisure behavior (Ajzen, 1991). This kind of human behavior differs a lot from human behavior in organizational change processes in which a major joint effort on the part of organizations and individuals is needed in order to learn to master the use of a new tool and create new shared work practices (see, e.g., Lyytinen and Damsgaard, 2001). Thus, the motivational drivers and the context of the behavior are mostly dissimilar. Additionally, DOI theory was developed for a more general context, and it is based on voluntary adoption decisions (Gallivan, 2001). As Fichman (1992, 1) states, it is important to pay attention to the matching of the context of a borrowed theory to the context of the new application of the

theory, or "tailor the theory to account for contextual differences". However, ICT implementation and adoption research in management and business has not always taken the contexts of management and business operations into account.

The strengths of TAM are its simplicity and parsimoniousness (Davis, 1989; Davis et al., 1989), which has been achieved by leaving social and organizational factors outside the scope of the theory. Nevertheless, many extensions and combinations of TAM try to respond to the challenge of contextuality by adding new independent variables, such as individual characteristics (gender, motivation etc.), situational variables (experience, training etc.), or organizational characteristics (subjective norms). The extensions have led, however, to some further challenges. First, the extensions and combinations caused a forest of variables, which cause the theory to lose its strength; the theory is weaker in its parsimony and clarity (see Bacharach (1989) on the purpose of theoretical statements). For example, the Unified Theory of Acceptance and Use of Technology (UTAUT, Venkatesh et al., 2003) has 41 independent variables for predicting intentions and eight independent variables for predicting behavior (Bagozzi, 2007). Second, different models and independent variables may cause a theoretical confusion "in which it is not clear which version of the many iterations of TAM is the commonly accepted one" (Benbasat and Barki, 2007, 211). Third, the many extensions of TAM did not succeed in deepening the theory in the sense of explaining (see Whetten, 1989 on theory building) the essential concepts in greater depth, for example, by explaining exactly what perceived usefulness or ease of use mean (see also Bagozzi, 2007).

Learning Theories and Concepts

Several researchers view learning theories and concepts as being beneficial in explaining and understanding ICT implementation and adoption (e.g. Attewell, 1992; Auer, 1998; Bagozzi et al., 1992; Boudreau and Robey, 2005; Fickman, 1992 ; Gallivan, 2001; Korpelainen and Kira, 2010). An implementation of an ICT system always entails both organizational and individual change (e.g., Rogers, 1995, 395; Van de Ven, 1986), and this change requires both organizational and individual learning abilities (e.g., Argyris, 1993). Even so, the most commonly cited thematic groups consider learning theories and concepts only marginally, and do not often take advantage of the extensive previous literature on learning. For example, Boudreau and Robey (2005)

introduced a concept they called “improvised learning”, but they did not refer to a similar and common concept known in the learning literature as “informal learning”, examined, for example, by Eraut et al. (1998) and Gerber et al. (1995). In other words, learning as approached in this literature might be connected more closely to the relevant theories and concepts in the learning literature.

Methodological Approach

The majority of the studies in the most cited thematic groups were executed by using a single philosophical approach regarding the underlying nature of the phenomena being investigated, the appropriate research methods, and the evidence of valid knowledge – the data were collected by field surveys with positivistic research assumptions. It is as if the research positions were taken for granted, and the research methods or research assumptions were not explicitly justified. That is, they gave the impression that the researchers did not, for example, question their data collection procedures, and whether they were the best methods to answer the research questions that they had formulated. I agree with Orlikowski and Baroudi’s (1991) suggestion that ICT system research could gain more if a plurality of research perspectives were effectively employed. Using a plurality of research assumptions and methods and being more aware of one’s research assumptions may lead to valuable contributions. 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). However, some researchers claim that TAM may have attracted research with a narrow focus and less innovativeness, and therefore little attention has been given to some key problems related to technology acceptance (e.g., Bagozzi, 2007; Benbasat and Barki, 2007; Lee et al., 2003). For example, they claim that TAM research has reduced the amount of attention given to the role of technology and design, and factors which make technology useful and easy to use (Lee et al., 2003); it has overlooked essential determinants of decision making and action (Bagozzi, 2007) and different consequences (e.g., adaptation and learning behaviors) in order to reach a more comprehensive understanding of the factors influencing ICT adoption (Benbasat and Barki, 2007).

5 CONCLUSIONS: SUGGESTIONS FOR FUTURE RESEARCH STREAMS

Future ICT implementation and adoption research in the field of management and business would benefit if implementation and adoption processes were examined with the help of systems theories and theories of group dynamics. It would also be beneficial to examine them from the viewpoint of learning literature and organizational change processes. Additionally, qualitative and interpretive, even critical, research is needed in order to bring out new and unexpected experiences and views from ICT adopters. It would also be valuable if researchers could consider, justify, and be more aware of their methodological approaches and choices (e.g., Orlikowski and Baroudi, 1991). Next, I discuss these issues in more detail.

Future research might benefit from considering implementation and adoption as a part of a dynamic social system, and not as an individual decision to adopt or not adopt ICT in isolation (see, e.g., Bannon and Bødger, 1991). For example, Engeström's (1978) activity system model considers a subject (the actor), object (of an action), and outcome of the activity, and also the tools applied (e.g., an ICT system). It considers the entire socio-cultural context, including the members of the community in question and the division of labor and the rules that regulate their collaboration. Additionally, the model includes the view that an activity system is in a state of continuous change and development. Such a comprehensive, dynamic, and social theoretical framework offers a richer picture of the situation for analyzing and understanding ICT implementation and adoption processes and their consequences than the traditional adoption and acceptance models do.

Learning theories and concepts are most relevant when social and dynamic phenomena are being studied (e.g., Wenger, 1999), and they are well suited when the intention is to increase the knowledge and understanding of ICT adoption and implementation in constantly changing and unexpected organizational contexts (Benbasat and Barki, 2007). Learning theories and concepts can be helpful in these contexts, because change can be seen as a learning process (e.g. Argyris, 1993). ICT adoption and implementation research should also be more clearly connected to the research on change management and change leadership, because ICT adoption and implementation concern change and the acceptance of work tasks, processes, and collaboration.

Future research could also study the whole field of implementation and its different stages, as Cooper and Zmud (1990) suggest in their IT implementation model. One new research area could be the interface between an organizational decision to purchase ICT and the ICT supplier. Additionally, future research could consider more explicitly implementation and adoption processes and their consequences; that is, ways of adapting and learning to use the system (e.g., Benbasat and Barki, 2007), and not only intentions before adoption. This focus on consequences may lead to a better understanding of what influences adoption and acceptance, providing more useful practical recommendations for organizations on how to adopt new ICT systems (see also Benbasat and Barki, 2007). Important research questions could be, for example, what circumstances impact on ICT system implementation and adoption processes and how they do so, and how implementation and adoption processes could be supported on the organizational, group, and individual levels.

It would be beneficial to divide voluntary and mandatory ICT adoption into totally separate research areas. Contemporary organizations often assume that all their staff will adopt the ICT systems used in the organization, and this refers to studying mandatory conditions for adopting ICT. On the other hand, for example, users of e-commerce may freely choose whether or not to use the e-service on offer. It is important for a successful e-service to perceive what makes potential e-customers voluntarily and willingly adopt the use of an e-service system.

Non-adopters would be an interesting group of people to study, though they may be difficult to reach and motivate to participate in the research. Indeed, many researchers complain that TAM and DOI research neglect to study the point of view of non-adopters (e.g., Jeyaraj et al., 2006). Studying non-adopters would bring forth a valuable understanding about the non-adoption of ICT systems, such as the pre-beliefs and prejudices concerning the adoption and use of ICT systems and their consequences.

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APPENDICES

APPENDIX 1. TEN LEADING JOURNALS PUBLISHING ICT IMPLEMENTATION ARTICLES

Appendix 1: Ten Leading Journals Publishing ICT Implementation Articles				
No.	Journal	No. of articles (N=1303)	% of 1303	Subject categories
1.	Information & Management	166	12.7	Computer science, Information systems
2.	MIS Quarterly	102	7.8	Computer science, Information systems
3.	Journal of Information Technology	87	6.7	Computer science, Information systems
4.	Journal of Management Information Systems	83	6.4	Computer science, Information systems
5.	IEEE Transactions on Engineering Management	58	4.4	Engineering, Industrial
6.	Technovation	46	3.5	Engineering, Industrial, Operations research and Management science
7.	Information Systems Research	41	3.1	Information and Library science, Management
8.	International Journal of Technology Management	38	2.9	Engineering, Multidisciplinary, Operations research and Management science
9.	European Journal of Operational Research	37	2.8	Operations research and Management science
10.	International Journal of Operations & Production Management	32	2.5	Operations management

APPENDIX 2. TEN LEADING COUNTRIES PUBLISHING ICT IMPLEMENTATION RESEARCH

Appendix 2: Ten Leading Countries Publishing ICT Implementation Research			
No.	Country	No. of articles (N=1303)	% of 1303
1.	USA	652	50
2.	UK	165	12.7
3.	Canada	100	7.7
4.	Taiwan	83	6.4
5.	People's Republic of China	78	6.0
6.	Australia	71	5.4
7.	South Korea	50	3.8
8.	Netherlands	49	3.7
9.	Spain	43	3.2
10.	Singapore	37	2.8

APPENDIX 3. MOST CITED THEMATIC GROUPS WITH DETAILS

Appendix 3: Most Cited Thematic Groups with Details				
Main theory	Main contribution	Research Design	Author(s), year	Citations
1. Individual acceptance and adoption of ICT (21 articles)				737
TAM	An extension of TAM called TAM2 with social influence and cognitive instrumental processes, which accounts for 40-60% of the variance in useful perceptions and 34%-52% of the variance in usage intentions.	field survey	Venkatesh and Davis, 2000	*129*
TRA, the motivational model, TAM, TPB, DOI	A unified model UTAUT, which accounts for 70% of the variance in usage intention.	field survey	Venkatesh et al., 2003	*109*
TAM	An extension of TAM with gender differences and social influence.	field survey	Venkatesh and Morris, 2000	*64*
TAM	An extension of TAM with individual differences.	field survey	Agarwal and Prasad, 1999	*42*
TAM, intrinsic motivation	An extension of TAM with intrinsic motivation, which accounts for 40-60% of the variance in useful perceptions and 34%-52% of the variance in usage intentions.	field survey	Venkatesh and Smith, 1999	*38*
Literature on TAM	TAM is a useful method, but has to be integrated into a broader model including variables related to both human and social change processes.	review	Legris et al., 2003	*36*
TAM	TAM was able to provide a reasonable depiction of physicians' intention to use telemedicine technology	field survey	Hu et al., 1999	*28*
TPB	A model of the adoption of technology in households (MATH).	field survey	Venkatesh and Brown, 2001	*28*
TAM, Perceived Characteristics of Innovating (PCI)	PCI explains variance substantially better than TAM does; it also provides managers with more detailed information regarding the antecedents driving the adoption of technology innovation.	field survey	Plouffe et al., 2001	*24*
TPB	Age differences in technology adoption decisions	field survey	Morris and Venkatesh, 2000	*24*
TAM, task-technology fit model (TTF)	An extension of TAM with TTF constructs. The integrated model provided more explanatory power than either model alone.	field survey	Dishaw and Strong, 1999	*23*

TPB	Gender differences	field survey	Venkatesh et al., 2000	*22*
TAM, social presence theory, social influence theory	An extension of TAM with socio-psychological theories (social presence theory, social influence theory)	field survey	Karahanna and Straub, 1999	*21*
Institutional theory, TAMs	Findings suggest that beliefs about technology use can be influenced by top management commitment to new technology and individual factors of personal innovativeness and self-efficacy	field survey	Lewis et al., 2003	*18*
TAM, TPB, decomposed TPB model	Results highlight several plausible limitations of TAM and TPB in explaining or predicting the acceptance of technology by individual professionals.	field survey	Chau and Hu, 2001	*16*
TAM, TPB, decomposed TPB model	TAM may be more appropriate than TPB for examining the acceptance of technology by individual professionals.	field survey	Chau and Hu, 2002	*14*
TAM, DOI, perceived risk and cost	An extension of TAM with DOI, perceived risk and cost, to study user acceptance of mobile commerce.	field survey	Wu and Wang, 2005	*14*
TAM, the motivational model	An integrated model of TAM and the motivational model (game predictor of user behavior when compared to the existing models).	field survey and reanalysis	Venkatesh et al., 2002	*14*
TPB, TAM	A combined TPB and TAM model provided a better fit than either TPB or TAM alone.	field survey	Riemenschneider et al., 2002	*14*
TAM	An extension of TAM with user satisfaction	field survey	Wixom and Todd, 2005	*13*
TAM	An extension of TAM with training and project communication	field survey	Amoako-Guympah and Salam, 2003	*12*
2. Changes in user beliefs and attitudes (4 articles)				182
TRA, DOI	Potential adopter intention to adopt was solely determined by normative pressure, whereas user intention was solely determined by attitude.	field survey	Karahanna et al., 1999	*100*
Expectation confirmation theory	Users' intention to continue is determined by their satisfaction with IS use and perceived usefulness of continued IS use.	field survey	Bhattacherjee, 2001	*36*
Literature on post-adoptive behavior	A comprehensive research model of post-adoptive behaviors	review and theorizati	Jasperson et al., 2005	*26*

		on		
TAM, expectation-disconfirmation theory (EDT)	Emergent factors such as disconfirmation and satisfaction are critical to understanding changes in ICT users' beliefs and attitudes, and a recommendation that they should be included in future process models of ICT usage.	field survey	Bhattacherjee and Premkumar, 2004	*20*
3. Organizational decision making on ICT adoption (9 articles)				169
Literature on electronic data interchange (EDI)	Electronic data interchange (EDI) adoption model	field survey	Chwelos et al., 2001	*37*
Institutional theory	The results provide strong support for institution-based variables as predictors of adoption intention for interorganizational linkages.	field survey	Teo et al., 2003	*25*
A technology-organization-environment (TOE) framework	For small businesses, while direct benefits are perceived to be higher by adopter firms than by non-adopter firms, indirect benefits are not perceived differently by either adopter firms or non-adopter firms, contrary to the findings in studies on large businesses.	field survey	Kuan and Chau, 2000	*17*
Literature on the theory of networks and technology standards	The results support the network externalities hypothesis: banks in markets that can generate a larger effective network size and a higher level of externalities tend to adopt early, while the size of the bank's own branch network reduces the probability of early adoption.	statistical analysis of existing data bases	Kauffman et al., 2000	*17*
DOI, Literature on IS implementation	Relative advantage, top management support, organizational size, external pressure, and competitive pressure are important determinants of adoption.	field survey	Premkumar and Roberts, 1999	*17*
TAM, literature on strategic value	The authors proposed a research model that suggests three factors that have been found to be influential in previous research into the perception of the strategic value of other information technologies: operational support, managerial productivity, and strategic decision aids.	field survey	Grandon and Pearson, 2003	*17*
DOI, other IT adoption models	Findings reveal significant differences in the reasons why the firms studied decided to adopt Web technology, depending on when the firm made the adoption decision.	field survey	Beatty et al., 2001	*14*

Literature on mindfulness, Literature on IT innovation	The concept of mindfulness offers a fresh perspective on IT innovation adoption.	conceptu al paper	Swanson and Ramiller, 2004	*13*
Literature on e-commerce, Interorganizati onal information systems (IOIS), and electronic data interchange (EDI)	Critical factors affecting the decision to establish Internet-based interorganizational information systems	field survey	Soliman and Janz, 2004	*12*
4. Organizational assimilation of ICT (6 articles)				149
Institutional theory	These findings tend to emphasize the importance of a planned and coordinated approach toward the assimilation of Web technologies in e-commerce activities and strategies.	field survey	Chatterjee et al., 2002	*33*
Literature on knowledge-based and resource-based views of the firm	Findings provide robust evidence about the impacts of the CIO's (chief information officer) business and IT knowledge on IT assimilation.	field survey	Armstrong andSambamu rthy, 1999	*30*
Van de Ven and Poole's theoretical analysis of organizational change	We found that both strong core teams and carefully managed consulting relationships addressed configuration knowledge barriers. User training that included both technical and business processes, along with a phased implementation approach, helped firms to overcome assimilation knowledge barriers.	comparat ive case study	Robey et al., 2002	*30*
Literature on knowledge-based views of the firm, the role of institutional forces on the use of technology by individuals, and the assimilation of IT within organizations	The empirical evidence sheds light on the role of institutional forces that influence the rate of assimilation of the technology. The study demonstrated the value of incorporating metastructuring actions, i.e., organization-level technology use mediation actions, into the already robust literature on technological innovation.	field survey	Purvis et al., 2001	*22*

Assimilation gap concept, the diffusion modeling concept	Introduction of the assimilation gap concept and development of a general operational measure derived from the difference between the patterns of cumulative acquisition and deployments.	field survey	Fichman and Kemerer, 1999	*22*
Information processing model of organization	Tactical EDI planning should focus centrally on interface integration, regardless of how intensively management may want to consider plans to use EDI.	field survey	Truman, 2000	*12*
5. Business impact and value of ICT implementation (7 articles)				108
Literature on business process redesign and IT infrastructure	This study finds that all firms needed a basic level of IT infrastructure capability to implement BPR.	multiple-case design	Broadbent et al., 1999	*21*
Literature on the business value of information technology and on the value of ERP implementations	The major contribution is showing that despite the potentially high costs, the average ERP implementation is a productive investment.	statistical analysis of existing databases	Hitt et al., 2002	*20*
Organizational theories of learning and action, transaction cost theory	The results support the vendors-to-partners thesis that IT deployments in supply chains lead to closer buyer-supplier relationships.	field survey	Subramani, 2004	*18*
The technology-organization-environment (TOE) and resource-based theory	The study finds that technological competence, the size of the firm, financial commitment, competitive pressure, and regulator support are important antecedents of e-business use.	field survey	Zhu and Kraemer, 2005	*13*
Business value of IT, DOI	With a correct estimation of the valuation barriers, a company will be able to assess the success of the IT investment better.	case study	Chircu and Kauffman, 2000	*12*
Technology-organization-environment (TOE) framework	A research model for assessing the value of e-business at the firm level.	field survey	Zhu et al., 2004	*12*

Literature on IT payoff	The results indicate that the sample size, data source (firm-level or secondary) and industry in which the study is conducted influence the likelihood of the study finding greater improvements in the firm's performance.	meta-analysis of empirical studies	Kohli and Devaraj, 2003	*12*
6. Critical success factors of the implementation process (3 articles)				43
Critical success factors in IT implementation	This article identifies success factors, software selection steps, and implementation procedures critical to a successful implementation in the literature	mixed method: review and case study	Umble et al., 2002	*16*
Literature on organizational fit of ERP and ERP implementation	The success of ERP implementation depends significantly on the organizational fit of ERP and certain implementation contingencies.	field survey	Hong and Kim, 2002	*15*
Recent studies on the role of the institutional context in successful implementation	A contingent model, in which task interdependence moderates the effect of management support on the success of implementation.	meta-analysis	Sharma and Yetton, 2003	*12*
7. Role of ICT systems (2 articles)				42
Literature on IS research	The tendency to take IT artifacts for granted has limited our ability as researchers to understand many of their critical implications, both intended and intended, for individuals, groups, organizations, and society.	review	Orlikowski and Iacono, 2001	*26*
Literature on human agency	The study concludes that an integrated technology like ERP, which potentially represents a “hard” constraint on human agency, can be resisted and reinvented in use. This study contributes to the theoretical understanding of the role of information technology in programs of planned organizational change.	interpretive case study	Boudreau and Robey, 2005	*16*
		In total	N = 52	1430

APPENDIX 4. MAIN CONTRIBUTION

Appendix 4: Main Contribution							
Thematic group	Develop existing theory	Generate a new model or concept	Descriptive statements	Evaluate existing theory	Support existing theory	Synthesis of the literature	In total
1. Individual acceptance and adoption of ICT	15	-	1	4	1	-	21
2.Changes in user beliefs and attitudes	1	1	2	-	-	-	4
3. Organizational decision making on ICT adoption	-	4	3	-	2	-	9
4. Organizational assimilation of ICT	-	1	5	-	-	-	6
5. Business impact and value of ICT implementation	-	1	5	-	1	-	7
6. Critical success factors of the implementation process	-	1	1	-	-	1	3
7. Role of ICT systems	-	1	1	-	-	-	2
In total	16	9	18	4	4	1	52

APPENDIX 5. THE ROLE OF LEARNING IN ICT SYSTEM IMPLEMENTATION AND ADOPTION

Appendix 5: The Role of Learning in ICT System Implementation and Adoption			
	Short description of the role of learning	Theory	Author(s), year
1. User training (80 citations)			
	Intrinsic motivation in ICT training; user reactions and learning in Virtual Workplace System (VWS) implementation	An extension of TAM with intrinsic motivation	Venkatesh and Smith, 1999
	Training (learning) is identified as one critical success factor in ERP implementation	Critical success factors in ICT implementation	Umble et al., 2002
	Pre-training and training as user acceptance enablers in a new software technology application implementation	TAM, the motivational model	Venkates et al., 2002
	Training is recognized as one success factor in ERP implementation	TAM	Amoako-Guympah and Salam, 2003
2. Learning in a change process (46 citations)			
	After ERP system implementation changes in users' behavior are explained with improvised learning	Literature on human agency	Boudreau and Robey, 2005
	Dialectic learning process between old memory and new knowledge in ERP implementation	Van de Ven and Poole's theoretical analysis of organizational change	Robey et al., 2002
3. Beliefs as learned responses (42 citations)			
	Learning theories provide a basis for understanding how individual difference variables might influence the development of beliefs in ICT acceptance	TAM	Agarwal and Prasad, 1999

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