SNF-REPORT NO. 23/02

The adoption of text messaging services among Norwegian teens: development and test of an extended adoption model

by

Per E. Pedersen

THE ECONOMICS OF TELECOMMUNICATIONS

This report is one of a series of papers and reports on telecommunication economics published by the Institute for Research in Economics and Business Administration (SNF) as part of its telecommunication economics program. The main focus of the research program is to study the deregulation process of the telecommunication industry, and the economic and organizational consequences of changes in markets, technology and regulation. Being started in 1992, the program is now in its fourth period ending in 2005/2006. The program is financed by Telenor AS.

SNF- projects no. 6965 "The adoption of mobile services" and 6500 "Mobile and Channel Integrating Electronic Commerce"

The project is funded by The Research Council of Norway, Telenor, Den Norske Bank, A-Pressen, Ericsson ASA, Mobile Media and EasyPark.

SAMFUNNS- OG NÆRINGSLIVSFORSKNING AS
BERGEN, AUGUST 2002

ISBN 82-491-0212-6

ISSN 0803-4036

PREFACE

This report is part of a coordinated initiative of two projects funded by the Research Council of Norway, Telenor, Den Norske Bank, A-Pressen, Ericsson ASA, Mobile Media and EasyPark at SNF. The main purpose of the coordinated initiative is to provide evaluation frameworks that may be used by service providers to understand the behavioral requirements of end-users adopting mobile and channel integrating services. As part of the initiative, surveys studying the adoption of general mobile commerce services, text messaging services, mobile payment services, mobile gaming services and mobile contact services have been conducted. This report provides the theoretical framework for understanding the communication services of this collection of services, and reports the results of a study of young people's adoption of text messaging services. The report is written by Professor Per E. Pedersen. I also want to thank Senior Researcher Rich Ling at Telenor R&D and Professor Leif B. Methlie and Researcher Herbjørn Nysveen at the Foundation for Research in Economics and Business Administration for valuable comments on theory, models and findings.

Grimstad, August 2002

Per E. Pedersen

CONTENTS

ABSTRACT

Text messaging services in the form of SMS[1] have been one of the most successful mobile services recent years. Currently SMS is used either for mediating person-to-person communication or for accessing mobile end-user services. Currently, 11 % of European operator revenue comes from SMS-traffic (The Register, 2002). For example, operator revenues generated from SMS in Norway in 2001 were approximately NOK 1500 mill. (Nettavisen, 2002). Of this, almost 90% of SMS-traffic is person-to-person communication (MobileSpring, 2002). Thus, considerable operator and content provider revenues are now being generated from SMS services of different kinds. Understanding some of the mechanisms behind the adoption of these services, may be key issues to understanding the potential adoption of new mobile services in general.

We report the development and extension of a traditional model of ICT adoption that may be used to explain the adoption of mobile services. The model has been developed to explain the adoption of several types of mobile services, and a series of empirical studies based upon the model has been initiated. Here, we report the results of a study applying the model to explain the adoption of text messaging services.

In section 2, relevant theory from diffusion, adoption and computer mediated communication (CMC) research, communication research, and domestication research is reviewed and applied to develop an extended model based upon theory of planned behavior. The model is presented in section 2.5. In sections 3 and 4 we present the methodology and results of a study of young people's adoption of text messaging services in Norway using the proposed model. In

[1] Short Messaging Service

addition to testing the proposed model, we also report some of the descriptive results regarding young users of text messaging services in Norway. The results may be summarized in five findings. First, when comparing the original technology acceptance model (TAM), the theory of reasoned action (TRA), and the theory of planned behavior (TPB) to our extended and modified versions, we find that the modified versions show both better fit and more explanatory power than the original model. Second, new concepts added to the TAM-part of the model contribute significantly to the better fit and explanatory power of the extended and modified model. Thus, the inclusion of elements of enjoyment and expressiveness to the explanation of mobile services, at least among young users seems important. Third, for young users' adoption of text messaging services, subjective norm does not seem to be a significant explanatory variable. Fourth, behavioral control contributes significantly to fit and explanatory power, and should be included in models of young users' adoption of text messaging services. Finally, a rather surprising relationship between behavior control, intention to use and actual use is found suggesting that young users perceive some form of addiction or perceived deficient self-regulation to using text messaging services.

In section 5 we conclude and discuss our findings. Some implications for the mobile services industry are also provided in section 5.

1. INTRODUCTION

Users are now offered a variety of electronic messaging services with different forms of interactivity (e.g. synchronous vs. asynchronous), delivered over different electronic channels (e.g. traditional Internet vs. mobile networks) and with different levels of media richness (e.g. text vs. graphics-supported). Among these services, traditional email services, instant messaging or chat services (IRC, ICQ, IM), and text messaging services (SMS) have been most widely adopted. While email services and instant messaging services are delivered over the traditional Internet using traditional PC's or PDA's, text messaging services are delivered over wireless networks on mobile phones. Furthermore, while the adoption of email services have been widely studied applying traditional models of ICT-adoption and media use, instant messaging and, in particular, text messaging have been given less attention in traditional IS-research. As these messaging services become widely adopted, their importance in professional and working life is likely to increase (Churchill et al., 2000; Grinter and Eldridge, 2001). Thus, understanding the adoption and use of these services may be as important as understanding the adoption of more traditional messaging services like email.

Text messaging services in the form of SMS have been one of the most successful mobile services recent years. Currently SMS is used either for mediating person-to-person communication or for accessing mobile end-user services. Communication may also be mediated by services such as mobile chat or flirt services. Such services extend the use of SMS to one-to-many communication, and also makes it possible to display and store messages on other media. Currently, 11 % of European operator revenue comes from SMS-traffic (The Register, 2002). For example, operator revenues generated from SMS in Norway in 2001 were approximately NOK 1500 mill. (Nettavisen,

2002). Of this, almost 90% of SMS-traffic is person-to-person communication (MobileSpring, 2002), while the proportion of revenue generated from person-to-person communication is somewhat less due to premium taxation of many SMS services. Thus, considerable operator and content provider revenues are now being generated from SMS services of different kinds. Understanding some of the mechanisms behind the adoption of these services, related to service content and distribution as well as to users' behavior, may be key issues in understanding the potential adoption of new mobile services in general.

We report the development and extension of a traditional model of ICT adoption that may be used to explain the adoption of mobile services. The model has been developed to explain the adoption of several types of mobile services, and a series of empirical studies based upon the model has been initiated. Here, we report the results of the study applying the model to explain the adoption of text messaging services.

Because messaging services are particularly related to the coordination of everyday life, not working life, and because they are particularly widely adopted among young people, the adoption and use of these services have been studied in other traditions than IS-research. Thus, traditional media use and adoption models have not been applied in many of these studies, and the results so far also indicate that traditional adoption models need to be extended and modified when applied to these services. Still, we suggest traditional media use and adoption theory have much to offer in explaining the adoption of these kinds of services. It is also likely that the extensions and modifications necessary to explain the adoption of these services are relevant to understand the adoption of more traditional messaging services used in professional and working life settings.

1.1 Characterizing messaging services

In organizational contexts, research on the use of messaging services falls into the category of computer mediated communications (CMC) research. The research on CMC in organizations is large, but it mainly focuses the use of tools for supporting collaborative work (CSCW), such as group decision support systems, video-conferencing tools and email use in organizational contexts (Markus, 1994; Webster and Trevino, 1995; Fulk and Boyd, 1991; Te'eni, 2001), and little is focused on more recent messaging services such as IRC, ICQ, IM, paging and SMS. In research on the use of ICT in everyday contexts, studies of messaging services are found in a diversity of areas, such as domestication research (Silverstone and Hirsch, 1992) and uses and gratifications research (Blumler and Katz, 1974). These studies are found both within the context of messaging services as Internet services and messaging services as telephony services. Most of this research is dominated by sociologist researchers. Some of these studies are briefly reviewed below, but it is difficult to find any frameworks categorizing messaging services among these studies. CMC research, on the other hand, has been occupied with properties of media, messages and users as foundations for explaining media choice, and consequently, offers several frameworks for categorizing messaging services.

Te'eni's (2001) comprehensive review of CMC in organizations suggests organizing CMC-research by communication inputs, process and impact. Of most importance to a categorization of messaging are inputs, characteristics in the form of task situation, distance, and values and norms, and process characteristics in the form of communication goals, strategies, message form, medium and communication process complexity. When focusing characteristics of the medium, some form of media richness theory is most often suggested as a

basis for categorization (Daft and Lengel, 1986, Sillince, 1997). Media richness is influenced and characterized by the ability of a medium to transmit multiple cues, immediacy of feedback, language variety and the personal focus of the medium (personalization) (Dennis and Kinney, 1998). Te'eni (2001) suggests the following characterizing medium attributes of any CMC service: Channel capacity, interactivity and adaptiveness.

Channel capacity is an important property determining media richness and includes the potential to transmit a high variety of cues and languages (Te'eni, 2001). Text messaging includes only one cue variety, even though simple graphics such as smileys and other context symbols are often included in the messages. Thus, channel capacity is generally low.

Burgoon et al. (2000), suggest two ways of characterizing interactivity, by structural properties and by qualitative experiences. This also illustrates that interactivity may be considered a property of the technology used to mediate the communication or a property of the technology as it is perceived by the end-user. Of the structural interactivity properties that are mentioned by Burgoon et al. (2000) are: Participation, mediation, contingency, propinquity, synchronicity, identification, parallelism and anthropomorphism. Including the perceived conception of interactivity, we may add interaction involvement, mutuality and individuation as important properties of the service. Thus, interactivity is a multifaceted concept of many dimensions. Applying these conceptions of interactivity to text messaging services, these services may be characterized as offering a participating, mediated, contingent, distributed, asynchronous, identified, serial, unanthropomorphic, involved, mutual and individuated form of interactive communication.

Finally, adaptiveness refers to the potential to personalize a message to a particular receiver. In principle, text messaging is a one-to-one messaging

service and as such, the message is personalized for the individual receiver. However, text messages are also used in mediated chat and flirt services in a one-to-many context. In this context, the adaptiveness of the service is relatively low.

Using Te'eni's (2001) review, text messaging may be characterized as an interactive and adaptive messaging service applied in low capacity channels. While previous studies focusing on media richness only may suggest this type of mediated communication is useful for the performance of less equivocal tasks and the exchange of formal messages, recent research gives more mixed predictions. For example Te'eni (2001) suggests this type of CMC will lead to communication control by testing and adjusting, and to increased affectivity. This means that the low channel capacity is compensated including more affective components in the message. This also leads to an adjustment of message content such as reduction of distribution and to low formality in content. Thus, it seems that low channel capacity may be compensated by high interactivity and adaptiveness as long as the distribution is low.

While the suggestion of usage hypotheses based upon this kind of research is far beyond the scope of this introduction, the characterization of text messaging services indicates what properties of this medium are relevant to explain its widespread adoption. In addition to the properties of the medium, properties of the user, user context and the perception of the service as well as the interaction between properties of the medium, user and context should be included in the analysis of use (Markus, 1994). In this report, properties of the individual user as well as determinants of adoption rather than usage patterns and media choice are focused.

1.2 Problems and approach

This study focuses three issues in the adoption of text messaging services; their general adoption and the relationship between social and utilitarian explanations of adoption, their widespread adoption among young users and the implications this has to a general model of mobile service adoption, and finally, their adoption as a service supporting the coordination of everyday life activities. We briefly discuss these three problem areas here, and present our approach to further investigating them.

In organizational studies of CMC focusing particularly on communication, attitudes towards communication media, media use and media choice have been the dependent variables traditionally studied (Trevino et al., 2000). In addition, media impacts, such as individual and organizational effects have also been given some attention (Te'eni, 2001). Attitudes towards media and media choice are often studied in a rational perspective (Webster and Trevino, 1995), while media use and media impacts are often studied applying social influence based theory (Fulk and Boyd, 1991).

In Norway, text messaging services have been popular among mobile telephony users, in particular among younger users, as a means of communication and as a service access method for the last two years. Thus, among young people, these services have now been domesticated and they are now part of the everyday communication pattern of these users (Ling and Yttri, 2002). Many suggestions have been made of what characterizes services that are widely adopted by young people (e.g. Taylor and Harper, 2001a,b; Oksman and Rautiainen, 2000; Leung and Wei, 2001). Common to the findings of most of these studies is that many of the concepts of traditional adoption theory, such as ease of use and usefulness, may need to be reinterpreted and new determinants of attitude towards use may have to be added to traditional adoption models. In addition,

studies of mobile phone use also draw attention to the importance of social and symbolic value of the services and devices in explaining their adoption (Skog, 2002).

Based upon CMC-research, however, the fact that these services are now widely adopted and domesticated suggests expectancy based explanations and social influence based explanations may have less to offer when explaining their usage patterns and service adoption. Actually, the determinants of use and adoption may be more oriented towards usefulness, ease of use and other utilitarian gratifications for services provided by a domesticated technology. In fact, recent studies of mobile phone use among young people suggest this may now be the case (Karlsen et al. 2001; Ling, 2001c). A similar view has been expressed by some CMC-researchers, concluding that "*for newer media, social explanations will be more important than rational explanations*" (Webster and Trevino, 1995, p. 1550), but as media is domesticated, social explanations loose their explanatory power and should be replaced by rational explanations because "*people generally agree about their use*" (Webster and Trevino, 1995, p. 1549). Thus, as media gets domesticated, rational explanations may become more important than social explanations. As the domestication process is a continuous process, however, the point in the process where social explanations loose their power is not easily identified. In a previous study of adoption of mobile commerce services, we found that social explanations significantly improved the explanatory power of the adoption model (Pedersen, 2001). However, text messaging services are well domesticated services when compared to mobile commerce services.

One of the problems with applying many of the results in CMC-studies to everyday contexts is that everyday contexts often lack the task focus and organizational structure of organizational settings typically found in CMC-

research. In addition, the combination of everyday life contexts of use and young people as primary adopters may further complicate the application of CMC and adoption research to explain the adoption of new mobile services. Still, as these services are domesticated, they are likely to play an integrated role in both working life and everyday life. For example, Palen et. al. (2001) found that while mobile services were sometimes adopted for primary use in working life contexts, their use was soon transferred to e.g. the coordination of everyday activities. The results from a whole line of research studying how mobile services contribute to a blurring of the boundaries between working life and everyday life may be applied to suggest that media use in working life influence media use in everyday life and vice versa (Yttri, 1999; Gant and Kiesler, 2001). Thus, ignoring theories and findings of adoption and CMC research when studying media choice and adoption in everyday contexts, may be as dysfunctional as only applying sociological theory of communication in everyday contexts.

To summarize, text messaging services are well incorporated into the lives of young people as a service for mediating communication. According to both domestication and CMC-research, this may implicate that social explanations of their adoption may have to be replaced by more rational and utilitarian explanations. Further, the widespread adoption of text messaging services is not limited to young users, but these users still represent the majority of users having domesticated text messaging services. As shown above, this may require that extensions and modifications are made to existing adoption and media use models when applied to explain the adoption of services among young users. Finally, mediated communication is typically studied in either working life or everyday life contexts applying separate theories and models, but recent research on the blurring of these two contexts suggests CMC and adoption

theory should be combined with sociological theory of communication to explain services adopted across working life and everyday life contexts.

In this report, we approach the three problems indicated above by integrating adoption and CMC-theory on media use and adoption with findings from sociology, communication and domestication research on mobile services. We suggest a modified version of the theory of planned behavior (TPB) (Taylor and Todd, 1995) as a basis for explaining the adoption of text messaging. We also test the model against other standard models in ICT-adoption research, such as the theory of reasoned action (TRA) (Fishbein and Ajzen, 1975) that includes elements of social explanation of media use from other CMC-models and the technology acceptance model (TAM) (Davis, 1989). In section 2, relevant theory from diffusion, adoption and CMC-research, communication research and domestication research is reviewed and applied to the model presented in section 2.5. In sections 3 and 4 we present the methodology and results of a study of young people's adoption of text messaging services in Norway. In addition to testing the proposed model, we also report some of the descriptive results on young users' adoption of text messaging services in Norway. In section 5 we conclude and discuss our findings. Some implications for the mobile services industry are also provided.

2. THEORY

Four different traditions have been identified studying the adoption and domestication of messaging services. Diffusion research has its foundation in marketing and economics, and studies the aggregate diffusion or adoption of a technology or service in an industry, in a community or in society in general. Uses and gratifications research has its foundation in media and communication theory, and studies the gratifications sought by adopters of media of different kinds. Adoption and media choice research has its foundation in information systems research, and studies the adoption and use of information and communication technology in general and in organizations in particular. Domestication research has its foundation in sociology, and studies the adoption, use and domestication of technology in society with a particular focus on the societal consequences of technology domestication. In this section, the four traditions are briefly introduced, and representative examples of research in each tradition focusing on messaging services are reviewed. A model integrating many of the most relevant findings from the uses and gratifications, adoption and media choice, and domestication traditions is presented.

2.1 Diffusion research

The classic diffusion study typically contrasts the technology requirements of different user categories to *describe* the adoption process a posteriori. Several aggregate mechanisms are proposed to explain the observed diffusion process. In marketing, the Bass model (see Mahajan, Muller and Bass, 1990) focuses on how information is communicated in media and interpersonally, and how the two mechanisms of communication result in the S-shaped aggregate adoption rate often observed in studies of innovation diffusion. Discontinuous models have also been applied to explain the shifts in adoption rates found for some technologies (e.g. Loch & Huberman, 1999).

Rogers (1995) goes beyond aggregate adoption process description, and tries to *explain* the observed adoption by characteristics of the technology being introduced. While most of the models mentioned above are mainly concerned with describing the diffusion process over time, Rogers (1995) focuses on the innovation, the social system and the communication channels. Regarding the innovation or technology being adopted, he mentions relative advantage, compatibility, complexity, trialability and observability as the most important characteristics explaining why it is being adopted. These are all supply side characteristics presumed to influence usefulness and user friendliness. Some studies have also adapted these supply side determinants in studies of individual end-user adoption (e.g. Karahanna et al., 1999).

On the demand side, explanatory variables are not identified at the individual adopter level. Instead, diffusion theory focuses on describing aggregates of individual users and on categorizing groups of adopters, such as e.g. early adopters, early majority users and late adopters. Diffusion theory also applies more traditional demographic variables to characterize aggregates of individual adopters. For example, early adopters are typically found among the better educated and younger (Dickerson and Gentry, 1983). Many of the studies following this tradition actually suggest the categorization of end-users into adopter categories and the corresponding analysis of the demographic, socioeconomic and personality characteristics of these groups as explanatory models of adoption. In this way, diffusion theory characterizes the social system by categorizing its users in demographic and socioeconomic groups.

Diffusion studies of mobile services also classify adopters as belonging to different categories (segments), such as early adopters, early majority, late majority, laggards and non-adopters. For example, Wei (2001) studied the socioeconomic characteristics of mobile phone laggards in Hong Kong,

Tjøstheim and Boge (2001) studied the demographic characteristics of early adopters of mobile commerce when compared to non-adopters, while Mante-Meijer and Haddon (2001) did the same for general mobile services like voice and messaging. Mante-Meijer and Haddon (2001) characterized adopters of messaging services in Europe as younger than adopters of voice services (30.5 vs. 42.2 years average) and found that the probability of adoption was lower among people living with partners and even lower for people with children. In general, it is also assumed that an individual's text messaging use decreases as the user gets older (see also Ling, 2001c) and that use of text messaging complements voice services for economic reasons (see also Karlsen et al., 2001). In Mante-Meijer and Haddon (2001), the general aggregate adoption rate of text messaging services among mobile phone users was estimated at 15 %, and almost all these users are Internet users as well. More recent Norwegian data indicates that among teens, the aggregate adoption rate of mobile phones is approximately 95% (Ling, 2001c), and this rate is higher among female users than male users in the early teen age categories. Within this category of users, the aggregate adoption rate of text messaging services is approximately 96 % (Karlsen et al., 2001). In Norway, female users also use text messaging significantly more than men in all comparable age categories. In addition, the use of SMS for service access (e.g. personalization) is higher among male users, and thus, the difference in use of person-to-person text messaging (texting) is considerable between female and male users (Ling, 2001).

Similar survey studies focusing particularly on the characteristics of young adopters of Internet based messaging services are also found. For example, Fox et al. (2001) found the aggregate adoption rate of instant messaging services to be 74% among online teens and 44% among online adults. Comparing this figure to the 92% aggregate adoption rate of email among the same teenagers, instant messaging has been widely adopted among American teens. As for text

messaging, female users have a higher adoption rate (78%) than male users (71%). A similar characterization was given by Schiano et al. (2002) in a more recent survey of young instant messaging users in US. These results illustrate how diffusion research is useful for characterizing and describing adoption and use of services both at the macro level and in characterizing different user groups (segments). However, it is of less help in *explaining* why the particular aggregate adoption pattern or differences between user categories may be observed.

Diffusion research also explains the aggregate adoption process by the characteristics of the technology or by the characteristics of the channels used to communicate information about the technology. For example, Mahler and Rogers (2000) suggest that the difference in the adoption processes of mobile and fixed telephony may be explained by differences in network effects (externalities) between the two technologies, and Gruber and Verboven (2001) suggest the regulatory regime provided by license regulation and competition explains the widespread diffusion of 2G mobile telephony in Europe using a logistic diffusion model. These aggregate studies of diffusion processes are of little help in the development of individual level models of service adoption, but are typically applied to predict the aggregate adoption rates of new technologies as a function of time (e.g. Kim et al., 1999).

2.2 Uses and gratifications research

Uses and gratifications research has its foundation in communication research, an integrated field of researchers in media, sociology and social psychology originally focusing on mass media and mass communications (Blumler and Katz, 1974). Uses and gratifications research focuses the individual user or adopter, and the general idea is that adopters seek gratifications in mass media

and technology use based upon their individual "needs" or" motivations" (Lin, 1996). As such, it has a functional foundation similar to rational or utilitarian theories of media use in traditional CMC and adoption research. However, the difference between these traditions is that uses and gratifications studies always start with an exploratory phase where the researcher does not hypothesize which particular gratifications are sought by a particular mass medium or technology. Instead, the individual subjects are either studied in a qualitative setting to explore possible gratifications or a list of possible gratification assumed to be common to all media is presented to and rated by the subjects. These gratifications are mostly based upon early uses and gratifications studies (e.g. Rubin, 1981). Some uses and gratifications studies also investigate the relationship between identified gratifications and usage measures, and thus extend this research from a description of gratification factors to tests of the explanatory power of these gratifications. Generally, uses and gratifications research has been criticized for its lack of theoretical foundation (Lin, 1996) and low explanatory power (LaRose et al., 2001). Since the original studies focusing on gratifications of mass communication media, uses and gratifications research has been extended to study the gratifications of such diverse technologies and services as the home VCR (Cohen et al., 1988), video games (Sherry et al., 2001), Internet (Papacharissi and Rubin, 2000; LaRose et al., 2001), email (Dimmick et al., 2000), household telephones (Dimmick and Sikand, 1994), instant messaging (Leung, 2001), pagers (Leung and Wei, 1999) and mobile phones (Leung and Wei, 2000), just to mention a few examples. Common to most uses and gratifications studies is that they focus the gratifications of technology in everyday life, and even though young users are not particularly in focus, many studies include these users because they are often considered early adopters of the technologies studied by uses and gratifications researchers.

Many gratifications have been identified that are believed to be particularly relevant for teens and adolescent users. For example, Arnett (1995) identified the gratifications "identity formation, high sensation, coping and youth culture identification" (Arnett, 1995, p. 520) to be more important for adolescents than for children or adults.

Of particular relevance to this report are the recent uses and gratifications studies of messaging services both on the Internet and on the mobile. Of the studies of services on the Internet, some study the Internet as a source of entertainment and information (e.g. Lin, 1999), while other focus the importance of the Internet as a medium for communication (Dimmick et al., 2000). Not surprising, the gratifications suggested and investigated are very different with these two approaches, but this is only seldom clarified in uses and gratifications studies of the Internet (see LaRose, 2001 for a brief review). We focus on the communication oriented studies here. Pappacharissi and Rubin (2000) accept the combinations of traditional media gratifications and interpersonal gratifications sought in Internet use, and identify a general gratification of interpersonal utility, and four traditional media gratifications of Internet use; "pass time", "information seeking", "convenience" and "entertainment". Focusing particularly on email gratifications, Dimmick et al. (2000) identify a set of interpersonal gratifications and a set of utilitarian gratifications, such as low cost and quick communication. They find that while the telephone was superior in fulfilling the interpersonal gratifications, email was superior in fulfilling the utilitarian gratifications. Thus, it may seem that the use of services like email are more related to utilitarian than to interpersonal gratifications when compared to a richer medium like the telephone.

In a study of college students' gratifications from using ICQ, Leung (2001) identified seven gratifications termed "express affection", "entertainment",

"relaxation", "fashion", inclusion", "sociability" and "escape". These findings oppose the utilitarian gratifications identified by Dimmick et al. (2000) for email. They also suggest that traditional media gratifications like entertainment and escape are sought from messaging services, and indicate that users may seek different gratifications from different messaging services. Thus, different messaging services may be complementary and provide the basis for the use of a cluster of functionally similar technologies among young users. Leung (2001) found that ICQ use was positively related to mobile phone and email use, supporting the hypothesis that young people adopt a cluster of functionally similar technologies and do not substitute the use of one service or technology for another. Leung (2001) also found that female users used ICQ more than male, and that they use ICQ for sociability reasons while male users use it more for relaxation and entertainment reasons. In a comparison of light and heavy users, heavy users were motivated by affection and sociability while light users were more motivated by fashion.

Turning to mobile services, one may expect other gratifications to be sought from mobile voice services than traditionally sought from fixed telephony. Dimmick and Sikan (1994) identified three general gratifications; "sociability", "instrumentality" and "reassurance" from fixed telephony before the widespread adoption of mobile phones. Leung and Wei (2000) stress that newer generations of mobile telephony introduces the telephone as a content medium as well as a communication medium. In general, seven gratifications were identified; "fashion/status", "affection/sociability", "relaxation", "mobility", "immediate access", "instrumentality" and "reassurance". Thus, the traditional telephony gratifications are found, but in addition, gratifications related to fashion, relaxation and entertainment, flexibility and mobility are identified. In uses and gratifications "inspired" study, Aoki and Downes (2002) identified four "gratifications" from mobile phones; "necessity", "cost efficiency",

"safety", "dependency". On closer inspection, these gratifications loosely corresponds to the "fashion", "instrumentality", "reassurance" and "mobility"/"immediate access" gratifications of Leung and Wei (2000). Aoki and Dowes (2002) used the study to suggest segments of users termed the "cost conscious", "safety conscious", "dependent", "early adopters" and "practical users". Thus, the same gratifications do not seem to be sought by all users.

None of these studies focus particularly on messaging services on the mobile phone. However, Leung and Wei (1999a) studied the gratifications from pager use among young users in Hong Kong and found three factors termed "information-seeking", "novelty" and "fun-seeking". However, this study only investigates the gratifications related to news search by pager use, and as such is only relevant for the service access functionality of text messaging services. In Leung and Wei (1999b) however, the general gratifications from pager use is identified as "sociability", "information seeking", "entertainment", "utility", and "fashion/ status". Thus, the gratifications of pager use were very similar to those sought from mobile phones, but the "fashion and status" gratification was found to be a very important gratification of pager use. Consistent with findings for instant messaging services, the "fashion and status" gratification was more important for light users of the pager services. In addition, the sociability gratification was more important to female users and entertainment was more important to adolescent users.

Höflich and Rössler (2001) have conducted the only uses and gratifications study focusing particularly on text messaging that we have been able to identify. Their study was done among 204 German mobile phone owners of age 14 to 18. They identified the following gratifications; "reassurance" (rückversicherung), "sociability" (kontaktpflege), "immediate access /availability" (verfügbarkeit), "instrumentality" (lebenshilfe) and

"entertainment/enjoyment" (nutz-spaz). Thus, the gratifications were very similar to those of the mobile phone identified above. Of these gratifications, only "instrumentality" significantly predicted the use of text messaging services. Use of text messaging were found to correlate positively with voice service usage, but was uncorrelated with email and text message flirting service usage.

From these studies we may conclude that the gratifications sought from text messaging services are likely to be very similar to the general gratifications sought from mobile phone use. Thus, the reasons for choosing between text messaging and voice services can not be found in uses and gratifications research, but must be sought elsewhere. However, uses and gratifications research shows how the gratifications of text messaging and mobile phone use in general is different from the gratifications of the fixed telephone, and to some extent of email, but very similar to the gratifications sought by instant messaging. However, the similarity of text messaging, mobile phone use and instant messaging gratifications may be caused by bias in the user segments studied in uses and gratifications research and may be gratifications sought by young users regardless of the media chosen.

2.3 CMC and ICT adoption research (IS-research)

Information systems research has been established as a separate research area from informatics and general ICT-research. It primarily focuses behavioral issues of systems development and implementation, and has mainly studied information systems in organizational contexts or managerial issues related to information systems. However, as information technology has been widely adopted outside organizational contexts, information systems researchers now study behavioral issues of information systems in general (e.g. Kraut et al.,

1999). When reviewing IS-research for relevant studies of messaging services usage and adoption, we have identified two areas of research of relevance. In CMC-research, attitudes towards media, media use, media choice and to some extent, media effects have been studied (see Rudy, 1996; Te'eni, 2001). Of these variables, the media use and choice variables are of particular interest to understanding the adoption of different media. The other area of research identified and reviewed is, naturally, ICT adoption research.

2.3.1 CMC and media use studies

Trevino et al. (2000) suggest separating the variables of media use and media choice in CMC research. While general media use is the patterns in media use and is influenced by media attitudes and social influence, individual choice of a particular medium for a particular message is much more influenced by situational factors. Thus, we focus studies of media use here, but also review relevant studies of media choice when discussing the choice between different messaging media below.

Media use is typically explained by using one of two different approaches in CMC-research; a rational or social approach. Theories assuming media use is the result of individual users' evaluations of the utilities gained from media use or particular media choices are typically applied in the rational approach. The dominant theory in this approach is some variant of media richness theory (Daft and Lengel, 1986). Recent studies suggest media richness theory is better suited for explaining media choice than use (Trevino et al., 2000). Theories assuming media use is the result of social influence from peers and external sources are typically applied in the social approach. Theory assuming media use can be explained by their symbolic meaning are also included in this approach (see Webster, 1998). While some researchers have seen these rational and social

approaches as providing competing explanations (e.g. Dennis and Kinney, 1998), the general understanding is now that these approaches are complementary (Webster and Trevino, 1995). Recently, more comprehensive frameworks have been suggested (e.g. Trevino et al., 2000) explaining media attitudes, use and choice using integrated frameworks of rational, social and person/technology interaction theories. These approaches have been applied to study media attitudes, use and choice of technologies such as the telephone[2] (see Markus, 1994), videoconferencing (e.g. Webster, 1998), discussion forums (see Te'eni, 2001), and group decision support systems (see Walther, 1996), just to mention some examples. However, email is the mediation communication technology most widely studied.

Zack (1993) found that email complements face-to-face communication and is most efficient for communication within an established context. It has also been assumed that, due to less richness of text based messaging, it is more likely to be used for task-oriented than socially-oriented communication (Hinds and Kiesler, 1995; Walther et al., 2001) and for unequivocal rather than equivocal tasks (Trevino et al. 2001). As indicated in section 1, it seems the low channel capacity may be compensated by high interactivity and adaptiveness as long as the distribution is low (Te'eni, 2001). Thus, high interactivity of a messaging medium makes it suitable for socially-oriented communication as well (see Walther, 1996). This may be one of the attributes that distinguish more interactive messaging services like instant messaging and text messaging from email. In general, there is mixed support for media richness theory partly due to the complexity of the media richness concept (Markus, 1994), and partly due to the lack of focus on media choice versus media use in CMC-studies (Trevino et al., 2000).

[2] However, no studies focusing particularly on mobile telephony have been identified.

Markus (1994) found that media richness explained media attitudes, but not actual email use. Trevino et al. (2000) developed a comprehensive framework and found support for the importance of media richness in media choice, but not in general media use. For general media use, situational, social and symbolic variables were more powerful determinants. In a comprehensive review of CMC-research, Te'eni (2001) organizes findings according to communication inputs, process and media effects. The review expresses relevant findings in the form of propositions. The relevant propositions for media use of messaging services are summarized in table 2.1.

Table 2.1 CMC-research propositions based on Te'eni (2001).

Independent variable	Proposition
Interactivity	For control by testing and adjusting, high rather than low, interactivity is more effective
	When interactivity is high, senders will exchange shorter, rather than longer, messages
Channel capacity	For contextualization, high rather than low, channel capacity is more effective
	When channel capacity is low, senders will exchange messages of higher, rather than lower, formality
	For affectivity, high rather than low, channel capacity is more effective
Adaptiveness	For perspective taking, high rather than low, adaptiveness is more effective
Interactions of media attributes	Senders will adapt to low channel capacity coupled with high interactivity by increasing control through testing and adjusting
	Senders will adapt to low channel capacity coupled with low interactivity by increasing control through planning
	Senders will adapt to low channel capacity coupled with low interactivity by decreasing affectivity
	Senders will adapt to low channel capacity coupled with high interactivity by increasing affectivity

In general, messaging services will be most efficient for communication goals of control and for formal messages. However, when comparing different messaging services, email, instant messaging and text messaging are mainly different when it comes to interactivity and length of message. In this case, Te'eni (2001) suggests the higher interactivity will lead to shorter messages, suited for text messaging, and that senders will adjust their goals towards more testing and adjusting and by increasing affectivity. There are also many other interactions of variables that are relevant in CMC-research, such as the interactions between media, communication goals and message attributes, or the interactions between cognitive or affective distance and communication goal adjustments. However, reviewing these interactions goes far beyond what is the focus of this brief review on media use.

Even though there is no particular focus on age and messaging in CMC-research, Higa et al. (2000) found that, as expected, email use among teleworkers decreased with increasing age. However, no support was found for reduced email richness and productivity with increasing age.

No study has been found on text messaging services in CMC-research, but a few studies are found on the use of instant messaging or proprietary chat services. In a study trying to integrate the contexts often separated in research on mediated communication (work, learning, community and leisure), Haythornthwaite (2001) studied the use of email, discussion forums and IRC in a distance learning class. Even though the study focused social network analysis, some findings were reported on media use. Discussion forums were used as a forum for diffuse, background information exchange in one-to-many communications. IRC was used for class-wide communication, but "*more to named others*" (Haythornthwaite, 2001, p. 221). Over the period of the study, use of IRC increased, while person-to-person email communication decreased.

However, email was the most frequently used medium and was used in particular for intrateam communication. Haythornthwaite (2001) concludes that "*email emerges as important for strong, project-oriented ties, and the Webboard and IRC for weaker class-wide ties*" (p. 222).

Users seem to combine messaging services with other forms of mediated communication as well as with other messaging services. For example, text messaging services are cognitively lightweight services that may be combined in specific ways with more media rich and cognitively demanding services (Churchill et al., 2000; Nardi et al., 2000). A number of studies have investigated the use of instant messaging services in workplace settings (e.g. Churschill and Bly, 1999; Churchill et al., 2000; Bradner et al., 1999). Most of these studies are usability related and positioned in CSCW design traditions rather than in CMC-research. However, some of them includes references to CMC-research and includes behavioral studies of message service use. Churchill and Bly (1999) found that users of a simple MUD environment did not require complex interfaces, but instead adapted their communication behavior to fit the simple messaging environment provided by the MUD-application. There were no requests for advanced awareness functionality, but the fact that some awareness functionality was available made the service popular. An interaction was also found between the primary use of the service and its adoption. The number of chat rooms with work related focus increased as the number of social related chats decreased, and adoption also increased with the number of work related chats. Thus, user interactions make users "create their own services" from a service structure or application. Some of the elements identified as important for the success of the messaging service were: Prior knowledge of participants, service as complement to other tools, and organizational support. Segerstad and Ljungstrand (2001) found that a university wide messaging service was used to support both work and social

activities, but that it was also extensively used for playful behavior. In another study of instant messaging in the workplace, Nardi et al. (2000) found that these services were used for the purpose of negotiating availability, sustaining social connections, switching media, and retaining context. Thus, the service functions as an unattended awareness tool (availability, social connections and retaining context), and as a tool for switching media. The study also clearly showed how messaging services complement other media, such as phone and email, at the workplace.

A limitation of CMC-studies to our setting is their focus on organizational contexts and managerial or professional users. One should be careful when generalizing from these contexts and users to the everyday life contexts of young users. Still, many of the findings reported above seem highly consistent and are certainly relevant beyond organizational settings.

2.3.2 ICT-adoption studies

Three models stand out as the most widely applied to explain ICT-adoption; the technology acceptance model (TAM) originally proposed by Davis (1989), the theory of reasoned action (TRA) originally proposed by Fishbein and Ajzen (1975), and the extension of TRA into a theory of planned behavior (TPB) originally proposed by Ajzen (1985).

The technology acceptance model (Davis, 1989, Davis et al., 1989) focuses on the attitudinal explanations of intention to use a specific technology or service. It includes five concepts - perceived user friendliness, perceived usefulness, attitudes towards use, intention to use and actual use. The TAM-model has been used by several researchers to explain the attitudes and behaviors of information system users. Although the model is mainly applied to explaining the adoption of technology within organizations, the constructs of the model are

meant to be fairly general (Davis et al., 1989; Doll et al., 1998). In many ways, TAM corresponds to rational or utilitarian theories of media choice and use.

The TAM-model has been both extended and modified. The typical extension is in the development of antecedents and determinants of perceived user friendliness and perceived usefulness. While the determinants of perceived user friendliness are believed to be rather general and have been given much attention (e.g. Venkatesh and Davis, 1996), the determinants of perceived usefulness are service-dependent, and have been given less attention (Venkatesh and Davis, 2000). The second extension is by introducing social determinants of use or intended use. Some have introduced these concepts as determinants of perceived usefulness (Venkatesh and Davis, 2000), while others have criticized the model for not incorporating such issues at all (Bhattacherjee, 2000). The third extension is the introduction of behavioral control and user resources as an issue in the TAM model (e.g. Mathieson et al., 2001).

TAM may be seen as a special case of the TRA (Fishbein and Ajzen, 1975). Thus, TRA is a more general theory than TAM. It is used to explain behavior beyond the adoption of technology. However, when applied to the explanation of use or adoption behavior, the model includes four general concepts - behavioral attitudes, subjective norm, intention to use and actual use. In general, TRA does not propose specific determinants of behavioral attitudes (attitudes towards use). In TRA, however, these attitudes are composed of the belief that use leads to certain outcomes and the evaluation of the desirability of these outcomes. The inclusion of subjective norm represents an important addition when compared to TAM. In TRA, subjective norm is composed of the user's perception of how others think she should behave, and her motivation to comply with the expectations of these referents (Fishbein and Ajzen, 1975).

With the subjective norm concept, TRA includes elements of social influence found in social explanations of media choice.

TRA has been applied in its original form to explain the adoption of ICT-applications (e.g. Liker and Sindi, 1997), but typically TRA is used as a basis for modifying the TAM-model with subjective norm as suggested above (Venkatesh and Davis, 2000; Venkatesh and Morris, 2000).

The theory of planned behavior was proposed as an extension of the theory of reasoned action to account for conditions where individuals do not have complete control over their behavior (Ajzen 1985, 1991). However, the theory also proposed more explicit formulations of the determinants of the behavioral attitude and subjective norm of the TRA-model. The components of behavioral attitudes and subjective norm are the same in TPB as in TRA. In addition, the model includes behavioral control as a perceived construct. Perceived behavioral control reflects the internal and external constraints on behavior, and is directly related to both behavioral intention to use and actual use. Consequently, actual use is a weighted function of intention to use and perceived behavioral control (Taylor and Todd, 1995). While the status of subjective norm in TPB is unclear, the inclusion of behavioral control has been shown to significantly improve the predictive power of TPB over TAM and TRA. No variable corresponding to perceived behavioral control is found in the theories of media choice introduced above. TPB has been applied to explain the adoption of such diverse systems as spreadsheets (Mathieson, 1991), computer resource centers (Taylor and Todd, 1995), and recently, video conferencing systems (Townsend et al., 2001) and electronic commerce services (Battacherjee, 2000), just to mention a few examples.

Even though most studies of messaging services in IS-research have been done in a CMC-research perspective, there are some studies of messaging services

applying an adoption research perspective. Some of the earliest studies applying the TAM model studied the adoption of early email services (Davis 1989). However, the focus of much of this research was the validation of the measurements of the TAM model. Some of the measures of the TAM model were also included in Trevino and Webster's (1992) study of flow in email use. They found that ease of use was the most important determinant of flow and that both flow and ease of use affected users attitudes towards using email. Adams et at. (1992) studied the discriminant and convergent validity of the TAM model across subjects and technologies, and found the model useful for explaining the use of both voice mail and email services. The model discriminated the subjects' perceptions of voice mail and email, but predicted usage of the two services with very similar models consistent with Davis' (1989) findings. For example, usefulness was found to be a far more important predictor of use than ease of use. However, when comparing the TAM of these two similar technologies with the TAM model explaining the use of dissimilar technologies like spreadsheets, Adams et al. (1992) found the two models very different. Thus, there is no "*consistent information technology effect*" (Adams et al., 1992, p. 245) universally explaining its adoption. This finding has been used as an argument to extend and modify the TAM model according to the particular information technology or service being adopted.

One extension when explaining the adoption of messaging services is to maintain the TAM model but include determinants of usefulness, ease of use and attitudes. This approach was used by Eikebrokk (1997) finding that organizational attitudes affected individual attitudes, thus, indirectly suggesting a social dimension should be added to TAM when explaining the adoption of messaging services. A similar approach was followed by Gefen and Straub (1997) in a study of gender differences in the adoption of email. They suggested that women perceive social presence in email use different from men

and thus, that they perceive email as more useful and easy to use than men due to their perceived social presence. They found support for perceived differences in social presence and usefulness. They also found a difference in perceived ease of use, but in the opposite direction of what was proposed, and no difference in actual use was found between men and women. Later, Karahanna and Straub (1999) suggested that in general, social presence, social influence and support are important determinants of usefulness, and support and accessibility are important determinants of ease of use of email. However, they found that support did not influence usefulness and ease of use, but that social influence variables and accessibility did. This also suggests extending the TAM model with social presence and influence variables, and with accessibility. Karahanna and Limayem (2000) replicated Adams et al. (1992) comparison of email and voice mail, and included the same determinants as mentioned above. Opposing the findings of Adams et al. (1992), they found the adoption model different for email and voice mail services. While ease of use and social influence explained use of email, usefulness and ease of use explained the use of voice mail. In addition, accessibility was important in predicting ease of use and usefulness of email, while this was not the case for voice mail. Even though these studies include social influence variables and extend the TAM model, no study has systematically compared the TAM model to TRA and TPB by gradually including social determinants and perceived behavioral control determinants in a way similar to Mathieson (1991) or Taylor and Todd (1995). However, the importance of social dimensions in explaining the adoption of messaging services is well documented in CMC-research on media use reviewed above.

Few studies are found on the use of mobile telephony services in general in IS-research (for a few exceptions see Hinds and Kiesler, 1995; Manning, 1996). There are even fewer studies applying adoption research models to mobile

services or telecommunication services in general. However, some studies have been identified applying adoption models to explain the intention to use telemedicine applications. For example, Hu et al. (1999) suggested that the TAM model may be too parsimonious when being applied to explain the adoption of such specific technologies as telemedicine applications. The model showed good fit and reasonable explanatory power when explaining intention to use, but was only able to explain 37 % of the variance in attitude towards use. Thus, Hu et al. (1999) suggested incorporating additional explanatory factors in the TAM model when applied to health-care contexts. Kwon and Chidambaram (2000) applied the TAM model to explain the general adoption of mobile phones among regular subscribers in a metropolitan area in Hawaii. They also suggested the TAM model should be extended and included social pressure as an additional variable. Somewhat surprising, the authors did not find support for the social pressure variable, and contrary to many other studies applying TAM, they found that ease of use was perceived to be more influential in explaining intentions to use than usefulness. Pedersen (forthcoming) applied the TAM model to explain the intention to use mobile commerce services. He found the TAM model should be extended. However, the main improvement in explanatory power was obtained by extending the model into a modified version of TPB and not in the isolated inclusion of subjective norm as a measure of social influence. Based upon these few studies applying adoption research to mobile phone contexts, results are mixed. However, all studies indicate that the original TAM model needs to be extended when applied to explain the adoption of devices and services in this context.

So far, no studies have been identified applying these models to instant messaging or text messaging services on the traditional Internet or mobile networks.

2.4 Domestication research

Domestication research is dominated by social science researchers and its reference disciplines are sociology, anthropology and ethnology. The main focus of domestication research is on the societal consequences of the domestication of technology; that is the process in which the use of technology becomes integrated into our everyday life. Domestication research has a long tradition of studying everyday life technology as the object being adopted (see Silverstone and Hirsch, 1992). Examples of technologies studied are fixed telephony (see Fisher, 1988), television (Silverstone and Haddon, 1996a) and home computers (Silverstone and Haddon, 1996b). Domestication studies are not limited to studies of individuals or aggregates, but are found describing the adoption and usage patterns of groups in society (e.g. Townsend, 2000) as well as individual end-users (e.g. Ling, 1997). In investigations of the societal consequences of adoption and use, both aggregate and individual level studies are found. For example, Townsend (2000) analyzed the consequences of mobile telephony for the planning of cities, while Fortunati (1998) analyzed the consequences for the family as an institution.

Domestication research often describes the domestication process as a five stage process consisting of imagination, appropriation, objectification, incorporation and conversion (Silverstone and Haddon, 1996b). The first two stages of this process represent stages normally characterized by the term adoption in other research directions, but understanding the process of objectification and conversion is also important for example when studying the adoption of generations of technologies or clusters of complementary technologies (Rogers, 1995). The five stage domestication process also represents much of the explanatory power in domestication research when explaining adoption. However, the bases for explaining the consequences of

technology domestication are more varied, and are found in a variety of sociological, ethnological and social psychological theory.

A review of issues studied in domestication research on mobile services is found in Haddon (2001). This literature is now of a considerable size, and consequently, we will mainly focus on studies of messaging services here. Of the domestication studies focusing on the adoption, use and domestication of mobile services, important findings may be categorized by the contexts of technology and service use. For example domestication research has studied differences in adoption and use of mobile services in work and leisure contexts, in different contexts represented by demographic variables such as age (young versus other users) and gender (female versus male users), in contexts of private and public use, and in the dynamic contexts represented by multiple and changing roles of modern technology users (Wellmann, 2001; Green et al., 2001).

In the work context, much previous domestication research has been conducted on the adoption of mobile services among knowledge workers (e.g. O'Hara et al., 2001), but recent work has also focused "blue collar" workers (e.g. Brodie and Perrie, 2001). Even though much of this research is interesting because it focuses on utilitarian reasons for adoption, little of it has been directed specifically at the adoption decision of end-users. Instead, most of the research on mobile work is usability studies applied to design user interfaces and to develop work-related support applications. Research focusing the leisure context has either focused directly on the functional use of mobile services in leisure and everyday contexts, or focused on how the boundary between work and leisure contexts is blurred by the use of such services. For example, Palen et al. (2001) studied the impact of mobile phones adopted for functional, work related reasons (e.g. availability, flexibility), on the users' everyday life

activities. These findings indicate that utilitarian explanations of the adoption of mobile services should be investigated across work and leisure contexts, but none of these studies have focused on messaging services in particular.

When contrasting the contexts of demographic groups, the "introduction of mobile phones into existing situations illuminates various aspects of the context" (Ling, 2001a, p. 134). Several studies focus on gender differences in mobile end-user service adoption. An early study in this tradition was conducted by Rakow and Navarro (1993). Their work described interesting communication patterns, such as e.g. "remote mothering" among women. Rakow and Navarro asserted that, at an early point in the diffusion of the device, the mobile telephone was a device that replicated preexisting gender patterns, i.e. the role of the woman as an accessible nurturer and a person in need of male protection. Later, several studies have elaborated on gender differences in the adoption of both voice and other mobile services (e.g. Ling, 2001a, Ling, 2001c). The mobile telephone was earlier mainly seen as part of the male domain (Puro, 2002). As the adoption process has continued, and indeed teen girls adopt mobile telephones in significantly higher numbers than their same-aged male counterparts (Ling, 2001c), the device has been redefined as a social network device and thus within the domain of women. Thus, domestication research suggests explanations of the observed gender differences in messaging services use observed in all research directions reviewed above. For example, Skog (2002) observed that girls valued social functionality of the mobile phone higher than boys, who on the other hand stressed technical functionality. She explained this finding with general *role theory* suggesting that text messaging is more functional in maintaining female roles, than male roles. This is also observed in the content differences in text messages of girls and boys. For example, Kaseniemi and Rautiainen (2002) observed that girls more often used all 160 characters of an SMS and filled it

with references and social gossip, while boys often wrote messages of 40-50 characters with "plain language". Both Ling and Yttri (2002) and Larsson (2000) describes a careful examination, interpretation and sharing of messages among and between female users (particularly teens) that may be explained by *attributes of the social networks* of female versus male users (e.g. female social networks being more comprehensive, open and everyday life as opposed to working life oriented). The channel richness, interactivity (asynchronous) and format of text messaging services may be particularly well suited for maintaining such social networks. The expressive use of mobile phones explained by theory of social identity and identification is common to both sexes, but is conducted in different ways by male and female users. Gender differences in expression of social identification has been explained by Larsson (2000) using rather general theory of *group identity formation* and by Skog (2002) using *image* theory and theory of *social classes*. Male users express their identity with technical attributes, such as brand name and model, while female users express their individuality and confirm their group identity by sending, receiving, filtering and sharing text messages. Valid explanations of gender differences in text messaging use should somehow be integrated into a more formal model of text messaging adoption.

The differences in adoption patterns between young people (teens, adolescents) and other users have been one of the most widely studied issues in domestication research on mobile services. An important finding from descriptive studies is that from age 20, adoption is a linearly decreasing function of age (Mante-Meijer and Haddon, 2001). However, when compared to Internet adoption, the older people have a much higher adoption rate of mobile phones than of the Internet. Still, their use of services is very simple, focusing almost exclusively on voice. The teenage segment has been described in several studies, both qualitative and quantitative. A summary of qualitative

observations is found in Plant (2001). Among the most penetrating studies are a set of qualitative studies done by Rautiainen and Oksman on Finnish adolescents (e.g. Oksman and Rautiainen, 2001), by Weilenmann on Swedish teenagers (e.g. Weilenmann and Larsson, 2000) and by Ling and others on Norwegian teenagers (e.g. Ling, 2001a, Ling and Yttri, 2002). In these studies, service adoption and usage varies in segments of teenagers in a way that treating the teenager group as a homogeneous segment is not advisable. In quantitative studies, mobile phones are shown to have an adoption rate of close to 100 percent in teenage segments. Thus, the use of mobile services is very well integrated in the daily lives of teenagers. However, the impression that services are adopted for non-functional and social status reasons only (e.g. Skog, 2002), is contradicted by many of the descriptive studies. For example, Karlsen et al. (2001) found a remarkable orientation towards usability and costs in their study of the potential adoption of mobile Internet services among Norwegian teenagers.

A variety of explanations have been suggested of the widespread adoption of mobile services among young users. For example, it has been suggested that the adoption behavior can be explained by a "theory of fashion" (e.g. Ling, 2001b) wherein the popular characterization of the device seems to have changed with time, by the use of services as "ritual gift giving" (e.g. Taylor and Harper, 2001a), by treating the mobile phone as "symbolic capital" (e.g. Skog, 2002) or as an instrument in "family differentiation and symbol of individuality" (e.g. Taylor and Harper, 2001b), and by the use of services as a "group marker or social identifier" (e.g. Weilenmann and Larsson, 2000) or as a "self identifier" (e.g. Hume and Peters, 2001). Currently, these explanations should all be treated as tentative because none of them has undergone formal hypothesis development and confirmatory testing. However, they suggest important

explanations that, when validated, will have to be integrated as parts of a more formal theory of mobile service adoption.

Most of these explanations have also been applied in studies of young users' text messaging adoption. Even though text messaging was not explicitly focused by Ling (2001b), he indicated three conceptions of *fashion and style*, and suggested a development from style as display through style as communication to style as a means to integrate social networks. With these conceptions, the use of text messaging may be understood as both a way of communication and as a means of social integration that plays a role as style marker when the mobile phone itself has lost its significance as an object of style display. This is closely related to Skog's (2002) interpretation of the mobile phone as *symbolic capital*. These symbolic elements of mobile phone use have also been confirmed in studies of mobile phone use in organizational contexts (Manning, 1996). However, Manning (1996) found that the mobile phone was status-enhancing at some levels in the organization while it was status-reducing at other levels. Consequently, Manning observed what he termed "countersymbolization" and "counterappropriation" used to express an opinion against adopting the mobile phone as well as excessive eager among others to adopt the phone for symbolic reasons.

There is also a relationship between symbolic capital and *social capital* when the object of symbolic value is a communication medium. In that case, there is a relationship between style as a way of communication and style as an indication of group membership (Weilenmann and Larsson, 2000). This gives rise to the idea of text message sending, receiving, filtering and sharing as an expressive communication activity used to display style and social capital[3]. Because text

[3] Anecdotal evidence worth mentioning may be that during a study of mobile payments, we discovered that some users sent almost 100 text messages a day to the free balance request

messaging is asynchronous, discrete and stored (at least for a while), this particular use of the mobile is better suited as a style and social identity marker among experienced users than regular calls. These explanations all support the importance of including subjective norms and its social pressure determinants of external and interpersonal influence as important adoption determinant of text messaging services.

The explanation of mobile service usage as "*ritual gift giving*" applies particularly to the explanation of text messaging services (Taylor and Harper, 2001a,b; Johnsen, 2001). For example, Kaseniemi and Rautiainen (2002) observed three additional uses of text messaging besides regular peer-to-peer messaging; message collection, chain messaging and collective reading. Most other studies of teenage text messaging use have reported similar behaviors (Ling and Yttri, 2002, Larsson, 2000). Taylor and Harper (2001a,b) gives references to alternative explanations of gift-giving behavior that fits the observed use of text messaging, such as ritual explanations rooted in primitive elements of our culture, but also sociological, social psychological and economic explanations of gift-giving have been suggested. Based upon this theory, text messaging may be adopted for social influence reasons (pressure to participate in the ritual gift-giving), or it may be explained instrumentally (in which text messaging based gift-giving practices are adopted for utilitarian reasons). In adoption research, the first explanations will be represented by subjective norms while the second will be represented by a reinterpretation of what is considered useful in a service (usefulness).

---

service even though no use of the payment service was observed. One may hypothesize that the service was used to show heavy incoming and outgoing text messaging activity only.

Ling and Yttri (2002) have suggested that text message adoption among teens may be explained by a theory of *social learning and development* (and emancipation) because text messaging are particularly well suited for exchanging ideas on issues focused in teenagers social learning (e.g. exploration of sexuality, social interaction). For example, many of the chain messages identified by Kaseniemi and Rautiainen (2002) were of sexual content and were used to explore the limits of appropriate content in messages. It is believed that exploring the limits of what is considered appropriate behavior is part of adolescent learning, and thus a widespread adoption is observed for social learning reasons.

Another suggestion is that the asynchronous form of messaging is particularly well suited for initiating and exploring new relationships (Ling and Yttri, 2002, p. 160). For example, Ling and Yttri (2002) mention several situations in which text messaging is preferred to voice because it is used as an awareness or initiating service similar to what Nardi et al. (2000) report for instant messaging services. Thus, a *social network explanation* is introduced in which the difference between teenagers and other users is explained by the social networks of teenagers being more dynamic.

In addition to these, mainly social explanations of messaging service adoption and use among young users, there have also been some domestication studies following the line of reasoning from functionally oriented, work/leisure context studies. For example, Grinter and Eldridge (2001) studied the adoption of text messaging among teenagers and found that text messaging were preferred to other media because it was considered quicker, cheaper, easier and more convenient to use. Thus*, instrumental or utilitarian* explanations of the adoption of these services are relevant also for younger users.

For some time, domestication researchers have studied - and expressed opinions on - how society is affected by technology that brings the public into the private sphere. This question was first raised by researchers studying the domestication of fixed telephony (see Fisher, 1988). However, researchers studying the adoption of mobile end-user services now investigate how society is affected by the fact that an instrument for managing personal relations and networks - the mobile phone - can be used ubiquitously. Answers to this question may be given both at the micro level by studying individuals' use of mobile services in public places such as restaurants (e.g. Ling, 1997), or at the macro level by studying more fundamental changes in society (Townsend, 2000). At the micro level, these studies also suggest a situational explanation of text message adoption. Because mobile phone use is considered inappropriate in many public places, text messaging is a means to maintain ones social network at the "back stage" (Ling and Yttri, 2002). Thus, a situation element not often considered in adoption research (but often used in media choice explanations) is introduced.

The most recent trend in domestication research on mobile service adoption treats contexts as dynamic and end-users as "negotiating and managing their numerous identities and relationships" in a "role-to-role" society (Green et al., 2001, p. 150; Wellman, 2001). Applying this perspective, Palen et al. (2001) found that the "mobility of ones profession", the "number of roles one assumes professionally and personally" and the "degree of integration one has across those roles" influences mobile service adoption (Palen et al., 2001, p. 116). This issue of role management has been given little attention in previous research on ICT-adoption, but should somehow also be integrated into a comprehensive model of mobile service adoption.

2.5 Model and propositions

This section introduces an adoption model previously developed for explaining the adoption of mobile services (Pedersen, 2001). The arguments for extending the model from the parsimony TAM model into a TPB model when explaining the adoption of mobile services is briefly presented. For an elaboration of these arguments, we refer to Pedersen (2001). We then turn to the discussion of how this general model should be modified and extended based upon the findings reviewed above when applied to the adoption of text messaging services among young users.

The model represents a modification and extension of the theory of planned behavior. In figure 2.1, the modified TPB-model is illustrated. We use this illustration as a basis for the discussion of how the general TPB-model is extended and modified.

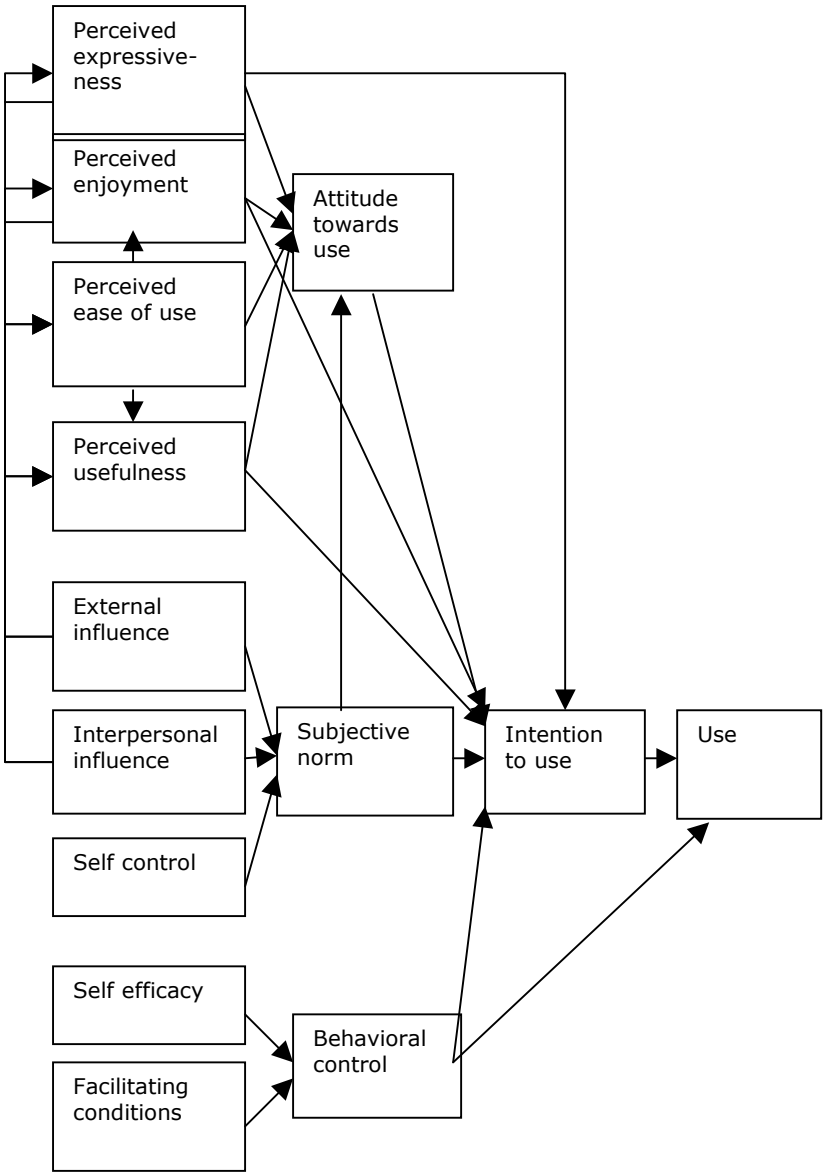

Figure 2.1 Proposed model of text messaging service adoption

In the model, perceived usefulness is defined as "*the degree to which a person believes that using a particular system would enhance his or her job performance*" (Davis, 1989, p. 320). User friendliness is defined as "*the degree to which a person believes that using a particular system would be free of effort*" (Davis, 1989, p. 320). Attitude towards using the system is defined as "*the degree of evaluative affect that an individual associate with using the target system in his job*" (Davis et al., 1989, p. 476). Later, these concepts have

been given a general interpretation also relevant outside job-related contexts of ICT use (Doll et al., 1998).

The role of subjective norm in TPB when compared to TAM has been somewhat unclear, but research reviewed in CMC-research above and recent adoption studies support extensions of TAM with subjective norms (e.g. Venkatesh and Davis, 2000). Subjective norm is defined as the "*perceptions that significant referents desire the individual to perform or not perform a behavior*" (Taylor and Todd, 1995, p. 149). In our model subjective norm is composed of external and interpersonal influence (Karahanna et al. 1999; Battacherjee, 2000). External influence refers to "*mass media reports, expert opinions, and other nonpersonal information considered by adopters*" and interpersonal influence refers to "*influence by friends, colleagues, superiors and other prior adopters known to the potential adopters*" (Battacherjee, 2000, p. 413). These definitions are consistent with Karahanna et al.'s (1999) informational and normative forms of social influence.

The inclusion of behavior control in the TPB-model represents a valuable addition to the explanatory power of TPB when compared to TAM (Mathieson, 1991; Taylor and Todd, 1995). Behavioral control, defined as "*perceptions of internal and external constraints on behavior*" (Taylor and Todd, 1995, p. 149) encompasses two components. The first component is "facilitating conditions" representing the resources required to use a specific system. Examples of such resources are time, financial resources and other ICT-related resources. The second component is self-efficacy; that is "*an individual's self-confidence in his/her ability to perform a behavior*" (Taylor and Todd, 1995, p. 150).

In a choice of models, parsimony is also important. While the decomposed TPB adds complexity when compared to TAM, several studies have shown that the increased complexity of the TPB-model may be a small price to pay for its

added explanatory power. From the perspective of explaining mobile service adoption, the inclusion of subjective norm and behavioral control in the theory of planned behavior seems essential (Pedersen, 2001).

When applying the TPB-based adoption model of figure 2.1 to study the adoption of text messaging services among young people, findings from the research directions reviewed above suggest modifications, extensions and also provide a basis for suggesting explicit hypotheses on the relevance of each model concept. Two issues are of relevance with respect to *ease of use* in the model; the higher competence of younger users and their more exploratory and advanced use of service functionality. Several studies report that young users acquire "digital capital" (Skog, 2002) from their use of mobile services. For example, it is not uncommon to see citations in qualitative studies of mobile service use that indicate that the younger users of the family have taught their parents how to use their phones, PC's, or services on these platforms. Thus, younger users may be more skilled and experienced technology users and thus, ease of use may not be as important for these users as for other users. However, studies also report a more playful use of mobile phones among younger users and clearly they are more focused on exploring the functionality of a service. For example, the practice of personalizing the phone or service is typical among young users (Oksman and Rautiainen, 2001). This also indicates that younger users may perceive ease of use differently. For example, if personalization, filtering and adjustment of initial settings are not offered by an application or service, its user friendliness may be perceived as low. Studies have also indicated a relationship between digital capital and symbolic capital suggesting that services designed for young users should not be too easy to use (Taylor and Harper, 2001b) because then, no status would stem from being able to handle the device, application or service. These findings indicate that even though ease of use in general is believed to be of little importance to mobile

services (Ling, 2001), it may be even less important to young users. However, their perceptions of what is user friendly may be different from those of other users and may originate from traditional ease of use (as opposed to complexity), trialability, adaptability or personalization, and transferability, determinants of which have also been suggested in diffusion research (Rogers, 1995). Opposing these findings is a qualitative domestication study by Grinter and Eldridge (2001) of 10 teenagers' text messaging use. They found that despite their apparent skillfulness, the teenagers often misinterpret and misunderstand the content of text messages. Thus, while the functionality of the service is easily managed, young users indirectly create a level of sophistication in service use that raises new barriers to adoption.

Perceived *usefulness* was originally seen as a fairly simple concept including components such as effectiveness and efficiency that are mainly related to extrinsic motivation in work contexts. Later, researchers have included elements of intrinsic motivation in the definition of both ease of use and usefulness (e.g. Thompson, Lim and Lai, 1999). However, intrinsic motivation has been mainly associated with ease of use and extrinsic motivations with usefulness. As seen from uses and gratifications studies, the extrinsic motivations of mobile services are not limited to effectiveness and efficiency. Motivations of accessibility, flexibility, sociability and security have all been mentioned in these studies. These motivations are not limited to mobile services, but are typical of communication (as opposed to information) services. In addition, motivations of enjoyment, fashion, and status and expressiveness have been mentioned. Some of these motivations are intrinsic, but other may perhaps best be described as derived. In figure 2.2, the relationships between traditional intrinsic and extrinsic motivations and these derived motivations have been illustrated.

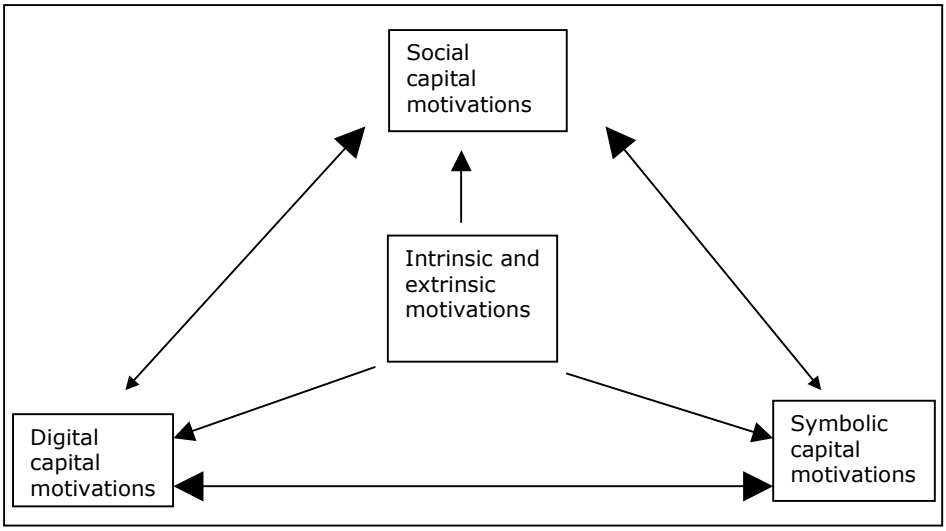

Figure 2.2 Intrinsic, extrinsic and derived motivations

In figure 2.2, traditional extrinsic and intrinsic motivations not directly related to ease of use, are shown as well as some of the derived motivations mentioned in uses and gratifications and domestication research. These motivations are organized by the capital they contribute to (Skog, 2002). The interactions between these motivations are also illustrated with the size of the arrows illustrating the hypothesized strength of an interaction. For example, intrinsic motivations of enjoyment lead to skills which provide the user with digital capital, which in some social networks gives access to both symbolic and social capital. Thus, the traditional usefulness concept should be modified and extended when trying to explain the adoption of mobile services among young users. First, traditional usefulness, such as efficiency and effectiveness may be less important to young users. Thus, one is lead to the hypothesis that traditional extrinsic motivations are less important. However, extrinsic motivations derived from uses and gratifications research should be included in the usefulness concept. Thus, effectiveness and efficiency should be related to availability, flexibility and security, but these concepts may be interpreted as determinants of usefulness of a communication service or as components of usefulness. We find that by redefining and modifying the usefulness concept,

these conceptions of usefulness may be included. This is made possible if redefining the traditional operations of usefulness. Thus, we find no need to replace the usefulness concept with more specific instrumental components to cover the differences in extrinsic motivations of mobile and traditional services. However, studies also suggest the usefulness concept should be extended and supplemented to cover the issues of intrinsic and derived motivations discussed above. For example, *enjoyment and entertainment* go beyond ease of use and is perceived as instrumental of services primarily designed for entertainment (mobile games, mobile video and audio streaming, chat and flirt services) (Leung and Wei, 1998, 2000). The instrumentality of these services is enjoyment and entertainment in itself, not the efficiency or effectiveness of being able to access mobile entertainment services ubiquitously. This indicates that enjoyment should be included in an adoption model developed for young users of mobile services as a separate concept contributing both to perceptions of usefulness, ease of use and attitudes towards use.

To get access to symbolic and social capital by using a service, a requirement is that it has some element of *expressiveness*. It should be possible to express style (in all Ling's (2001b) conceptions of style) using the service. In addition, text messaging services are communication services primarily, and thus the extrinsic motivations for using the service is communication related. In addition, however, the requirements of expressiveness suggested by domestication research also include using the communication service to communicate at several levels, to demonstrate participation in several networks maintaining different roles, and to share and collect prior communication sessions. These are all expressive elements of communication that originate in the derived motivations discussed above. In CMC-research, expressiveness is compared to instrumentality as two styles of communication (Boneva, et al. 2001). Expressiveness is used of communication in relationships of emotional

intimacy and sharing, while instrumentality is used of communication in relationships based on common activities. For example, Boneva et al. (2001) believes female communication to be more expressive, while male communication is believed to be more instrumental. Based on these assumptions, services that communicate expressiveness in this form are more likely to be appreciated by female users. Thus, expressiveness is an instrumental attribute of a communication service partly influencing usefulness and partly influencing attitudes directly. The term expressiveness has also been used in other traditions, such as personality research and consumer psychology. We discuss some of the conceptions of expressiveness in these traditions in section 3.

Attitudes are generally believed to be the results of personal and social influences. However, in TAM, attitudes towards use are determined by instrumental determinants only. When including subjective norm in the model, it is possible to create a relationship between norms and attitudes that may be particularly relevant to young users' adoption of mobile services. However, it is also important to conceptually discriminate norms and attitudes in adoption models. Thus, we suggest accepting an influence of subjective norm on attitudes, but rejects including influences of external and interpersonal influence on attitudes directly. We also suggest extending the determinants of attitudes towards use from purely instrumental determinants to more derived determinants such as enjoyment and expressiveness. However, the attitude formation process is believed to be similar for usefulness, ease of use, enjoyment and expressiveness in that the individual sees a service as instrumental in fulfilling intrinsic, extrinsic and derived gratifications, and consequently develops a positive attitude towards using it.

Above, we have discussed one of the two aspects of *external influence*; the symbolic capital derived from style in all its conceptions. The other aspect is that of external influence on the development of subjective norms. The first aspect of external influence is how a user of mobile services uses these services to more or less consciously express style and get access to symbolic capital. The second aspect is how external influence represents an external pressure on the user to develop a specific norm and consequently, show a specific behavior. The two aspects have also been characterized as the "reciprocal influences" of mobile phones by Alexander (2000). External influence also represents an important determinant of expectations, and may influence perceptions of instrumentality as well. However, as technology gets domesticated, expectations are replaced by the generalization of experiences, and for explaining the adoption and use of text messaging services, expectations are believed to be less important. However, the second aspect of external influence, the determination of subjective norm, is believed to be particularly important to young users (Leung and Wei, 1999; Ling, 2001b). Young users may be more affected by external influence because their subjective norms are developing and changing, they may be more exposed to the sources of external influence, such as general mass media, and they are more directly approached by advertising of a persuasive approach by terminal vendors and operators (Townsend, 2000).

Interpersonal influence has been suggested as important in explaining the adoption of communication technologies in CMC-studies and the adoption of mobile and messaging services in domestication research. However, there are issues of instrumentality that must be separated from issues of social influence in communication services. We have discussed issues of instrumentality related to the management of and access to social networks, and related to symbolic capital above. Interpersonal influence is the influence of others in developing

norms that the use of a particular service is expected. In principle, it is unrelated to instrumentality. Almost all explanations in domestication research introduced above include elements of interpersonal influence. For example, the suggestion that young users are more subject to social influence because they are at a stage of social development and learning (Ling and Yttri, 2002), the suggestion that young users' social networks are more dynamic and thus exposed to influence than other users' (Oksman and Raitiainen, 2001), or the interaction between symbolic and social capital that makes instrumental motivations and social influence interrelated for communication services. Consequently, interpersonal influence is assumed to be more important when explaining the adoption of messaging services and the adoption of services by young users in general.

Both external and interpersonal sources of information influence the *expectations* that users have of a technology or service. In figure 2.1, these influences are implemented by the links from both external and interpersonal influences to all instrumental determinants of attitudes towards use. These should be interpreted as expectation influences, but in prior studies applying a similar mode, only relationships between external influence and instrumental determinants of attitudes have been found significant (Pedersen, 2001).

Studies in domestication research have also focused on the importance of individuality and the relationship between individuality and social pressure as both a determinant and consequence of mobile service use (Fortunati, 1998; Skog, 2002). Thus, determinants of individuality and resistance to social pressure should be included as components or moderators of subjective norm. We suggest including the concept of *self-control* as an extension of the self efficacy concept of TPB and as an additional determinant of subjective norm. While self efficacy (related to adoption) is an individual's self-confidence in

that adoption will lead to the desired behavior (Bandura, 1982), self-control is often believed to include self efficacy, but also go beyond it (Rosenbaum, 1980). For example, self-control is related to time dependence when an individual chooses not to consume something today because the utility is believed to be higher from consuming the good at a later point in time. In a study of mobile commerce service adoption (Pedersen, forthcoming), self-control was found a very important determinant of subjective norm, improving the explained variance in subjective norm from 38 to 45%. In addition, elements of self-control and individuality are included in many qualitative studies as particularly important when understanding mobile service use among young users. For example, Oksman and Rautiainen (2001) have shown how the mobile is used by parents as an instrument in the emancipation process of adolescent users. Simultaneously, it is used as a symbol of increasing individuality and self-control by young users. Thus, self control is believed to be an important component or moderator of subjective norm, and its influence is likely to vary with the age of the user.

Subjective norms are the norms developed through external and interpersonal influence. In general, Webster and Trevino (1995) suggest social influences, and thus, subjective norms to be more influential in explaining the adoption and use of new media. The question, however, is whether text messaging should be considered new media among young users. As indicated above, almost all teenagers in Norway have adopted text messaging, and some of the users now have more than 3 years of experience. Consequently, even though social motivations for adoption may be important, these motivations may by now be more instrumental than norm based, and should be identified through instrumental determinants of attitude toward use rather than through subjective norm. To give an example, young users may find text messaging instrumental in social coordination because all other members of their social network uses it,

but still feel little social pressure towards using text messaging services as a norm.

As indicated above, *self efficacy* in this context is the individual's confidence in that adoption of a service will lead to the desired behavior (Bandura, 1982). The determinants of self-efficacy are typically found in attributes of the individual adopter, such as experience, skills and education. Even though it is considerable variance in young users' skills and experience in using mobile services (Oksman and Rautiainen, 2001; Grinter and Eldridge, 2001), these users are generally believed to be among the more experienced and skillful users of these services (Ling, 2001c; Skog, 2002). For example, Oksman and Rautiainen (2001) found that adolescents found mobile phones to be a more controllable technology than PC's. Thus, one may expect that self efficacy in general will be higher among young users than among other users in general, and thus, of less importance as a determinant of adoption.

A variety of *conditions may facilitate* or inhibit the use of mobile services. In general, lack of facilitation is believed to reduce the perceived behavioral control of a service or technology. Examples of such conditions are price, service and terminal availability, support, roaming and interconnect, security issues and service compatibility. In general, these conditions are controlled by the facilitators (operators, service providers) and individual users (through their resources). Recent developments of services particularly for the young segment, and the widespread use of prepaid service plans particularly designed for young users suggest the facilitating conditions controlled by facilitators are perceived as good. In addition, the social networks of young users function as support networks trough the interaction mechanisms of digital, symbolic and social capital discussed above. On the other hand, young users in general have limited financial resources. However, prior studies (Grinter and Eldridge, 2001)

have shown that when compared to voice services, text messaging services were believed to be cost efficient services. Still, other studies (e.g. Karlsen et al., 2001) have shown a cost consciousness among young users that obviously makes facilitating conditions of importance to young users. In particular, Carroll et al. (2002) mentioned the issue of hidden costs that appear after users' appropriation as a particularly important determinant of what they call disappropriation - that the users stop using a service after an initial adoption.

The inclusion of *behavioral control* in TPB has been an important contributor to its explanatory power. In general, we have argued that the determinants of behavioral control are believed to be less important to young users than other users because of their experience and skill in using text messaging services and the facilitation of services supporting regular text messaging use offered by operators and service providers to the young user segment. Financial resources and pricing, however, is indirectly believed to be an important determinant of behavioral control due to both limited resources among young users and recent findings that these users are more price sensitive than previously assumed (Karlsen et al., 2001). However, their perception of text messaging as cost efficient services makes their perceptions of behavioral control of these services less important as a determinant of adoption than of voice services. Thus, behavioral control is believed to be of less influence to young users' adoption of text messaging than to their adoption of other services or to the adoption of services in general among other users.

Implicit in our presentation of the model and its concepts and relationships, we have suggested several hypotheses. In this report, however, no hypotheses have been explicitly formulated. The main propositions we make are: First, that adoption models provide a valuable basis for going from the description of the adoption of mobile services towards explaining it. Second, that traditional

adoption models need modifications and extensions when being applied to the adoption of mobile services. In the following, an empirical study is reported in which we investigate these propositions when applying the model to explain the adoption of text messaging services among young users.

3. METHODOLOGY

Four purposes should be mentioned of this study. One is to review the literature on adoption of mobile services and to propose an adoption model. A second is to develop measures of the model that are reliable and valid. A third is to test the adoption model proposed, and a fourth is to compare the results of the adoption model when applied to young users' adoption of text messages with previous adoption studies conducted on mobile services (Pedersen, 2001; Pedersen, forthcoming). Thus, a survey was conducted among young text messaging users. We present the design, sample and measures used in the survey here.

3.1 Design, procedure and sample characteristics

A simple one-group posttest design was applied in which respondents were recruited from three upper secondary schools in the Agder region. The three schools were "Tyholmen videregående skole" in Arendal, "Dahlske videregående skole" in Grimstad and "Flekkefjord videregående skole". Table 3.1 shows the number of citizens in the three local regions, the number of students at each school and our sample size for each region.

Table 3.1 Sample by region

Region	Population	School population	Sample size
Arendal	39547	513	363
Grimstad	18052	350	231
Flekkefjord	8866	194	64
Total	66465	1057	658

From table 3.1, we find that the overall response rate was 62.3%, with the lowest response in Flekkefjord.

The survey was administered by school contacts (typically the principal's secretary). The school contacts had a direct dialogue with individual teachers, and the survey was distributed during a social science-oriented class. In Flekkefjord we were not allowed to distribute the survey during class, and consequently, a lower response rate was obtained. The students answered the survey questionnaire individually and returned their answers using briefcases put up in school traffic areas. To motivate subjects for participating, gift certificate drawings were used at all schools. All data were anonymous, and answers were checked for careless response.

The generally high response rate of the survey indicates that there are few systematic differences between respondents and non-respondents in the survey. The demographic characteristics of the sample are shown in table 3.2.

Table 3.2 Demographic characteristics of the sample (in % of total)

Age (N=653)		Sex (N=654)	
< 16	0.5	Male	44.3
16	21.4	Female	55.7
17	29.6		
18	33.8		
19	12.1		
> 19	2.6		

Naturally, subjects between the age of 16 and 19 represent most of the sample. There is little difference in the distribution of age across the three schools. A somewhat larger proportion of female than male subjects responded, a difference that is consistent across all schools. Because we do not have population data on age and gender at the three schools, we can not tell whether there are systematic differences in age and gender distribution of sample and population. However, when compared to age and gender statistics from

comparable upper secondary schools in general, the sample seems representative of upper secondary school students.

3.2 Measures

In the questionnaire, subjects were first asked about their use and intentions to use specific services. Then, the "stimulus material" was introduced with the following text: "*We now want you to focus on text messaging services that in different ways are used to keep or get in contact with others. Examples of such services are sending text messages to friends and family, chat services and flirt services. Using SMS to receive logos and ring tones is not relevant here*". This statement represents the stimulus used to introduce the service context to subjects. Thus, the interpretation of all measures should be made within this context.

The model in section 2.5 includes 14 concepts: Ease of use, usefulness, expressiveness, enjoyment, attitudes towards use, external influence, interpersonal influence, subjective norm, self-control, self-efficacy, facilitating conditions, behavioral control, intention to use and actual use. Most of these concepts are well founded in adoption, uses and gratification, or domestication research literature reviewed in section 2. Consequently, the construct validity of these concepts is in general considered acceptable. Newer concepts, such as enjoyment, self-control and expressiveness have been given particular attention in section 2, and will also be given particular attention in the validity discussion below, and in section 5.

To measure the concepts, a questionnaire was designed containing multiple measures of each of the 14 concepts. In the questionnaire, the concepts were measured by the subjects indicating their agreement with a set of statements using a seven-point scale ranging from "strongly disagree" to "strongly agree".

Some concepts were measured using seven-point scales of bipolar adjectives. The questionnaire is found in appendix A. The measures of the traditional TAM part of the model are shown in table 3.3.

Table 3.3 Measures of the traditional TAM part of the model

User friendliness	Usefulness	Attitude towards use
Learning to use text messaging services is easy to me	Using text messaging services make me save time when staying in contact with friends and family	Good/bad
It is easy to make the text messaging services do what I want them to	Text messaging services make me more social and available	Wise/foolish
My interaction with text messaging services is clear and understandable	Text messaging services make me a person it is easier to stay in contact with	Favorable/ unfavorable
I find it easy to understand and interpret text messages	Text messaging services are useful to me when staying in contact with friends and family	Beneficial/harmful
I find it easy to use text messaging services	Text messaging services make my contact with others better	Positive/negative
α=0.87	α=0.87	α=0.87

Table 3.3 also shows Cronbach's α for all the measures of the traditional TAM part of the model. Ease of use was measured using five items developed from adapting the original items of Davis et al. (1989) to our setting. Similar operations are found also in Taylor and Todd (1995) and in Battacherjee (2000). Usefulness was measured using five items indicating the original dimensions of time saving, improvement, efficiency, usefulness and quality suggested by Davis (1989). Because the setting of text messaging services is an everyday life situation, the original items of Davis had to be converted into more "everyday life" terms and adapted to the context of "staying in contact

with others" as the main instrumentality of the service. Finally, attitude towards use was measured using five bipolar adjectives indicating different aspects of the subjects' attitude towards use. The items were very similar to those used by Davis (1989), Taylor and Todd (1995) and Battacherjee (2000).

The measures of the extended TAM are shown in table 3.4.

Table 3.4 Measures of the extended TAM

Enjoyment	Expressiveness
I find using text messaging services entertaining	Text messaging services is something I often talk with others about or use together with others
I find using text messaging services pleasant	Text messaging services is something I often show to other people
Using text messaging services is exciting	I express my personality by using text messaging services
It's fun to use text messaging services	Using text messaging services gives me status
α=0.93	α=0.74

The enjoyment concept of this study was defined as incorporating a group of gratifications identified in studies of the Internet as "enjoyment" (Pappacharissi and Rubin, 2000), of ICQ as "entertainment" (Leung, 2001), of mobile phones as "relaxation" (Leung and Wei, 2000), of pagers as "fun-seeking" (Leung and Wei, 1999b), and of text messaging as "nutz-spaz" (Höfflich and Rössler, 2001). To cover these elements of enjoyment, a four item scale was developed collecting items from uses and gratification scales. The first of the item covers the "entertainment" conception, the second the "relaxation" conception, the third item covers the "excitement" conception also found in studies of video-game and TV-gratifications (Sherry et al., 2001), and the last is a general item covering the "fun-seeking" gratification. The wording of each item is taken from uses and gratifications studies reviewed above.

The need to include expressive use of mobile services is obvious in our review of both uses and gratifications and domestication research above. However, the choice of a particular concept - "expressiveness" - as a perceived attribute of a service or technology is unique in our model. The term has been used in social psychology of individuals' general ability to express their emotions or identity. For example, in family relationship studies it is used as a measure of how well emotions are expressed by parents and children and how this influences family relationships (Cassidy et al., 1992). In research on identity formation and personality, it is used as a measure of the relationship between what a person believes about herself (what her potentialities are, see Schwartz et al., 2000, p. 507), and how she express herself, using the concept of "personality expressiveness" (Waterman, 1993). In this line of research, a person expresses herself through activities, and expressiveness is measured by subjects indicating how important these activities are in expressing their identity. In consumer research, the expressiveness concept has been extended from individuals to products indicating how well a product express values beyond instrumental utility (Mittal, 1994). Thus, value-expressive products are seen as expressing the consumer's identity. While the expressiveness concept in consumer research covers gratifications of prestige, fashion, pride and mood stimulation, it primarily focuses issues of how products are used to "express my personality" and are "compatible with how I like to think of myself" (Mittal, 1994, p. 258). Thus, items measuring these conceptions of expressiveness have been included. In addition, expressive gratifications have been identified in uses and gratifications research. For example, Arnett (1995) included "identity formation" as a particular gratification of young users, Leung (2001) included "express affection", "fashion" and "inclusion" as gratifications of ICQ-use, and Leung and Wei (1999b, 2000) included "fashion and status" as a gratification of both pager and mobile phone use. From these studies, the status item of table

3.4 is included. Studies of text messaging use has shown how one of the most important ways of expressing ones service use is to discuss the service with others and to share it with others (Larsson, 2000; Grinter and Eldridge, 2001; Kaseniemi and Rautiainen, 2002). Thus, items referring to this particular form of expressiveness are included. Similar items, measuring the gratification of sharing technology use with others - social interaction, have been included in studies of video games as well (Sherry et al., 2001) and TV (Lee and Lee, 1995).

The measures of the subjective norm part of the model are shown in table 3.5.

Table 3.5 Measures of the subjective norm part of the model

External influence	Interpersonal influence
Media is full of reports, articles and news suggesting using text messaging services is a good idea	Almost all of my friends use text messaging services
Media and advertising consistently recommend using text messaging services	In the family and at work everybody think using text messaging services is a good idea
(*) At school it is advisable to use text messaging services	My friends think that we should all use text messaging services
	My friends recommended I should try out new text messaging services or use them in new ways
α=0.63	α=0.73
Self-control	Subjective norm
Generally, I want to do what my friends think I should do	People important to me think I should use text messaging services
Generally, I want to do what my family and my teachers think I should do	It is expected that people like me use text messaging services
(*) My friends/colleagues and I use the same kinds of text messaging services	People I look up to expect me to use text messaging services
α=0.90	α=0.80

(*) Item used in instrument but excluded in reliability measure and final analysis

The measure of external influence was based on three sources of influence - media, society and profession (school). Thus it includes, integrates and extends the measures used by Battacherjee (2000) and Taylor and Todd (1995). The measure of interpersonal influence was based on Battacherjee's (2000) extension of the measures used by Taylor and Todd (1995), and adapted to our setting. As argued in section 2.5, self-control is believed to be a component of or moderator of subjective norm. Self-control was measured by items reflecting indirect indicators of self-control, such as resisting group pressure, superior influence and group conformity. The items were mainly based upon a subsection of the self-control measure suggested by Rosenbaum (1980). The measure does not capture the whole range of the self-control components as defined by Rosenbaum (1980), but includes some items from these more complex self-control scales. Subjective norm was measured using two items almost identical to the items used by Mathieson (1991) and Battacherjee (2000). A somewhat simpler version of the measure was used by Venkatesh and Davis (2000). In addition, a general norm item was designed inspired by sociological research on mobile service use (Skog, 2002).

The measures of the behavioral control part of the model are shown in table 3.6. The measure of self-efficacy is based on the items used by Battacherjee (2000) and Taylor and Todd (1995), but adapted to our context. The measure also corresponds well to the extended *user* resources part of the "resources" scale of Mathieson et al. (2001).

Table 3.6 Measures of the behavioral control part of the model

Self efficacy	Facilitating conditions	Behavioral control
I am able to use text messaging services without the help of others	(*) I am given the necessary support and assistance to use text messaging services	I feel free to use the kind of text messaging services I like to
I have the necessary time to make text messaging services useful to me	I have the financial resources required to use text messaging services	Using text messaging services is entirely within my control
I have the knowledge and skills required to use text messaging services	I have access to the necessary technology required to use text messaging services	I have the necessary means and resources to use text messaging services
I am able to use text messaging services reasonably well on my own	The text messaging services I use are stable and support other means of staying in contact with friends and family	
	My service provider/operator facilitates the use of text messaging services	
	There are no compatibility problems related to the text messaging services and other services I use to stay in contact with friends and family	
α=0.79	α=0.75	α=0.66

(*) Item used in instrument but excluded in reliability measure and final analysis

To test the discriminant validity of self-control and self-efficacy measures, a principal components analysis of the items is shown in table 3.7.

Table 3.7 Principal components analysis of the self-control and self-efficacy items (loadings below 0.30 not shown)

Component	Self-cont. 1	Self-cont. 2	Self-eff. 1	Self-eff. 2	Self-eff. 3	Self-eff. 4
1			0.69	0.74	0.87	0.85
2	0.91	0.92				

The principal components analysis extracted two factors with eigenvalues greater than 1. Cumulative explained variance of these two factors was 70.0%. The factors correspond well to the items intended to measure the original self-efficacy measure of the decomposed TPB-model and the new measure of self-control suggested as a moderator of subjective norm in our model.

The measure of facilitating conditions is based on the same sources as the self efficacy measure. It also extends these measures with specific items related to the infrastructure of mobile services and the facilitation of service usage by the user's provider or operator. The measure of behavioral control is almost identical to the measure applied by Battacherjee (2000) and Taylor and Todd (1995). The reliabilities of the measures are indicated in table 3.6.

Finally, intention to use and actual use was measured by presenting 22 text messaging services organized by user context and complexity to the subjects. The subjects were asked to indicate how much they had used and intended to use these services on a 7-point scale form "very little or not at all" to "very much". Use and intention to use were aggregated over the 22 items. The measure of actual use had a reliability of α=0.82 and intention to use had a reliability of α=0.85. To comply more fully with the measures of adoption research, intention to use was also measured with a three item scale adapted from Battacherjee (2000) and Mathieson (1991). This measure had a reliability of α=0.79. Actual use was also measured in more traditional ways, and a psychometric measure consisting of three items similar to that used in several

adoption research studies had a reliability of α=0.91. In addition, actual use was measured as the number of text messages sent pr. day and the amount of money spent on voice and text messaging services pr. month. The correlation between the psychometric measure and the measure of the number of text messages sent is r=0.62.

All our traditional measures are based upon previously validated measures (Venkatesh and Morris, 2000), and their reliabilities are considered acceptable. There are two measures with a reliability coefficient α below the recommended 0.7 - external influence at 0.63 and behavioral control at 0.66. The consequences of a possible low reliability of these measures are discussed in sections 4 and 5. All new measures not traditionally used in adoption research have been validated conceptually, and they have shown very good reliabilities.

In addition to the measures of the model, we measured innovativeness, gender, age and subscription plan. Innovativeness was measured adapting Goldsmith and Hofacker's (1991) product innovativeness scale to our setting of mobile services. Goldsmith (2001) has also applied this innovativeness scale to Internet users as a measure used to identify innovators, majority users and laggards. We applied exactly the same items as those used by Goldsmith except from replacing the term "Internet" in Goldsmith's items with the term "mobile services". The measure had a reliability of α=0.91. The measure has also been used by Agarwal and Prasad (1998) studying the innovativeness of Internet users. When compared to a previous study on mobile commerce services among early adopters, our subjects had a mean innovativeness of 10.5 and a standard deviation of 6.0 as compared to the mean innovativeness of 33.0 and a standard deviation of 8.4 of the early adopters. This indicates that we have not systematically recruited innovative or early adopter users. Age and gender were simply measured by the subjects indicating their age in years and their sex. The

questionnaire was pre-tested using 12 early undergraduate student subjects of Agder University College.

4. RESULTS

In this section, we present the results of the study. The section is organized in three sub-sections. First, we present some of the descriptive results from the study, such as demographics, service usage and usage intentions. We then turn to the testing of the proposed model in section 2. Finally, we investigate different versions of the model organized by gender and innovativeness.

4.1 Descriptive results

For demographic characterization of our sample, we refer to section 3. Of the descriptive results of our study, two issues are of interest; the absolute levels and differences in gender and age in the variables of the model in section 2, and the results for actual use of services and user intentions. The means and standard deviations of the variables in our model are shown in table 4.1.

The means of table 4.1 should not be interpreted as relative levels that may be compared across variables. However, the absolute level of the means and their corresponding standard deviation may be given a preliminary interpretation. For example, ease of use generally seems to be high and the attitudes towards use of these services seem to be positive.

Table 4.1. Descriptive statistics for the variables

Variable (*)	Mean	St.dev.	Sex	Age
Ease of use	5.81	1.05	**-	*-
Usefulness	4.51	1.49	**-	*-
Enjoyment	4.02	1.63	**-	
Expressiveness	2.43	1.13	**-	**-
Attitude towards use	4.97	1.25		*-
External influence	3.78	1.45		
Interpersonal influence	3.72	1.23		**-
Self-control	5.28	1.39	**-	*+
Subjective norm	3.42	1.65		
Self-efficacy	5.77	1.19		
Facilitating conditions	4.82	1.23		
Behavioral control	3.85	0.85		
Intention to use	4.28	1.57	**-	
Actual use	3.07	1.64	**-	

(*) All scales are transformed to the original 7-point scale. The self-control scale has been reversed. For sex and age, * and ** means there are significant relationships between the variables and gender or age at the 0.05 and 0.01 levels of significance, respectively. For sex, -signs means larger values among female users, while for age, -signs mean negative relationship with age. The + signs represent the opposite.

The perception of ease of use is confirmed by the high level of self efficacy. In addition, the facilitating conditions indicate that these users perceive text messaging services as well facilitated. Somewhat surprising is the low level of expressiveness associated with these services. However, this level can not be interpreted as a low influence of this variable because it is the relationship between this variable and intention to use that is relevant, not its absolute level.

More interesting though is that table 4.1 also shows that there are significant differences in the variables for male and female users and that there are significant relationships between the variables and age. Thus, female users perceive text messaging services as significantly more easy to use, useful, enjoyable and expressive. Consequently, they both use and intend to use these services more than male users. Somewhat more surprising is the higher level of

self-control of female users. However, this finding is less relevant because we primarily treat self-control as a moderating component of subjective norm. There are also significant relationships between age and ease of use, usefulness, expressiveness, attitude, interpersonal influence and self control. Generally, the relationship is negative so that older users perceive text messaging as less easy to use, useful and less expressive. In addition they are more negative towards these services. Finally, they are less influenced interpersonally and have more self-control.

The second category of descriptive results is service use and intentions to use services among the respondents. In table 4.2, the results of our analysis of actual use and intentions to use particular services are shown. The table shows the mean evaluations of actual use and intentions to use each of the 22 investigated mobile services.

From table 4.2 we see that actual use and intention to use are fairly similar for each service. The services most in "demand" are ordinary text messaging, message sharing, phone number services, animated messages, and the new MMS-services. However, it is not clear if respondents have understood the contents of the MMS-service because at the time of the survey, this service was not generally available.

Table 4.2 Actual use and intention to use mobile services

Variable (***)	Actual use	Intention	Sex
Send ordinary message to friends or family	4.94 (-)	4.77 (**)	**-
Send animated message to friends or family	2.19 (+)	2.23 (*)	**-
Send message to a group of friends or family	1.92	1.95	**-
Send message to unknown	1.41 (-)	1.34 (**)	
Sharing message with others on the phone	3.13 (-)	3.00 (**)	**-
Sharing message with others on the Internet	1.12	1.15	
Multimedia messaging	2.18	2.21	**-
Answering service for voice	1.92 (+)	1.98 (*)	**-
Voice phone meeting service	1.19 (+)	1.27 (**)	
Mobile access to calendar or board sharing	1.08 (+)	1.17 (**)	
Find out who has a number	3.13	3.13	**-
Find out where someone are	1.38 (+)	1.64 (**)	
Mobile service for contact personals	1.06	1.07	
Mobile service for chatting with friends	1.45 (+)	1.50 (*)	
Mobile service for chatting with unknown	1.10	1.12	
Mobile flirt service	1.18	1.22	**+
Location based mobile flirt service	1.11 (+)	1.18 (**)	**+
Send messages for display during TV-program	1.55 (-)	1.50 (*)	
Mobile discussion forum access	1.08 (+)	1.12 (**)	
Mobile service for checking email	1.26 (+)	1.59 (**)	**+
Mobile service for sending email	1.22 (+)	1.52 (**)	**+
Mobile service for sending group email	1.15 (+)	1.30 (**)	**+

(***) Minus signs indicate lower intention than actual use, and plus signs the opposite. (*) and (**) indicates difference is significant at levels 0.05 and 0.01 respectively. For sex * and ** indicates if there is a relationship between the variable and use or intention to use, - indicates higher use or intention among female users and + the opposite.

Even though there are no large differences between actual use and intentions to use, many of the differences are significant. Worth noticing is the anticipated reduction in intended use of ordinary text messaging. The observed difference in use and intentions represents a 3.5% reduction in service use if actually fulfilled. Worth noticing is also the increase in intention to use location based services and mobile access to email services. We also notice that there are significant differences in use or intention to use between female and male users. While female users show more interest in traditional text message services,

male users show significantly more interest in flirt services and mobile email access. There is no relationship between age and use or the intention to use any of these services

A factor analysis of the intention to use particular mobile services in the next six months was performed. In the original service listing, two items were related to voice services and one item was without any particular factor score. The resulting 19 items were analyzed using principal components analysis and varimax rotation. This gave a factor structure of five factors explaining 63.3% of the variance in the material. The resulting factor structure is shown in table 4.3.

Table 4.3 Factor structure of intention to use services for the next six months

Variable (*)	F-1	F-2	F-3	F-4	F-5
Ordinary message	0.77				
Animated message	0.79				
Message to group	0.52				
Sharing message on phone	0.65				
Organizing messages on Internet					0.78
Multimedia message	0.79				
Calendar or board sharing		0.43			0.44
Find out who has a number	0.57				
Find out where someone are		0.49		0.50	
Contact personals			0.75		
Chat with friends				0.74	
Chat with unknown			0.42	0.69	
Flirt			0.80		
Location based flirt			0.78		
Message during TV-program			0.51		
Discussion forum access			0.46		0.45
Check email		0.93			
Send email		0.91			
Group email		0.82			

(*) Factor loadings below 0.4 is not shown

Based upon the identified factor structure, we have chosen to interpret the factors 1-5 as "text", "email", "flirt", "chat" and "organize". A few of the variables have high loadings on more than factors, but this often reflects the duality of a service. For example, discussion groups are used for getting in touch with new people as well as for interest based discussion. Of these services, "text", "flirt" and "chat" are traditionally SMS-based services. The other "email" and "organize" services may be accessed by SMS in other ways. Analyses of variance were conducted with gender as independent variable. These analyses showed that there are significant differences in the intention to use "text", "email" and "flirt" services between male and female respondents. There is a higher intention among female users to use "text" services and a lower intention among these users to use "email" and "flirt". There are no differences in the intentions to use "chat" and "organize" services. There is no relationship between age and the intention to use these categories of services.

4.2 Testing the adoption model

The model estimation section is organized in two sub sections. We first estimate and analyze the measurement model. Based upon the analysis of measures in section 3 and the results of the estimation, we discuss the validity of our measurement model. We then turn to the relationships of the model proposed in section 2.

4.2.1 Measurement model

In section 3, the reliability of all measures was discussed. The coefficient alpha of external influence was 0.63 and behavioral control was 0.66. The rest of the measures were found to have acceptable reliabilities. Thus, a test of the complete measurement model is necessary to establish the reliability of

complete set of variables. In table 4.4 the results of a confirmatory factor analysis of the measurement model is shown.

Table 4.4 Confirmatory factor analysis of measurement model

Measure	Value
$\chi 2$/df	2.783
NFI	0.975
RFI	0.970
CFI	0.984
RMSEA	0.052
df	524

Table 4.4 shows that the measurement model has good fit[4]. All regression coefficients between items and theoretical constructs are significant at the 1% level. Based upon the analysis of reliability in section 3 and the good fit of our complete measurement model, we conclude that the complete model has sufficient reliability despite the somewhat low coefficient alpha of two individual variables.

4.2.2 Model relationships

All structural models were investigated using the whole or parts of the measurement model presented above. In table 4.5, the different models that have been tested are listed.

[4] We generally employ parsimony adjusted measures of fit only. According to Browne and Cudeck (1993) cited in Arbuckle and Wothke (1999), a RMSEA less then 0.08 is acceptable. According to Bentler (1989) cited in Battacherjee (2000), $\chi 2$/df should be less than 5, preferably less than 2, and all other indexes should be close to 1 (Taylor and Todd, 1995). In general, we apply the rules of $\chi 2/df \approx 2$ or better, RMSEA<0.08 and all other indexes ≈ 1.

Table 4.5 Models tested

Model number	Description	Model type
Model 1	TAM	Traditional
Model 2	Extended TAM	Modified and extended
Model 3	TRA	Traditional
Model 4	Extended TRA	Modified and extended
Model 5	TPB	Traditional
Model 6	Extended TPB (complete model)	Modified and extended

To simplify comparisons of the different models to the reader, we first report the three traditional models. These models are nested versions of each other. Thus, they are more easily compared. We generally report the most complex model first and then investigate how much explained variance or fit is lost by introducing the more parsimony model. In table 4.6, important fit and explained variance measures are shown for each of the three traditional models.

Table 4.6 Fit and explained variance of traditional models

Model	Description	χ2/df	CFI	RMSEA	R^2 Intention	R^2 Use
Model 1	TAM	3.277	0.99	0.059	57.8	45.0
Model 3	TRA	3.351	0.98	0.060	56.4	43.7
Model 5	TPB	3.204	0.98	0.058	59.2	50.1

From table 4.6 we see that all models have acceptable fit. The parsimonious TAM-model shows very good fit primarily because we use parsimony-adjusted measures of fit. When comparing explained variances, some surprising results are found. First, the most complex model explains a large amount of the variance in both use and intention to use. Some explained variance in intention to use and actual use is lost when simplifying the model into the TRA-model. The most surprising, however, is that explained variance in intention to use and actually use increase in the simple TAM-model. If we were to select among

these models only, the parsimonious TAM-model would be the optimal choice. It is a simple model with good fit and surprisingly high explained variance.

However, one of the main purposes of this report is to investigate if the traditional TAM, TRA and TPB models need to be extended and modified when applied to mobile service adoption. We have argued that the following extensions and modifications need to be made: 1. Adding two new components to the TAM-model - enjoyment and expressiveness; 2. Adding one new component to the TRA-model - self-control; 3. Adding expectancy relationships between influence and determinants of TAM; 4. Adding relationships between subjective norm and TAM. In the following, extensions 1 is tested in model 2, while the rest of the modifications are tested in model 4. Finally, the complete model adding behavioral control is tested in model 6. In table 4.7 important fit and explained variance measures are shown of the three extended and modified models.

Table 4.7 Fit and explained variance of the extended and modified models

Model	Description	$\chi 2$/df	CFI	RMSEA	R^2 Intention	R^2 Use
Model 2	eTAM	2.991	0.99	0.055	69.1	51.3
Model 2b	eTAM+ cleaned	2.984	0.99	0.055	69.1	51.2
Model 4	eTRA	2.711	0.98	0.051	69.4	51.1
Model 4b	eTAM+ expectancy	2.924	0.98	0.054	69.7	51.3
Model 6	eTPB	2.679	0.98	0.051	73.9	58.1
Model 6b	eTPB+ no norm	3.036	0.98	0.056	73.6	58.5

From table 4.7 we see the estimation results of the three main models based upon our model in section 2. First, model 6 is the full model of section 2, model 4 is the model without behavioral control, and model 2 is the model without subjective norm. When comparing these results, we make four important

observations. First, the extended and modified models consistently have better fit and more explanatory power than the original models of table 4.6. Thus, we conclude that the additions and modifications we have suggested from uses and gratifications and domestication research consistently improves our adoption model when compared to the original TAM, TRA and TPB models. Second, little is lost or gained in parsimony adjusted fit when going from the complex to the simpler TRA or TAM models. Third, when eliminating behavioral control in the model, much explained variance in both intention to use and actual use is lost. In general, behavioral control contributes to an increase in explained variance of approximately 4% in intention to use and 7% in actual use. Fourth, nothing is lost in explanatory power when eliminating subjective norm in the model. This is consistent with the findings of table 4.6 and implicates that subjective norm has no explanatory power in our model. We have also investigated details in our model by making several small adjustments to the three models 2, 4 and 6. The results of these estimations show that, given acceptable fit, model 6 has the greatest explanatory power. In figure 4.1, the explained variances and regression coefficients of model 6 is shown.

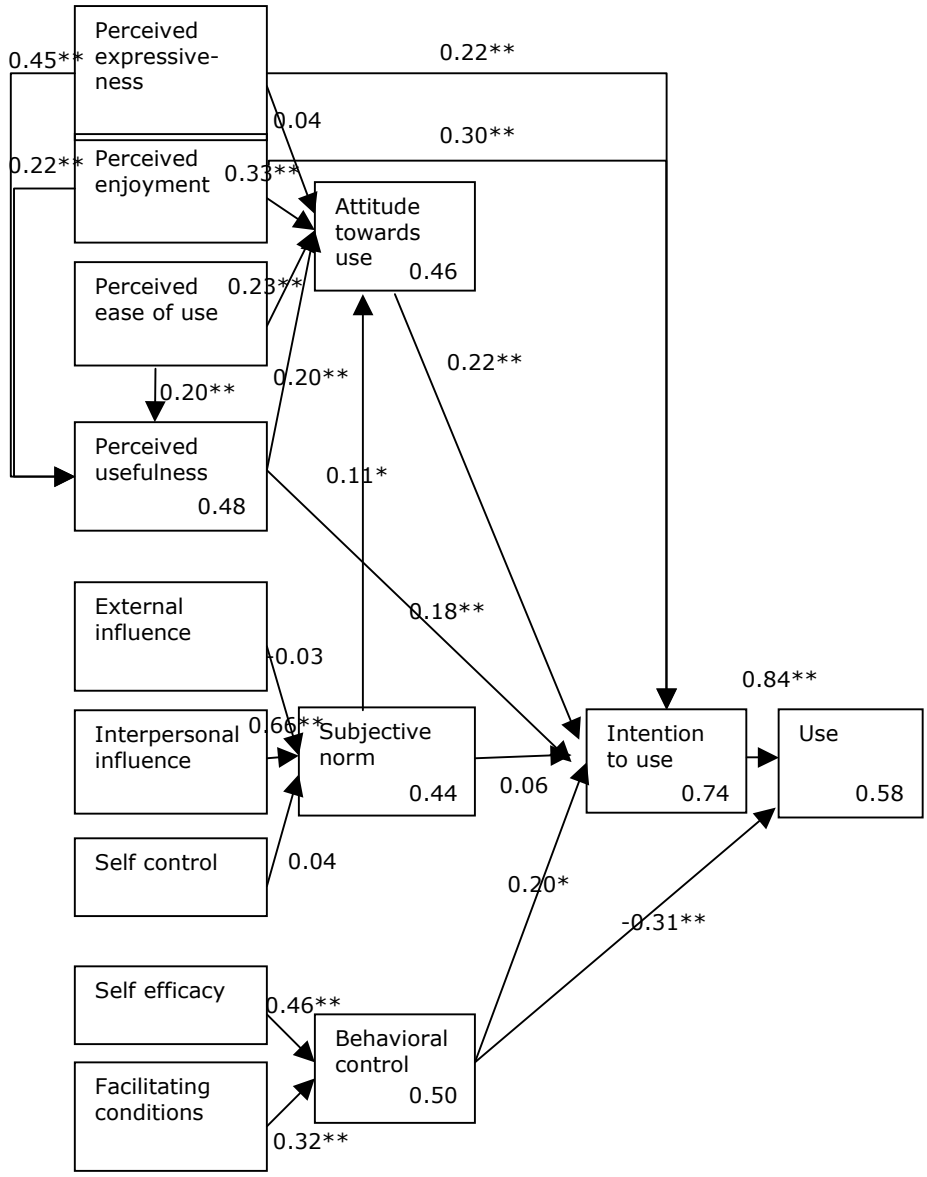

Figure 4.1 Estimation of the model in section 2 (Model 6)

In figure 4.1 standardized regression coefficients are shown along each arrow. Significance is indicated by (**) representing significance at the 1% level. In the squares representing each of the predicted variables R^2 is shown. In the model of figure 4.1, expectancy relationships are not included due to high complexity and recursive relationships in the model. However, expectancy relationships are explicitly investigated below. From figure 4.1, we observe that the relationship between expressiveness and attitudes, external influence and subjective norm, and between self-control and subjective norm are not

significant. Most important however, is that the relationship between subjective norm and intention to use text messaging services is not significant. Thus, the model comparisons made in table 4.7 is well documented in the relationships of model 6 as well, and this implies that the modifications of the theoretical model of section 2 seem necessary.

In model 6b, subjective norm is eliminated and behavioral control retained. This model clearly demonstrates the lack of explanatory power of subjective norm. In model 4b we have eliminated subjective norm and included expectancy relationships. However, no explanatory power is gained from this, implicating that expectancy relationships are not important in our model. Finally, we have cleaned up insignificant relationships in model 2b and re-estimated the modified and extended TAM-model.

To summarize, our results show that the modifications and extensions to traditional adoption models that were suggested in section 2 are important when explaining the adoption of mobile services. They also show that subjective norm is not important when explaining the adoption of text messaging services. Thus, there seem to be a choice between two modified and extended models - one including behavioral control and a simpler, extended version of the TAM-model. In this choice complexity must be evaluated against explanatory power. However, because our fit measures are adjusted for complexity, they suggest one should focus explanatory power and only choose the simpler model for practical reasons. For example, the simpler model may be chosen because it is easier to apply when used for evaluating the adoption potential of services. For scientific purposes, however, the adjusted version of model 6 should be chosen. In figure 4.2, this model has been illustrated including explained variances and regression coefficients.

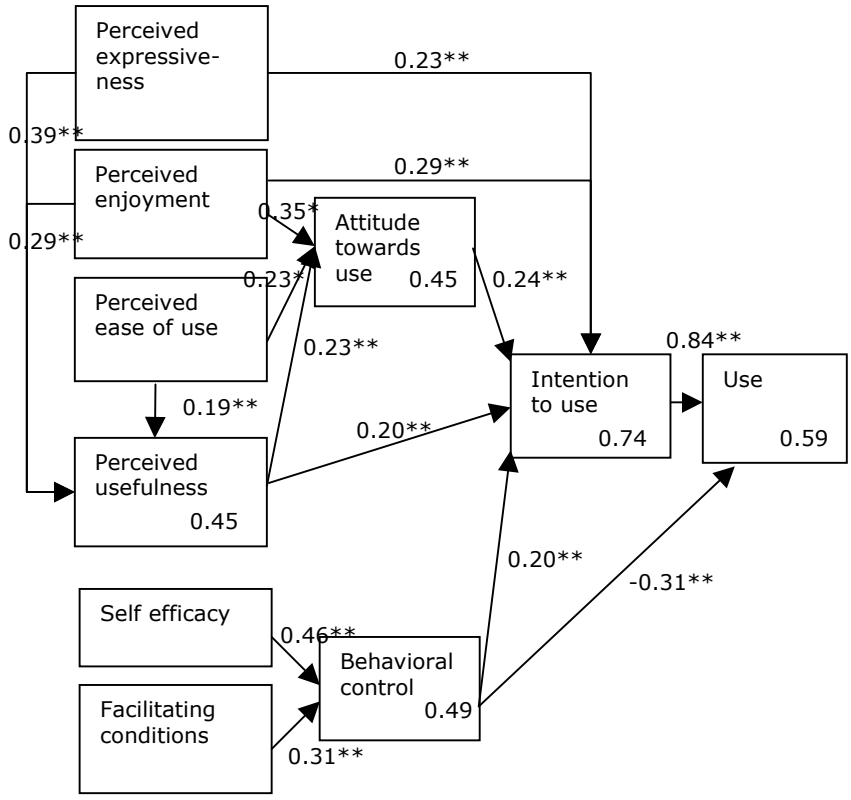

Figure 4.2 Model including behavioral control (insignificant relationships and underlying component removed)

In figure 4.2 standardized regression coefficients are shown along each arrow. Significance is indicated by (**) representing significance at the 1% level. In the squares representing each of the predicted variables R^2 is shown. The relationships are as expected from the model in section 2 except for the relationship between behavioral control and actual use. For example, the new variable expressiveness is important in explaining usefulness and intentions, and enjoyment is important in explaining usefulness, attitudes and intentions. Thus expressiveness, and in particular, enjoyment are important predictors of text messaging use. Attitudes, usefulness and behavioral control are found to have approximately equal influence on intentions to use. However, the finding that is most difficult to comprehend is the negative relationship between behavioral control and actual use. When investigating the relationship between the self-efficacy and facilitating conditions components of behavioral control

and intention to use and actual use, we found that there is only a significant relationship between the facilitating conditions component and intentions and only between self-efficacy and actual use. The relationships are illustrated in figure 4.3.

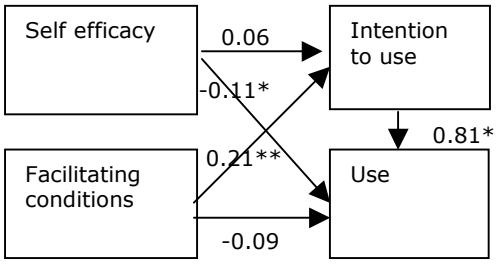

Figure 4.3 Relationships between components of control and use measures.

Thus, it is the self-efficacy component of behavioral control that relates negatively to actual use, and the facilitating conditions component that relates positively to intention to use. Thus, the relationships may be interpreted as follows: The better I feel the service is facilitated, the more I intend to use. The more I intend to use it, the more I use it. The more I feel I control use of the service, the less I actually use it. These findings indicate that there is an element of perceived addiction to the actual use of text messaging services. In fact, it seem that users that feel they are in control of the service use less and users that feel that they are not in control of the service use it more, given similar levels of intentions to use. These findings are also partly supported by the relatively large number of traditional text messaging services where users have intentions of using the service less than they do today. However, the relationship is not as one would expect if applying TPB to explain the addiction to practices that are socially unaccepted. In that case, intention to use and actual use are both negatively related to self-efficacy, actual use is positively related to facilitating conditions, and no relationship between intention to use and actual use is to be expected. Arguments for a similar relationship, and a similar

importance of "perceived addiction", may be found in LaRose et al.'s (2001) study of Internet uses and gratifications. They suggest introducing the concept of deficient self-regulation as a determinant of use, but what we have observed may perhaps better be categorized as "perceived deficient self-regulation". Some of the literature on television addiction (e.g. Finn, 1992) may provide further insight into the observed relationships.

4.2.3 Gender differences in adoption models

Recent findings in diffusion and domestication research indicate that there are gender differences in the adoption and use of text messaging services. For example, female users have been observed to use text messaging more than male users in all comparable age categories, and they have been observed to more frequently share messages and use longer messages. When estimating the same models for both female and male users, we may expect to observe some differences in models. In table 4.7, the results of our estimations of the three different extended and modified adoption models are shown.

Table 4.7 Fit and explained variance of the extended and modified models

Model	Description	$\chi 2$/df	CFI	RMSEA	R^2 Intention	R^2 Use
Model 2	Female	2.265	0.98	0.059	67.0	51.1
Model 2	Male	2.012	0.98	0.059	71.7	50.0
Model 4	Female	2.089	0.98	0.055	68.0	50.9
Model 4	Male	1.901	0.98	0.056	72.1	50.4
Model 6	Female	2.041	0.98	0.054	73.3	55.4
Model 6	Male	1.834	0.97	0.054	76.9	60.8

In general, the same patterns in goodness of fit and explanatory power are observed for these models as for the general models in section 4.2.2. However, the pattern is most similar for female users indicating a loss in explanatory power when removing behavioral control and little loss in explanatory power

from removing subjective norm. In figures 4.4 and 4.5, model 6 is estimated and illustrated for female and male users.

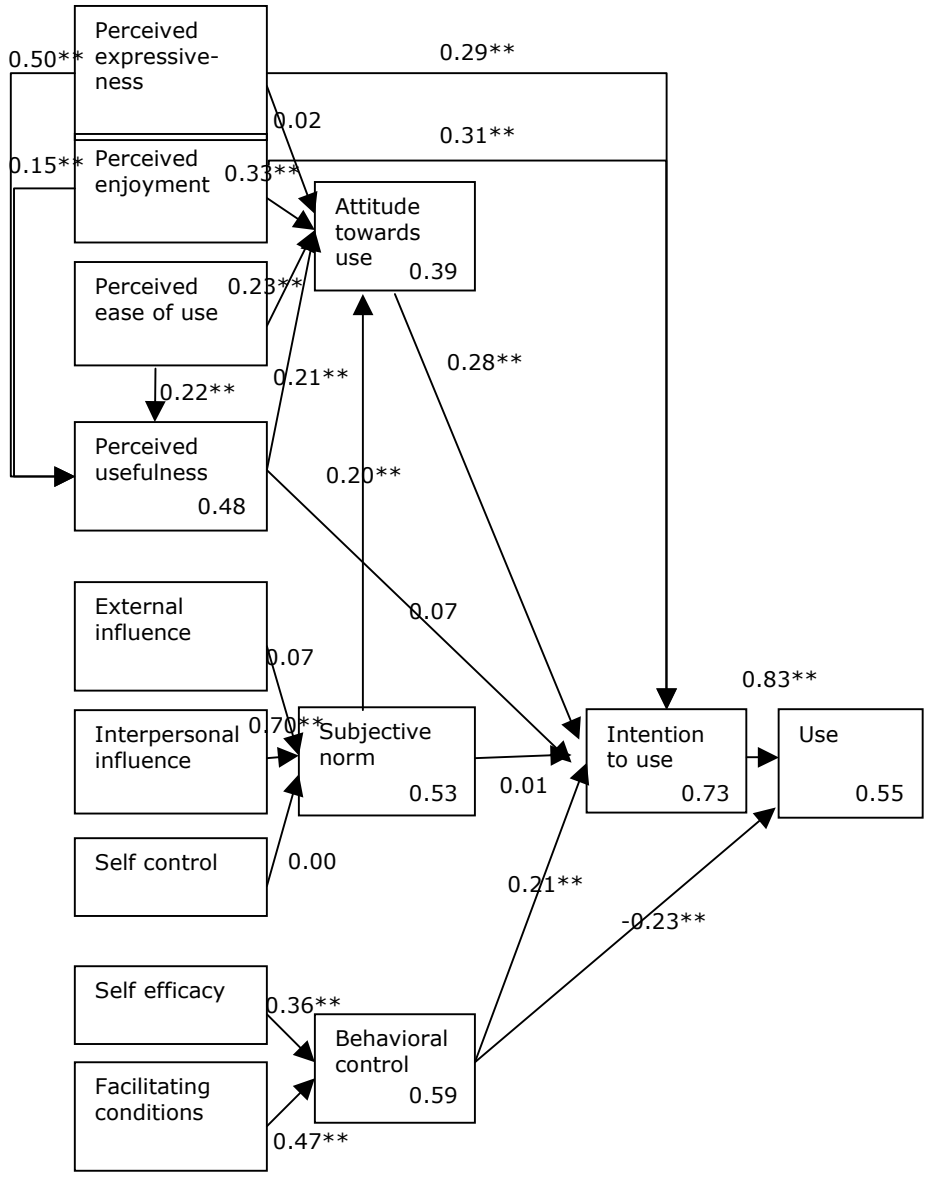

Figure 4.4 Estimation of the model of female users

From figure 4.4, we see that the model is very similar to the general model estimated in section 4.2.2. There are some differences in the absolute value of coefficients but these may not be interpreted as relative differences between the two models. However, the relationship between usefulness and intention to use is not significant in this model, and the relationship between subjective norm

and attitudes is significant at the 1% level. In figure 4.5, the corresponding model for male users is illustrated.

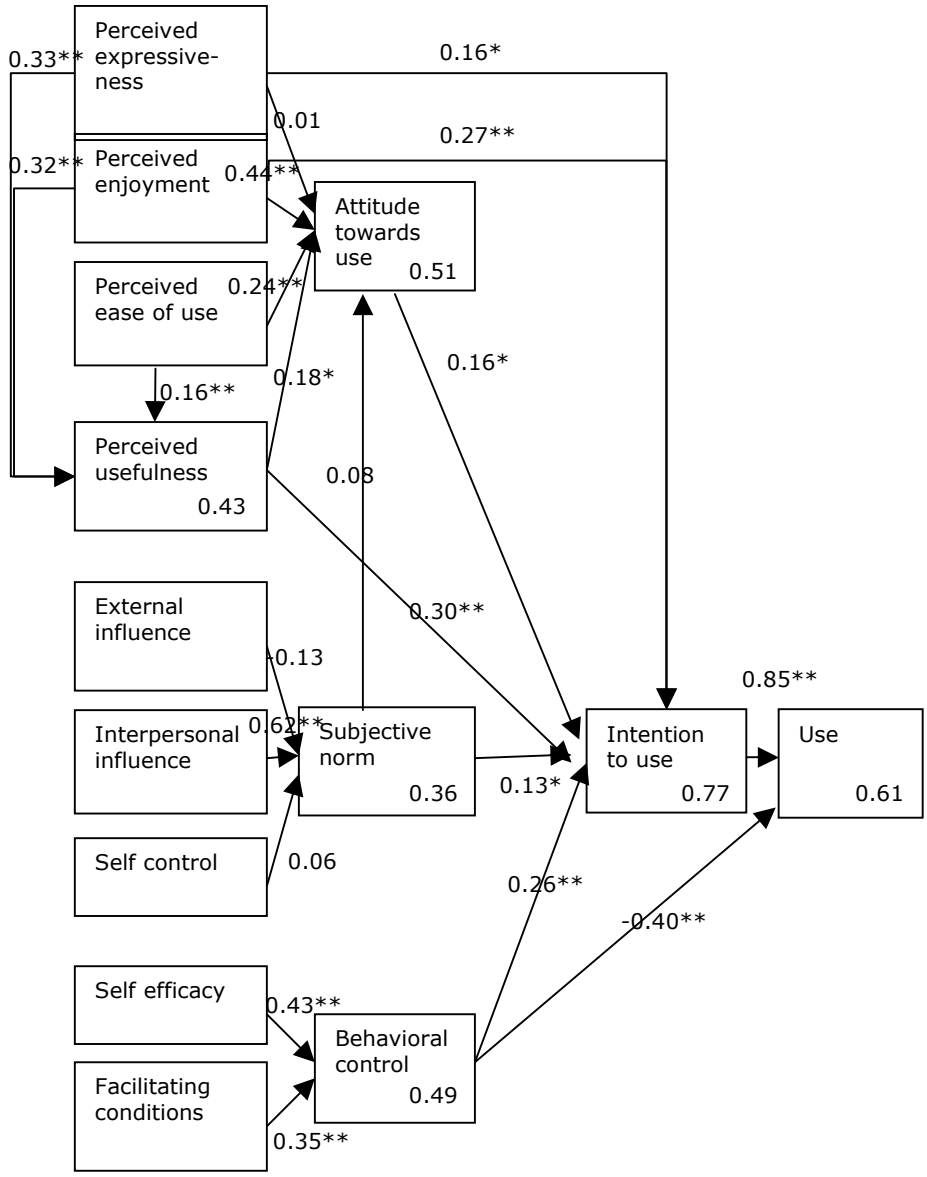

Figure 4.5 Estimation of the model of male users

From figure 4.5 we observe that this model is also very similar to the general model of section 4.4.2., but there are some important differences in details. The most important difference is that while subjective norm was not significant in explaining intention to use in the general model and in the model of the female users, it is significant at the 5% level in this model. The second difference is that while the relationship between usefulness and intentions is significant in

both the general and male user models, this relationship is not significant in the model of female users. A third difference is that while the relationship between subjective norm and attitudes was significant for female users, it is not significant for male users. There are also some notable differences in levels of the standardized coefficients. Most obvious are that the coefficients of enjoyment are generally higher among male users and the coefficients of expressiveness are generally higher among female users. To conclude, while female users are influenced by attitude-driven relationships, male users are influenced more by direct instrumentality and subjective norm. This is rather surprising. However, it may indicate a more consistent structure of gratifications among female users and a more dual structure of gratifications among male users. Further analysis of gender differences in the adoption of mobile services may thus be interesting.

4.2.4 Differences in adoption models of early and late adopters

Findings so far, and the theory presented in section 2, suggest that adoption models may differ for different services, user segments and points of time during the diffusion process. Because text messaging services are investigated at a specific time in this report, we have no possibility of investigating the first and second of these suggestions. We have, however, in section 4.2.3 shown that the adoption model varies with gender. Related to how adoption models vary with time is the different user categories addressed over time during a diffusion process. As in diffusion research, early adopters may be treated as a separate user segment with their own requirements for adoption when compared to late adopters. We have previously argued that the innovativeness of subjects with respect to their use of mobile services is a good variable when identifying early adopters of mobile services (Pedersen, 2001). Thus, the innovativeness measure of our study may be used to identify the adoption models of early and late

adopters. To simplify, we have used the measure to split our sample in two categories of users. Users with innovativeness higher to or equal to the mean are considered early adopters (innovators) and the rest of the subjects are considered late adopters.

In figures 4.6 and 4.7, the adoption models based upon model 6 of section 4.2.2 have been estimated for early (innovators) and late adopters respectively.

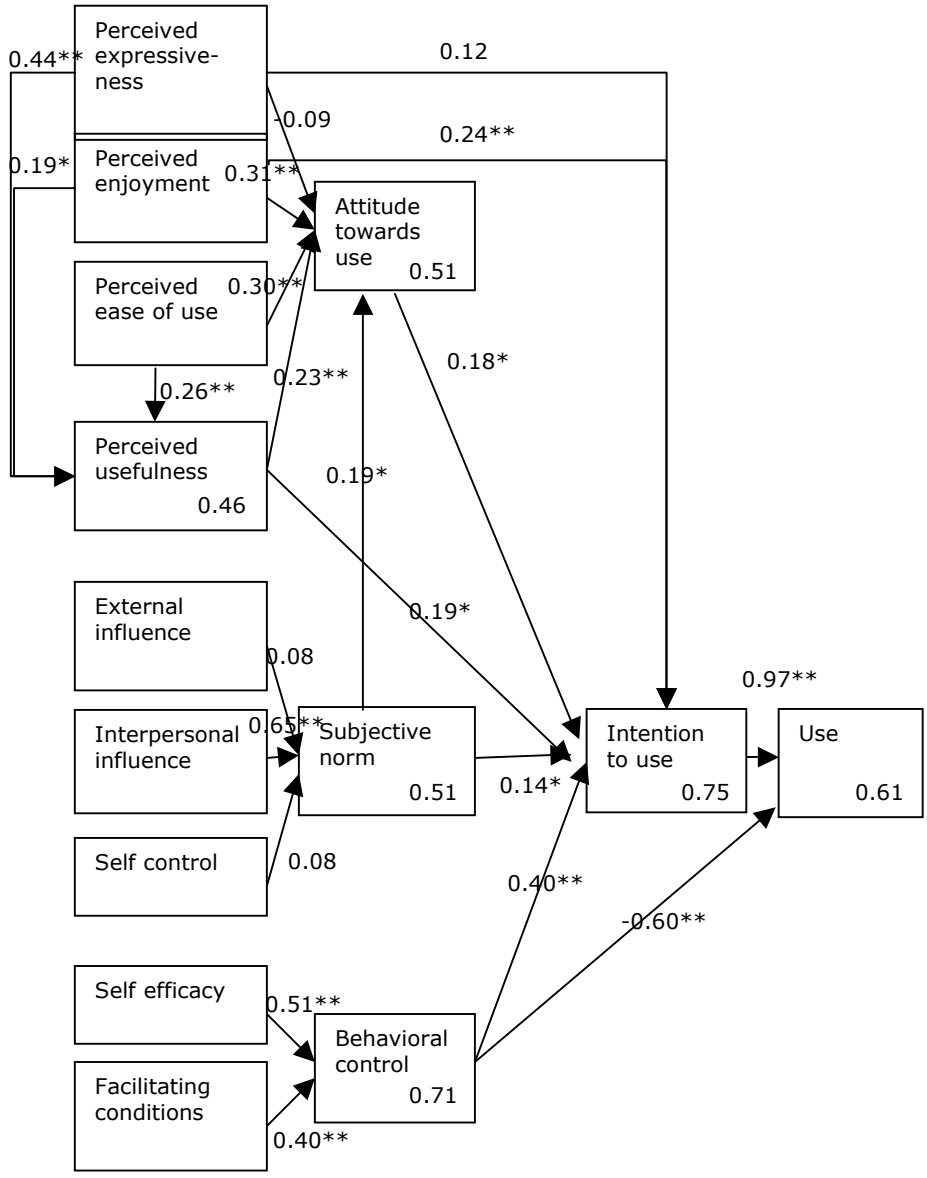

Figure 4.6 Estimation of the model of early adopters

The model of figure 4.6 showed good fit with $\chi 2/df=1.844$, CFI=0.97 and RMSEA=0.058. In figure 4.7, the corresponding model for late adopters is shown.

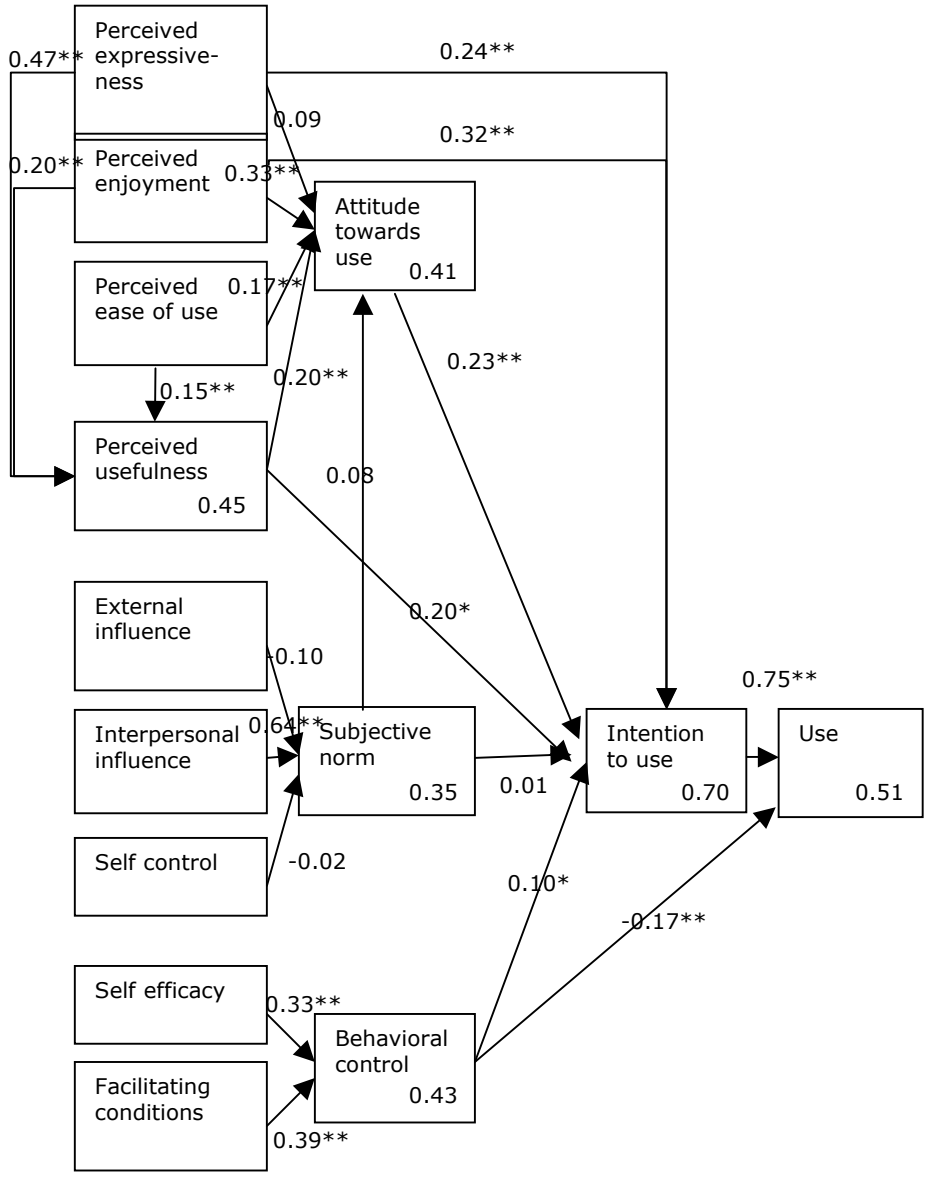

Figure 4.7 Estimation of the model of late adopters

The model of figure 4.7 showed good fit with $\chi 2/df=2.068$, CFI=0.97 and RMSEA=0.052. When compared to the model of early adopters four observations are of interest. First, subjective norm is significant in the early

adopter model and not in the late adopter model. At first sight, this seems to disagree with our first expectations of early adopters as self-confident innovators. However, when looking more carefully into what subjective norm is - the expectation of others that I should use a particular service, it is obvious that it is expected of early adopters of mobile services to be using text messaging services, while this is not necessarily expected of late adopters. The second observation is that ease of use is more important to early adopters. Even though these users are skilled users, they still appreciate ease of use. Third, early adopters seem to have a very strong relationship between behavioral control, intentions and actual use. If this is explained by a relationship of addiction as suggested in section 4.2.2, early adopters certainly seem more addicted to the use of text messaging services than other users. This may also be supported by the large difference in text messaging use among early adopters with a mean of 14.6 messages pr. month and late adopters with 3.3 messages pr. month ($F=750.4$, $d.f.=369$). The only result that is difficult to explain and understand is that expressiveness does not significantly influence intentions of early adopters.

5. CONCLUSIONS AND DISCUSSION

This report has two main contributions. First, it presents and reviews literature on communication services found relevant to the adoption of mobile communication services and messaging services in particular. In the review, findings from four different research traditions, diffusion, adoption, uses and gratifications, and domestication research, are reported. From the review, we suggest a theoretical model of text messaging services adoption particularly suited to understand young users' adoption. The model is based upon the theory of planned behavior, but modified and extended using important findings from our review. The second contribution is the empirical results of a study applying the model to young users' adoption of text messaging services in Norway. Based upon these results, the theoretical model is modified, and a validated model is suggested.

5.1 Conclusions

In the theoretical part of the study, we concluded that there are many theoretical perspectives and studies of mobile communication services. Few attempts have been made to integrate these findings into formal models suited for explaining the adoption process of individual service users. This situation was somewhat different than in a theoretical review of mobile *information* services we have previously conducted (Pedersen, 2001). The difference is probably mainly due to a longer tradition of treating mobile services as communication services and thus, the investigation of their use and adoption in different research traditions. As a basis for integrating many of these findings into an adoption model suitable for hypothesis deduction and formal empirical test, we found the theory of planned behavior useful. However, the theory had to be modified in several ways. First, new concepts had to be added to the TAM-part of the model. We added the concepts of enjoyment and expressiveness found relevant in studies

of mobile services in uses and gratifications and domestication research. Second, subjective norm and the TAM-part of the model should be better integrated. After clarifying the relationship between intrinsic, extrinsic and derived motivations and regular norms, we added a relationship between norms and attitudes. Further, previous studies had shown external and interpersonal influence to be important in an expectancy relationship between these concepts and the TAM-part of the theory of planned behavior. Finally, we introduced moderators of subjective norm into the model, particularly through the introduction of the self-control concept.

These modifications make the theory of planned behavior better suited for explaining the adoption of mobile communication services, in particular when adopted by younger users. Even though no explicit hypotheses where proposed in the theory section, the main implicit hypothesis was that this model was better suited for explaining the adoption of text messaging services than the original theory of planned behavior as specified by Taylor and Todd (1995). However, the modified and extended adoption model suggested is well suited for the deduction of formal hypotheses.

In the empirical part of the study, we conducted a survey analysis of young users' adoption of text messaging services applying the proposed adoption model. A total of 658 text messaging users mainly of age 15 to 20 participated in the survey. An analysis of the model measures showed that the measures were acceptably reliable. In particular, the new constructs suggested were highly reliable, and were also found to fit well with the conceptual structure of the model. Thus, they should be considered theoretically and empirically valid. Nine explanatory adoption models were estimated. Three models based upon the original TAM, TRA and TPB models and three versions of these models based upon our proposed TPB-model were estimated. The final version of the

TPB-model estimated was the suggested theoretical model. We also modified each of these three models based on the empirical results. The results of these estimations may be summarized in six findings.

First, when comparing the original TAM, TRA and TPB-models to our extended and modified versions we found that the modified versions showed both better fit and more explanatory power than the original model. Thus, our proposition that to explain the adoption of mobile services, traditional adoption models will have to be modified and extended, seems justified.

Second, the new concepts added to the TAM-part of the model contributed much to the better fit and explanatory power of the extended and modified models. Thus, the inclusion of elements of enjoyment and expressiveness to the explanation of mobile services, at least among young users also seems justified.

Third, the argument that subjective norm should be moderated or extended with components of self-control seems unjustified. There were no results in our study that supported the addition of self-control elements to strengthen the subjective norm concept. This was somewhat surprising because earlier studies of mobile commerce service adoption had found this moderation to be important.

The fourth and most surprising result was that for young users' adoption of text messaging services, subjective norm did not seem to be a significant explanatory variable at all. When compared to our earlier studies of mobile services and to the research reviewed in section 2, this was surprising. However, there is also research on adoption that suggests social influence is replaced by more instrumental social gratifications of use that may not be interpreted as norms. We discuss these issues below.

The fifth finding was that despite the lack of support for including subjective norm in the model, behavioral control still contributed significantly to fit and explanatory power, and should be included in models of young users' adoption of text messaging services. Finally, a rather surprising result was found in almost all models on the relationship between behavior control, intention to use and actual use. While a positive relationship was found between behavioral control and intentions and between intentions and actual use, a negative relationship was found between behavioral control and actual use. This suggests behavioral control has a moderating relationship with actual use. A decomposition of behavioral control showed that the reason was that self efficacy was negatively related to actual use and facilitating conditions was positively related to intentions. Thus, the moderating relationship may be explained by some form of perceived addiction or perceived deficient self-regulation to use text messaging services among young users.

The models were also estimated separately for male and female subjects and for early and late adopters. In the analysis of gender differences we found that there were important differences between male and female users' adoption models. First, subjective norm was not significant in the female users' model, while it was significant in the male users' model. Thus, female users are less influenced by subjective norm in their adoption and use of text messaging services than male users. There was also a difference in the direct relationship between usefulness and intentions and in the determination of attitudes that suggested female users are more driven by attitudes in their adoption process. Male users, on the other hand have a dual structure in their adoption model in which both norms and direct instrumentality are important. This is also further discussed below.

In the analysis of the segments of early and late adopters, we used Goldsmith's (Goldsmith and Hofacker, 1991; Goldsmith, 2001) innovativeness measure to determine which users where early and late adopters of mobile services in general. We found several interesting differences in the adoption models of the two user categories, but two are particularly interesting. First, despite our expectations that early adopters are self-confident innovators, they are more influenced by subjective norm than late adopters. However, this seems reasonable, because it is expected of early adopters that they use the "latest services", while this is not expected of late adopters. The second finding was a stronger relationship between behavioral control, intentions and actual use of the kind reported above of early adopters than late adopters. Thus, if this relationship indicates a perceived addiction to using particular services, this relationship is stronger among early adopters than late adopters.

Our findings have several implications for service providers and operators that are trying to understand the behavioral adoption requirements of end-users. First, our models generally show good fit and explanatory power. When compared to the general results of other adoption research studies, explained variances in intention to use of more than 70% and in actual use of almost 60% is not common. This suggests the extended and modified adoption model suggested here may be applied as a basis for designing adoption requirement frameworks for practical use by service providers and operators. When compared to our previous studies of mobile services there are considerable differences in models across services and user categories. This suggests adoption models and frameworks must be adapted specifically to particular mobile services and user segments.

The finding that subjective norm did not influence intention to use text messaging suggests norms are important only in particular user segments and at

particular phases of the diffusion process. This suggests communication methods based upon "word-of-mouth" and advertising should only be used for particular user segments at particular stages of the diffusion process. In a way there may be a "time window" that operators and service providers may have to utilize if these marketing instruments are to be effective. Outside this "time window", instrumental gratifications must be focused, and traditional forms of facilitations are most effective for stimulating the adoption of mobile services. Our extensions of the TAM-model show that gratifications of enjoyment and expressiveness are very important to mobile services, at least for young users. Service providers and operators may take these gratifications into considerations and try to understand the complex instrumentality of mobile services so that these services include elements of traditional usefulness, ease of use, enjoyment and expressiveness.

From our results of the user segment analysis, we found that there are considerable differences in male and female users' adoption process. These finding may be used when designing the content of services (in the form of differences in gratifications sought), when facilitating services (in the form of pricing, support and skill requirements of services), and in the communication process used to promote a service (in communicating differently to male and female users). Our findings of differences in early and late adopters suggest early adopters are a particularly important user group that often may be used as a "key opener" in the diffusion process. However, the instrumentality, facilitations and promotion of services to these users should be different from that of other users, and our findings suggest what some of these differences may consist of. Finally, the relationship between intention to use, actual use and behavioral control suggest that mobile services may give the users a perception of addiction to services that is a difficult "edge to balance". In particular for young users, the perception of addiction under constrained financial resources

may easily cause a general change in attitudes towards services use. This may turn a large group of heavy users into light users over a very short period of time. Thus, perceived addiction and its determinants and consequences should be further investigated by industry players.

5.2 Discussion

Several threats to the validity of our conclusions may be relevant. Still, our opinion is that most threats to the internal validity of our study have been considered, but external validity is naturally an issue in an exploratory study of the kind reported here. We have discussed the validity and reliability of our measures in sections 3 and 4. Furthermore, our theoretical concepts are generally well established and have previously been used and measured in studies of ICT use and adoption. The reliabilities of some measures could have been better, but when validated in the total measurement model, they were found acceptable.

Of other issues that may have threatened the internal validity of our study is the self-selection of subjects. For this to be a threat to validity though, the selection procedure should systematically interact with our findings (importance of entertainment and expressiveness, lack of influence of subjective norm etc.). The high rate of response of the study and the distribution of subjects by age and gender indicate that there are no systematic demographic differences between our self-selected subjects and young mobile users in general. Still, the methodology may favor response from subjects interested in text messaging and subjects with a positive attitude towards these services. However, the data collection procedure was designed so that all kinds of subjects were given an opportunity to participate without other activities disturbing their participation or response (in class). Further, it is not the level of use or level of positive or

negative attitudes that are focused in this study, it is the relationship between attitudinal concepts in the adoption model.

Even though we feel that the internal validity of the study is acceptable, there are several threats to the external validity of the study. Generally, three issues are relevant. To threaten external validity, the subjects, setting or time of the study must be special in a way so that our conclusions do not generalize to other subjects, settings and times. First, the subjects of the study were recruited as representative of young users of mobile services. We have documented that they are representative of that user category. However, they were recruited at upper secondary schools focusing general theoretical subjects required for university or college entrance. Students at these schools have previously been believed to be more reflected and "mature" with respect to self-perceptions, but this difference between different secondary school students is now more or less eliminated. Also when considering subject selection as a treat to external validity, the issue of interaction between selection and findings is relevant. For example, self-selection of reflected subjects may well have reduced the importance of elements of enjoyment and expressiveness rather than increased it.

The setting of the study was created by the introductory text shown in section 3. We have tested if the model could be used to predict the other service categories evaluated in the study, such as flirt and chat services. However, these models only explain some 5-10% of the variance in intention to use these services. Thus, we may be quite sure that subjects have responded to the text messaging services setting manipulation. The final threat to external validity is from time. Text messaging services have reached a mature stage of diffusion - almost all teenagers seem to use these services. Thus, time relevant threats are believed to be less relevant than if the study had been investigating a service in

early introduction. However, the maturity of the services naturally makes adoption models developed for understanding the decision to initially adopt or try out a service less valid. This is one of the reasons why a fairly general adoption model was chosen as the basis for the study, rather than a complex consumer choice model. Thus, we find that the internal and external validity of our study are acceptable. That said, the study should still be treated as exploratory. Generalization of our findings across user segments and services is not recommended. Because priority was given to internal validity rather than external validity, our conclusions are mainly relevant to understanding the adoption decisions of young users using mobile communication services.

There are several surprising findings and lacks of findings in our study that require further discussion. The most important of these is the lack of support for subjective norm as a determinant of intention to use. The typical explanation for this finding based upon the review of section 2 is that text messaging services are no longer new services in the young user segment. Thus, subjective norm is no longer important. This may seem a plausible explanation, and further research on the change in social influence over the diffusion process seems justified. However, we also found differences in the influence of subjective norm by gender and user category. These findings indicate that the influence of subjective norm may be more complex than suggested above.

The other surprising finding worth discussing here is the relationship between behavioral control, intention to use and actual use. While we suggested this could be explained by some form of "perceived deficient self-regulation", the relationships between intention to use, actual use and behavioral control or perceived resources in static studies have also been discussed by Mathieson et al. (2001 p. 95-96). They discuss possible reasons for including a direct

relationship to actual use, and suggest two reasons for including it; "individuals incorrectly estimating control over behavior" and "mismatch in the time of measurement of intention and behavior". Our findings indicate that both issues may be relevant in our study, but our suggested explanation of perceived deficient self-regulation as an element of behavioral control has not been discussed by Mathieson et al. (2001). The literature on addiction to media, in particular television addiction, may provide further insight into these relationships, and we suggest this is an issue for further research,

5.3 Further research

Even though the developed model seems promising in providing explanations of adoption behavior and not just descriptions, our research needs to be extended in several ways.

First, our model represents a cognitive and attitudinal model explaining the adoption decisions of individuals using attitudinal concepts such as usefulness and self efficacy. However, the determinants of these attitudinal concepts have not been investigated. For example, service properties may determine perceived usefulness, whilst individual traits may determine self efficacy. Furthermore, operator characteristics may be an important determinant of perceived facilitating conditions. Suggesting and testing such determinants are important issues in our future research.

Second, the importance of both determinants and attitudinal concepts may differ across mobile services. For example, the adoption of mobile commerce services may be less dependent upon the determinants of subjective norm, whilst these determinants, and the subjective norm concept itself, may be more important for modeling the adoption of services for the management of social relationships. Before service providers and developers can use our model as a

basis for developing an adoption evaluation framework, more research is needed on how the importance of the determinants and attitudinal concepts differ across services.

Third, the same may be true for different categories of users. In this study we found rather big differences in adoption models when comparing male and female users and when comparing early and late adopters. Thus, we will also extend our research to investigate the adoption decisions of users of various categories.

Finally, adoption models may change over the diffusion process of a technology. At least three issues are of relevance her. One is the change in how a service is perceived in society over the diffusion process. This process is the main reason for suggesting that the influence of subjective norm will be less for mature technologies and services. The other issue is that individuals' adoption models may change as they learn to use particular technology or service platforms, and this knowledge may be transferable to complementary services. The third issue is that different users may be early adopters of one service and late adopters of another. Thus, they belong to different user categories for different services introduced over the diffusion process of a "cluster of technologies" (Rogers, 1995). These issues have not been considered in this report, but should be given attention in further studies of the adoption of mobile services. However, we find that the theoretical and empirical work done in this study provides a solid basis for extending our research in the suggested directions.

REFERENCES

Adams, D.A., Nelseon, R.R. and Todd, P.A. (1992). Perceived usefulness, ease of use, and usage of information technology: A replication. *MIS Quarterly*, 16, 227-247.

Agarwal, R. and Prasad, J. (1998). A conceptual and operational definition of personal innovativeness in the domain of information technology. *Information Systems Research*, 9, 204-216.

Ajzen, I. (1985). From intentions to actions: a theory of planned behavior. In Kuhl, J. and Beckmann, J (eds). *Action control: from cognition to behavior*. Springer Verlag, New York, 11-39.

Ajzen, I. (1991) The theory of planned behavior. *Organization Behavior and Human Decision Processes*, 50, 179-211.

Alexander, P.S. (2000). *Teens and mobile phones growing-up together: understanding the reciprocal influence on the development of identity*. Presented at the Wireless World Workshop, University of Surrey, April 7, Guildford, Surrey.

Aoki, K. and Downes, E. (2002). *Cell phone usage: An analysis of users' subjective responses in the adoption*. Presented at ISTAS'02, June 6-8, Raleigh, NC.

Arbuckle, J.L. and Wohtke, W. (1999). *Amos 4.0 User's guide*. SmallWaters Corp., Chicago, IL.

Arnett, J. (1995). Adolescents' uses of media for self-socialization. *Journal of Youth and Adolescence*, 24, 519-531.

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist,* 37, 122–147.

Battacherjee, A. (2000). Acceptance of e-commerce services: the case of electronic brokerages. *IEEE Transactions on Systems, Man and Cybernetics*, 30, 411-420.

Blumler J.G. and Katz, E. (Eds.) (1974). *The uses of mass communications: Current perspectives on gratifications research*. Sage, Beverly Hills, CA.

Bradner, E., Kellogg, W.A. and Erickson, T. (1999). *The adoption and use of 'Babble': A field study of chat in the workplace.* Presented at the European Conference on Computer-Supported Collaborative Work (ECSCW), September 12-16, Copenhagen, Denmark.

Brodie, J. and Perry M. (2001). *Designing for mobility, collaboration and information use by blue-collar workers*. Presented at the ECSCW Workshop on Work/Place, Sep 18-20, Bonn, Germany.

Burgoon, J.K., Bonito, J.A., Bengtsson, B., Ramirez, A., Dunbar, N.E. and Miczo, N. (2000). Testing the interactivity model: Communication processes, partner assessments and the quality of collaborative work. *Journal of Management Information Systems*, 16, 33-56.

Cassidy, J., Parke, R.D., Butkovsky, L. and Braungart, J.M. (1992). Family-peer connections - the roles of emotional expressiveness within the family and childrens understanding of emotions. *Child Development*, 63, 603-618.

Churchill, E.F., Trevor, J., Bly, S. Nelson, L. and Cubranic, D. *Anchored conversations: Chatting in the context of a document.* Presented at the CHI 2000 Conference on Human Factors in Computing Systems, April 1-6, The Hague, Netherlands.

Churchill, E.F. and Bly, S. (1999). *It's all in the words: Supporting work activities with lightweight tools.* Presented at the Group'99 , November 15-17, Phoenix, Arizona.

Cohen A.A., Levy, M.R. and Golden, K. (1988). Children's uses and gratifications of home VCRs. *Communication Research*, 15, 772-780

Carroll J., Howard, S., Vetere, F. Peck, J. and Murphy, J. (2002). *Just what do the youth of today want? Technology appropriation by young people.* Presented at HICSS 35, Jan 7-10, Hawaii, US

Daft, R.L. and Lengel, R.H. (1986). Organizational information requirements, media richness and structural design. *Management Science*, 32, 554-571

Davis, F.D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 13, 319-340.

Davis, F.D., Bagozzi, R.P. and Warshaw, P.R. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management Science*, 35, 982-1002.

Dennis, A.R. and Kinney, S.T. (1998). Testing media richness theory in the new media: The effects of cues, feedback, and task equivocality. *Information Systems Research*, 9, 256-274.

Dickerson, M.D. and Gentry, J.W. (1983). Characteristics of adopters and non-adopters of home computers. *Journal of Consumer Research*, 10, 225-235.

Dimmick J., Kline, S. and Stafford, L. (2000). The gratification niches of personal e-mail and the telephone. *Communication Research*, 27, 227.248.

Dimmick J, and Sikand, J. (1994). The gratifications of the houshold telephone. *Communication Research*, 21, 643-664.

Doll, W. J. Hendrickson, A. and Deng, X. (1998). Using Davis's perceived usefulness and ease-of-use instruments for decision making: A confirmatory and multigroup invariance analysis, *Decision Sciences*, 29, 839 – 869.

Eikebrokk, T. (1997). *Communication Technologies in Organizations: An Empirical Study of Evaluations and Use*. Doctoral thesis, The Norwegian School of Economics and Business Administration, Bergen.

Finn, S. (1992). Television "addiction"? An evaluation of four competing media-use models. *Journalism Quarterly*, 69, 422-535.

Fishbein M. and Ajzen, I. (1975) *Belief, attitude, intention and behavior: an introduction to theory and research*. Addison-Wesley, Reading MA.

Fisher, C, (1988). *America calling: A social history of the telephone to 1940. Berkeley*, University of California Press.

Fortunati, L. (1998). *The ambiguous image of the mobile phone*. Cost 248 Report. Telia, Farsta, Sweden.

Fox, S., Horrigan, J., Spooner, T. and Carter, C. (2001). *Teenage life online. The rise of the instant-message generation and the Internet's impact on friendships and family relationships*. Pew Report. Pew Internet & American Life Project, June 6, Washington, US.

Fulk, J. and Boyd, B. (1991). Emerging theories of communication in organizations. *Journal of Management*, 17, 407-446.

Gant, D. and Kielser, S. (2001). Blurring the boundaries: Cell phones, mobility and the line between work and personal life. In Brown, B., Green, N., Harper, R. (Eds) *Wireless World: social and interactional implications of wireless technology*. Springer, London.

Gefen, D. and Straub, D.W. (1997). Gender differences in the perception and use of e-mail: An extension to the technology acceptance model. *MIS Quarterly*, 21, 389-400.

Goldsmith, R.E. (2001). Using the domain specific innovativeness scale to identify innovative Internet consumers. *Internet Research: Electronic Networking Applications and Policy*, 11, 149-158.

Goldsmith, R. E., and Hofacker, C. F. (1991). Measuring Consumer Innovativeness" *Journal of the Academy of Marketing Science*, 19, 209-221.

Green, N., Harper, R.H.R., Murtagh, G. and Cooper, G. (2001). Configuring the mobile user: sociological and industry views. *Personal and Ubiquitous Computing*, 5, 146-156.

Grinter, R.E. and Eldridge, M. (2001). Y do tngrs luv 2 txt msg? In Prinz, M., Jarke, Y., Schmidt, K. and Wilf, V. (eds.). *Proceedings of the Seventh European Conference on Computer-Supported Cooperative Work ECSCW'01*, pp. 219-238. Kluwer Academic Publishers, Dordrecht.

Gruber, H. and Verboven, F. (2000). *The evolution of markets under entry and standards regulation - The case of global mobile telecommunications*. Working paper, Centre for Economic Policy Research, London, UK.

Haddon, L. (2001). *Domestication and mobile telephony.* Presented at the conference "Machines that Become Us", Rutgers University, April 18-19, New Jersey.

Haythornthwaite, C. (2001). Exploring multiplexity: Social network structures in a computer-supported distance learning class. *The Information Society*, 17, 211-226.

Higa, K., Sheng, O.R.L., Shin, B. and Figueredo, A.J. (2000). Understanding relationships among teleworkers e-mail usage, e-mail richness perceptions, and email productivity perceptions under a software engineering environment. *IEEE Transactions on Engineering Management*, 47, 163-173

Hinds, P. and Kiesler, S. (1995). Communication across boundaries: Work, structure, and use of communication technologies in a large organization. *Organization Science*, 6, 373-393.

Höflich J.R. and Rössler, P. (2001). Mobile schriftliche Kommunikation oder: E-Mail für das Handy. *Medien & Kommunikationswissenschaft*, 49, 437-461.

Hu, P.J., Chau, P.Y.K., Lui Sheng, O.R. and Yan Tam, K. (1999). Examining the technology acceptance model using physicians' acceptance of telemedicine technology. *Journal of Management Information Systems*, 16, 91-112.

Hume, M. and Peters, S. (2001). *Me my phone and I: the role of the mobile phone*. Presented at the CHI 2001 Workshop on mobile communications, March 30- April 5, Seattle, WA.

Johnsen, T.E. (2000). *Ring meg! En studie av ungdom og mobiltelefoni*. Masters Thesis, Department of Culture Studies, University of Oslo, Norway.

Karahanna, E. and Limayem, M. (2000). Email and v-maul usage: Generalizing across technologies. *Journal of Organizational Computing*, 10, 49-66.

Karahanna, E., Straub, D.W. and Chervany, N.L. (1999). Information technology adoption across time: a cross-sectional comparison of pre-adoption and post-adoption beliefs. *MIS Quarterly*, 23, 183-213.

Karahanna E. and Straub, D.W. (1999). The psychological origins of perceived usefulness and ease-of-use. *Information & Management*, 35, 237-250.

Karlsen, M.A., Helgemo, I. and Gripsrud, M. (2001). *Useful, cheap and fun: A survey of teenagers demands for mobile telephony*. Research Report, Telenor R&D, Grimstad, Norway.

Kaseniemi, E. and Rautiainen, P. (2002). Mobile culture of children and teenagers in Finland. In Katz J.E. and Aakhus, M. (eds.). *Perpetual contact*. Cambridge University Press, New York.

Kim Y.B., Seo, S.Y. and Lee, Y. (1999). *A substitution and diffusion model with exogenous impact: Forecasting of IMT-2000 subscribers in Korea*. Presented at the IEEE VTC-99, May 16-20, Houston, TX.

Kraut, R., Mukhopadhyay, T., Szczypula, J., Kielser, S. and Scherlis, B. (1999). Information and communication: alternative uses of the Internet in households. *Information Systems Research*, 10, 287-303.

Kwon, H.S. and Chidambaram, L. (2000). *A test of the technology acceptance model: the case of cellular telephone adoption*. Proceedings of the HICSS-34, Hawaii, January 3-6.

LaRose, R. Mastro, D. and Easiton, M.S. (2001). Understanding Internet usage: A social-cognitive approach to uses and gratifications. *Social Science Computer Review*, 19, 395-413.

Larsson, C. (2000). *En mobiltelefon är inte bara en mobil telefon*. Magisteruppsats. Göteborgs Universitet, Gotenburg, Sweden.

Lee, B. and Lee, R.S. (1995) How and why people watch TV: implications for the future of interactive television. *Journal of Advertising Research*, November/ December, 9-18.

Leung, L. (2001). College student motives for chatting on the ICQ. *New Media & Society*, 3, 483-500.

Leung L. and Wei, R. (2000). More than just talk on the move: Uses and gratifications of the cellular phone. *J&MC Quarterly*, 77, 308-320.

Leung, L. and Wei, R. (1999a). Seeking news via the pager: An expectancy-value study. *Journal of Broadcasting & Electronic Media*, 43, 299-315.

Leung L. and Wei, R. (1998b). The gratifications of pager use: Sociability, information-seeking, entertainment, utility, and fashion and status. *Telematics and Informatics*, 15, 253-264.

Liker, J.K. and Sindi, A.A. (1997). User acceptance of expert systems: a test of the theory of reasoned action. *Journal of Engineering and Technology Management*, 14, 147-173.

Lin, C.A. (1996). Looking back: The contribution of Blumler and Katz's uses of mass communication to communication research. *Journal of Broadcasting & Electronic Media*, 40, 574-582.

Lin, C.A. (1999). On-line service adoption likelihood. *Journal of Advertising*, March-April, 79-89

Ling, (2001a). "We release them little by little": Maturation and gender identity as seen in the use of mobile telephony. *Personal and Ubiquitous Computing*, 5, 123-136.

Ling, R. (2001b). *"It is 'in.' It doesn't matter if you need it or not, just that you have it.": Fashion and the domestication of the mobile telephone among teens in Norway*. Working Paper, Telenor R&D, Oslo, Norway.

Ling, R. (2001c). *Adolescent girls and young adult men: Two sub-cultures of the mobile telephone*. Presented at the InterMedia workshop on mobility, Nov 20, Oslo, Norway.

Ling, R. (2000). Direct and mediated interaction in the maintenance of social relationships. In Sloane, A, og van Rijn, F (red.) *Home informatics and telematics. Information technology and society*. p. 61-86, Kluwer. Boston.

Ling, R. (1997). "One can talk about common manners!": the use of mobile telephones in inappropriate situations." In Haddon, L (ed). *Themes in mobile telephony*. Cost 248 Report, Telia, Farsta, Sweden.

Ling, R. and Yttri, B. (2002). Hyper-coordination via mobile phone in Norway. In Katz J.E. and Aakhus, M. (eds.). *Perpetual contact*. Cambridge University Press, New York.

Loch, C.H. and Huberman, B.A. (1999). A punctuated-equilibrium model of technology diffusion. *Management Science*, Vol. 45, No. 2, s. 160-177.

Mahajan, V., Muller, E. and Bass, F.M. (1990). "New product diffusion models in marketing: A review and directions for research". *Journal of Marketing*, 54, 1-27.

Mahler, A. and Rogers, E.M. (2000). The diffusion of interactive telecommunication innovations and the critical mass: the adoption of telecommunication services by German banks. *Telecommunications Policy*, 23, 719-740.

Manning, P.K. (1996). Information technology in the police context: The "sailor" phone. *Information Systems Research*, 7, 52-62.

Mante-Meyer, E. and Haddon, L. (Eds.) (2001). *Checking it out with the people – ICT markets and users in Europe* Eurescom Project Report, P903, Eurescom, Heidelberg,.

Markus, M.L. (1994). Electronic mail as the medium of managerial choice. *Organization Science*, 5, 502-527.

Mathieson, K. (1991) Predicting user intentions: comparing the technology acceptance model with the theory of planned behavior. *Information Systems Research*. 2, 173-191.

Mathieson, K. Peacock, E. and Chin, W.W. (2001). Extending the technology acceptance model: The influence of perceived user resources. *Advances in Information Systems*, 32, 86-112.

Mittal, B. (1994) A study of the concept of affective choice mode for consumer decisions. *Advances in Consumer Research*, 21, 256-263

MobileSpring (2002). The SMS Market. MobileSpring Announcement, MobileSpring Inc, [http://www.mobilespring.com/a_sms_mkt.html].

Nardi B., Whittaker, S. and Bradner E. (2000*). Interaction and outeraction: Instant messaging in action*. Presented at CSCW-00, Dec 2-6, Philladelphia, PA.

Nettavisen (2002). Vi tekster for halvannen milliard. Nettavisen, May 8, [http://www.nettavisen.no/servlets/page?section=9&item=213127].

O'Hara, .K., Perry, M., Sellen, A.J. and Brown, B. A. T. (2001) Exploring the relationship between mobile phone and document use during business travel.

In Brown, B., Green, N., Harper, R. (eds.) *Wireless World: social and interactional implications of wireless technology*. Springer Verlag.

Oksman, V. and Raitiainen, P. (2001). *"Perhaps it is a body part". How the mobile phone became an organic part of the everyday lifes of children and teenagers.* Presented at the 15. Nordiska konferensen för medie- ock kommunikationsforskning, Reykjavik, Island, August, 11-13.

Palen, L., Salzman, M. and Youngs, E. (2001). Discovery and integration of mobile communications in everyday life. *Personal and Ubiquitous Computing*, 5, 109-122.

Papacharissi, Z. and Rubin, A.M. (2000). Predictors of Internet use. *Journal of Broadcasting & Electronic Media*, 44, 175-196.

Pedersen, P.E. (2001). *Adoption of mobile commerce: An exploratory analysis*. SNF-Report 51/01, Institute for Research in Economics and Business Report, Bergen, Norway.

Pedersen, P.E. (forthcoming). Adoption of mobile Internet services: An exploratory study of mobile commerce early adopters. To appear in *Journal of Organizational Computing and Electronic Commerce*.

Plant, S. (2001). *On the mobile. The effects of mobile telephones on social and individual life*. Research Report, Motorola, US.

Puro, J.P. (2002). Israel: chutzpah and chatter in the Holy Land. In Katz J.E. and Aakhus, M. (eds.). *Perpetual contact*. Cambridge University Press, New York.

Rakow, L.F., and Navarro, V. (1993). Remote mothering and the parallel shift: Women meet the cellular telephone. *Critical studies in mass communication*, 10, 144-157.

Rogers, E.M. (1995). *Diffusion of innovations* (4. ed). The Free Press, New York.

Rosenbaum, M. (1980). A schedule for assessing self-control behaviours: preliminary findings. *Behaviour Therapy*, 11, 109-121.

Rudy, I.A. (1996). A critical review of research on electronic mail. *European Journal of Information Systems*, 4, 198-213.

Rubin, A.M. (1981). An examination of television viewing motivations. *Communication Research*, 8, 141-165.

Schiano, D.J., Chen, C.P., Ginsberg, J., Gretarsdottir, U., Huddleston, M. and Isacs, E. (2002). *Teen use of messaging media*. Presented at Human Factors in Computing Systems: CHI'2002, April 20-25, Minneapolis, MN.

Schwartz, S.J., Mullis, R.L., Waterman, A.S. and Dunham, R.M. (2000). Ego identity status, identity style, and personal expressiveness. An empirical investigation of three divergent constructs. *Journal of Adolescent Research*, 15, 504-521

Segerstad, Y.H. af and Ljungstrand, P. (2001). Instant messaging with WebWho. *International Journal of Human-Computer Studies*, 56, 147-171.

Sillince, J.A.A. (1997). A media-attributes and design-choices theory of the information technology-organization relationship, *Journal of Organizational Computing*, 7, 279-303.

Silverstone, R. and Haddon, L. (1996a) *Television, Cable and AB Households: A Report for Telewest*, August, University of Sussex, UK.

Silverstone, R. and Haddon, L. (1996b). Design and the Domestication of Information and Communication Technologies: Technical Change and Everyday Life', In Silverstone, and Mansell (Eds). *Communication by Design. The Politics of Information and Communication Technologies*, Oxford University Press, Oxford.

Silverstone R. and Hirsch, E. (1992). *Consuming Technologies*, Routledge, London.

Sherry J., Lucas, K., Rechtsteiner, S. Brooks, C. and Wilson, B. (2001). *Video game use and gratifications as predictors of use and game preference.* Presented at the ICA convention, May 26.

Skog, B. (2002). Mobiles and the Norwegian teen: identity, gender and class. In Katz J.E. and Aakhus, M. (eds.). *Perpetual contact*. Cambridge University Press, New York.

Taylor, A.S. and Harper, R.H.R. (2001a). *The gift of the gab?: a design oriented sociology of young people's use of 'mobilZe!* Working Paper, Digital World Research Centre, University of Surrey, UK.

Taylor A.S. and Harper, R. (2001b). *Talking activity: young people and mobile phones*. Presented at the CHI 2001 Workshop on mobile communications, March 30- April 5, Seattle, WA.

Taylor, S. and Todd, P.A. (1995). Understanding information technology usage: a test of competing models. *Information Systems Research*, 6, 144-176.

Te'eni, D. (2001). Review: A cognitive-affective model of organizational communication for designing IT. *MIS Quarterly*, 25, 251-312.

The Register (2002). *SMS: make hay while the sun shines*. The Register, April, 25, [http://www.theregister.co.uk/content/archive/25021.html]

Thompson, S.H., Lim, V.K.G., and Lai, R.Y.C. (1999). Intrinsic and extrinsic motivation in Internet usage. *Omega*, 27, 25-37.

Tjøstheim, I. and Boge, K. (2001). *Mobile commerce – who are the potential customers?* Presented at COTIM-2001, July 18 - 20, Karlsruhe, Germany.

Townsend, A.M. (2000). Life in the real – mobile telephones and urban metabolism. *Journal of Urban Technology*, 7, 85-104.

Townsend, A.M., Demarie, S.M. and Hendrickson, A.R. (2001). Desktop video conferencing in virtual workgroups: anticipation, system evaluation and performance. *Information Systems Journal*, 11, 213-227.

Trevino, L.K., Webster, J. and Stein, E.W. (2000). Making connections: Complementary influences on communication media choices, attitudes and use. *Organization Science*, 11, 163-182.

Trevino, L.K. and Webster, J. (1992). Flow in computer-mediated communication. *Communication Research*, 19, 539-574.

Venkatesh V. and Davis, F.D. (2000). A theoretical extension of the technology acceptance model: four longitudinal field studies. *Management Science*, 46, 186-204.

Venkatesch, V. and Davis, F.D. (1996). A model of the antecedents of perceived ease of use: Development and test. *Decision Sciences*, 27, 451-481.

Venkatesh, V. and Morris, M.G. (2000). Why don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behavior. *MIS Quarterly*, 24, 115-139.

Walther, J.B. (1996). Computer-mediated communication: Impersonal, interpersonal and hyperpersonal interaction. *Communication Research*, 23, 3-43.

Waterman, A.S. (1993). *Psychometric properties of the Personally Expressive Activities Questionnaire.* Unpublished manuscript, The College of New Jersey, Ewing.

Webster, J. (1998). Desktop videoconferencing: experiences of complete users, wary users and non-users. *MIS Quarterly*, September, 257-286.

Webster J. and Trevino L.K. (1995). Rational and social theories as complementary explanations of communication media choices: Two policy-capturing studies. *Academy of Management Journal*, 38, 1544-1572.

Wei, R. (2001). From luxury to utility: A longitudinal analysis of cell phone laggards. *J&MC Quarterly*, 78, 702-719.

Weilenmann, A. and Larsson, C. (2000). On Doing 'Being Teenager'. Applying Ethnomethodology to the Analysis of Young People's Use of Mobile Phones. In L. Svensson, U. Snis, C. Sørensen, H. Fägerlind, T. Lindroth, M. Magnusson, C. Östlund (eds.). *Proceedings of IRIS 23.* Laboratorium for Interaction Technology, University of Trollhättan Uddevalla, Sweden.

Wellman, B. (2001). Physical place and cyberplace: the rise of personalized networking. *International Journal of Urban and Regional Research*, 25, 227-252.

Yttri, B. (1999). Homework and boundary work. *Telektronikk*, 95, 4, 39-47.

Zack, M.H. (1993). Interactivity and communication mode choice in ongoing management groups. *Information Systems Research*, 4, 207-239.

APPENDIX A

SNF

Side **1** av 4

Under er det listet opp en del **mobiltjenester** som brukes for å holde kontakt med venner og familie og for å skape nye kontakter.

Vi vil du skal angi om du har **brukt noen av disse mobiltjenestene og om du har tenkt å bruke noen av dem de nærmeste seks månedene**. Hvis du **ikke** har brukt tjenestene vil vi likevel at du svarer på om du har tenkt å bruke noen av dem de nærmeste seks månedene. Husk at spørsmålet gjelder om du har brukt eller har tenkt å bruke disse tjenestene via **mobiltelefonen**.

Angi hvor mye du har brukt eller hvor mye du har tenkt å bruke hver tjeneste på en skala fra 1 til 7, der **1 er svært lite** og **7 er svært mye**.

	Har brukt	Har tenkt å bruke neste seks månedene
	Svært lite..... Svært mye 1 2 3 4 5 6 7	Svært lite..... Svært mye 1 2 3 4 5 6 7
Sende **vanlig tekstmelding** til venner eller familie	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
Sende **tekstmelding med tegning** (animert/dynamisk/flash) til venner eller familie	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
Sende **tekstmelding til en gruppe** av venner/familie (venneliste)	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
Sende tekstmelding til **ukjente**	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
Dele tekstmelding ved å **vise den til andre** på telefonen	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
Dele tekstmelding med andre ved å **lagre de** på felles område på Internett	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
Sende **bildebeskjed** (eventuelt også med lyd) til venner eller familie	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
	Svært lite..... Svært mye 1 2 3 4 5 6 7	Svært lite..... Svært mye 1 2 3 4 5 6 7
Egen **talepostkasse** (telefonsvarertjeneste)	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
Mobil tjeneste som gjør at flere kan delta i samme samtale (**telefonmøte**)	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
Mobil tjeneste som gjør at venner eller familie kan **dele kalender eller oppslagstavle**	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
Mobil tjeneste for å finne ut hvem som har et bestemt **telefonnummer**	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
Mobil tjeneste for å finne ut **hvor** noen befinner seg (buddy, lokasjonstjeneste)	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
Mobil tjeneste for **kontaktannonser**	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
	Svært lite..... Svært mye 1 2 3 4 5 6 7	Svært lite..... Svært mye 1 2 3 4 5 6 7
Mobil tjeneste for å "**chatte**" med venner og kjente	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
Mobil tjeneste for å "**chatte**" med ukjente	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
Mobil **flørtetjeneste**	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
Mobil flørtetjeneste som angir **hvor** de/den du flørter med befinner seg	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
	Svært lite..... Svært mye 1 2 3 4 5 6 7	Svært lite..... Svært mye 1 2 3 4 5 6 7
Sende tekstmelding til en tjeneste under et **TV-program** (f. eks. Sone2)	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
Mobil adgang til **diskusjonsforum** for å diskutere bestemte emner	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
Sjekke **epost** via mobilen	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
Sende epost via mobilen	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
Sende epost til flere venner **samtidig** (epostlister) via mobilen	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐

Fortsett på neste side når du er ferdig.....

Side **2** av 4

Vi vil at du nå skal **konsentrere deg** om **tekstmeldingstjenester** som på ulike måter brukes for å **holde kontakt med eller komme i kontakt med andre**.

Eksempler på slike **tekstmeldingstjenester** er det å sende tekstmeldinger til venner eller familie, "chattetjenester" og flørtetjenester. Bruk av SMS for å motta logoer og ringetoner til mobiltelefoner er **ikke** relevant i denne sammenheng.

Vennligst ta stilling til følgende utsagn, der du angir grad av enighet på en skala fra 1 til 7 der **1 er svært uenig** og **7 er svært enig**:	Svært uenig.....Svært enig 1 2 3 4 5 6 7
Det er lett å lære å bruke tekstmeldingstjenester	☐ ☐ ☐ ☐ ☐ ☐ ☐
Det er lett å få tekstmeldingstjenestene til å gjøre det jeg vil at de skal	☐ ☐ ☐ ☐ ☐ ☐ ☐
Bruken av tekstmeldingstjenester er enkel og forståelig	☐ ☐ ☐ ☐ ☐ ☐ ☐
Det er lett å forstå og tolke innholdet i tekstmeldinger	☐ ☐ ☐ ☐ ☐ ☐ ☐
Det er lett å bruke tekstmeldingstjenester	☐ ☐ ☐ ☐ ☐ ☐ ☐
Det forventes at folk som jeg bruker tekstmeldingstjenester	☐ ☐ ☐ ☐ ☐ ☐ ☐
De som betyr noe for meg forventer at jeg bruker tekstmeldingstjenester	☐ ☐ ☐ ☐ ☐ ☐ ☐
Folk jeg ser opp til forventer at jeg bruker tekstmeldingstjenester	☐ ☐ ☐ ☐ ☐ ☐ ☐

Angi langs en **skala fra 1 til 7** hvordan du, sett under ett, ser på **bruken av tekstmeldingstjenester** :

Dårlig	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Bra
Ufornuftig	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Fornuftig
Ugunstig	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Gunstig
Unyttig	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Nyttig
Negativ	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Positiv

Vennligst ta stilling til følgende utsagn, der du angir grad av enighet på en skala fra 1 til 7 der **1 er svært uenig** og **7 er svært enig**:	Svært uenig.....Svært enig 1 2 3 4 5 6 7
Tekstmeldingstjenester gjør at jeg sparer tid når jeg holder kontakt med venner og familie	☐ ☐ ☐ ☐ ☐ ☐ ☐
Tekstmeldingstjenester gjør meg mer sosial og tilgjengelig	☐ ☐ ☐ ☐ ☐ ☐ ☐
Tekstmeldingstjenester gjør meg til en person det er lettere å ha kontakt med	☐ ☐ ☐ ☐ ☐ ☐ ☐
Tekstmeldingstjenester er nyttige for å opprettholde kontakt med venner og familie	☐ ☐ ☐ ☐ ☐ ☐ ☐
Med tekstmeldingstjenester blir kontakten jeg har med andre bedre enn uten	☐ ☐ ☐ ☐ ☐ ☐ ☐
Massemediene er fulle av rapporter, artikler og nyheter som hevder at bruk av tekstmeldingstjenester er smart	☐ ☐ ☐ ☐ ☐ ☐ ☐
I medier og reklame finner en til stadighet anbefalinger om å bruke tekstmeldingstjenester	☐ ☐ ☐ ☐ ☐ ☐ ☐
I skolesammenheng er det anbefalt at man bruker tekstmeldingstjenester	☐ ☐ ☐ ☐ ☐ ☐ ☐
	Svært uenig.....Svært enig 1 2 3 4 5 6 7
Tekstmeldingstjenester er noe jeg ofte snakker med andre eller er sammen med andre om	☐ ☐ ☐ ☐ ☐ ☐ ☐
Tekstmeldinger er noe jeg ofte viser fram til andre	☐ ☐ ☐ ☐ ☐ ☐ ☐
Jeg uttrykker min personlighet gjennom å bruke tekstmeldingstjenester	☐ ☐ ☐ ☐ ☐ ☐ ☐
Å bruke tekstmeldingstjenester gir meg status	☐ ☐ ☐ ☐ ☐ ☐ ☐

Fortsett på neste side når du er ferdig.....

Side **3** av 4

Fortsett å ta utgangspunkt i **tekstmeldingstjenester**, og besvarer følgende spørsmål.

Vennligst ta stilling til følgende utsagn, der du angir grad av enighet på en skala fra 1 til 7 der **1 er svært uenig** og **7 er svært enig**:	Svært uenig.....Svært enig 1 2 3 4 5 6 7
Alle vennene mine bruker tekstmeldingstjenester	☐ ☐ ☐ ☐ ☐ ☐ ☐
I familien og på jobben synes alle at tekstmeldingstjenester er noe man bør bruke	☐ ☐ ☐ ☐ ☐ ☐ ☐
Vennene mine synes at alle i vennekretsen burde bruke tekstmeldingstjenester	☐ ☐ ☐ ☐ ☐ ☐ ☐
Jeg får stadig anbefalinger fra venner om å bruke nye tekstmeldingstjenester eller å bruke dem på nye måter	☐ ☐ ☐ ☐ ☐ ☐ ☐
Jeg føler meg fri til å bruke de tekstmeldingstjenester jeg selv ønsker	☐ ☐ ☐ ☐ ☐ ☐ ☐
Jeg har fullstendig kontroll over bruken av tekstmeldingstjenester	☐ ☐ ☐ ☐ ☐ ☐ ☐
Generelt sett har jeg de midler og ressurser jeg trenger for å bruke tekstmeldingstjenester	☐ ☐ ☐ ☐ ☐ ☐ ☐
Jeg har tenkt å bruke tekstmeldingstjenester for å holde kontakt med venner og familie de neste seks månedene	☐ ☐ ☐ ☐ ☐ ☐ ☐
Jeg har tenkt å bruke tekstmeldingstjenester mye de neste seks månedene	☐ ☐ ☐ ☐ ☐ ☐ ☐
Jeg har tenkt å bruke flere forskjellige tekstmeldingstjenester de neste seks månedene	☐ ☐ ☐ ☐ ☐ ☐ ☐
	Svært uenig.....Svært enig 1 2 3 4 5 6 7
Generelt sett ønsker jeg å gjøre det mine venner synes jeg burde gjøre	☐ ☐ ☐ ☐ ☐ ☐ ☐
Generet sett ønsker jeg å gjøre det familien og lærerne synes jeg burde gjøre	☐ ☐ ☐ ☐ ☐ ☐ ☐
Jeg og vennene mine bruker de samme tekstmeldingstjenestene	☐ ☐ ☐ ☐ ☐ ☐ ☐
Jeg trenger ikke hjelp av andre for å bruke tekstmeldingstjenester	☐ ☐ ☐ ☐ ☐ ☐ ☐
Jeg har tilstrekkelig tid til å bruke tekstmeldingstjenester på en smart måte	☐ ☐ ☐ ☐ ☐ ☐ ☐
Jeg har de kunnskaper og ferdigheter som er nødvendig for å bruke tekstmeldingstjenester	☐ ☐ ☐ ☐ ☐ ☐ ☐
Jeg føler at jeg behersker tekstmeldingstjenester fint på egenhånd	☐ ☐ ☐ ☐ ☐ ☐ ☐
	Svært uenig.....Svært enig 1 2 3 4 5 6 7
Jeg får nødvendig hjelp og støtte til å kunne bruke tekstmeldingstjenester	☐ ☐ ☐ ☐ ☐ ☐ ☐
Jeg har de økonomiske ressursene som er nødvendig for å bruke tekstmeldingstjenester	☐ ☐ ☐ ☐ ☐ ☐ ☐
Jeg har god tilgang på det som trengs av teknisk utstyr for å bruke tekstmeldingstjenester	☐ ☐ ☐ ☐ ☐ ☐ ☐
Tekstmeldingstjenestene jeg bruker er stabile og henger godt sammen med andre måter å holde kontakt med venner og familie på	☐ ☐ ☐ ☐ ☐ ☐ ☐
Det teleselskapet jeg bruker tilrettelegger godt for bruk av tekstmeldingstjenester	☐ ☐ ☐ ☐ ☐ ☐ ☐
Tekstmeldingstjenester fungerer fint sammen med andre tjenester jeg bruker for å holde kontakt med venner og familie	☐ ☐ ☐ ☐ ☐ ☐ ☐

Fortsett på neste side når du er ferdig.....

Side **4** av 4

Fortsett å ta utgangspunkt i **tekstmeldingstjenester**, og besvarer følgende spørsmål.

Vennligst ta stilling til følgende utsagn, der du angir grad av enighet på en skala fra 1 til 7 der **1 er svært uenig** og **7 er svært enig**:	Svært uenig.....Svært enig 1 2 3 4 5 6 7
Jeg synes det er underholdende å bruke tekstmeldingstjenester	☐ ☐ ☐ ☐ ☐ ☐ ☐
Jeg synes det å bruke tekstmeldingstjenester er hyggelig i seg selv	☐ ☐ ☐ ☐ ☐ ☐ ☐
Å bruke tekstmeldingstjenester er spennende	☐ ☐ ☐ ☐ ☐ ☐ ☐
Det er morsomt å bruke tekstmeldingstjenester	☐ ☐ ☐ ☐ ☐ ☐ ☐
Sammenliknet med andre sender jeg mange tekstmeldinger	☐ ☐ ☐ ☐ ☐ ☐ ☐
Jeg sender massevis av tekstmeldinger for å holde kontakt med venner og familie	☐ ☐ ☐ ☐ ☐ ☐ ☐
Jeg ser på meg selv som en storforbruker av tekstmeldingstjenester	☐ ☐ ☐ ☐ ☐ ☐ ☐
Vennligst besvar følgende spørsmål:	
Omtrent hvor mange tekstmeldinger sender du om dagen?	☐ stykker
Omtrent hvor mange telefonsamtaler har du om dagen?	☐ stykker
Omtrent hvor mange penger bruker du på mobiltelefonsamtaler og tekstmeldinger pr. måned?	☐ kroner
Vennligst ta stilling til følgende utsagn om **mobiltjenester mer generelt** (ikke spesielt for tekstmeldingstjenester):	Svært uenig.....Svært enig 1 2 3 4 5 6 7
Jeg er generelt blant de første i min vennekrets som tar i bruk nye mobiltjenester	☐ ☐ ☐ ☐ ☐ ☐ ☐
Hvis jeg hører om en ny mobiltjeneste som er kommet er jeg svært interessert i å prøve den ut	☐ ☐ ☐ ☐ ☐ ☐ ☐
Sammenliknet med mine venner bruker jeg mange nye mobiltjenester	☐ ☐ ☐ ☐ ☐ ☐ ☐
Jeg er generelt blant de første i min vennekrets som har hørt om nye mobiltjenester når de kommer på markedet	☐ ☐ ☐ ☐ ☐ ☐ ☐
Jeg prøver ut nye mobiltjenester selv om jeg ikke har hørt om andre som har prøvd dem	☐ ☐ ☐ ☐ ☐ ☐ ☐
Jeg vet om nye mobiltjenester før folk flest har hørt om dem	☐ ☐ ☐ ☐ ☐ ☐ ☐
Vennligst besvar følgende spørsmål:	
Hva er din alder?	☐ år
Er du kvinne eller mann?	☐ Kvinne ☐ Mann
Hva slags abonnement har du på mobiltelefonen?	☐ Ring kontant ☐ Abonnement med regning

Tusen takk for innsatsen!
Husk å levere slippen med din kontaktadresse og beholde delen med kontrollnummer.

PUBLIKASJONER INNEN TELEØKONOMI 1998 –

Pedersen, Per E.	The adoption of text messaging services among Norwegian teens: development and test of an extended adoption model. SNF-Report No. 23/2002, Bergen.
Foros, Øystein Kind, Hans Jarle Sand, Jan Yngve	*Do Incumbents Have Incentives to Degrade Interconnection Quality in the Internet?* SNF-Working paper No. 22/2002, Bergen.
Fjell, Kenneth	*Elasticity based pricing rules in telecommunications – a cautionary note* SNF-Working paper No. 19/2002, Bergen.
Kristoffersen, Siri Hege	*Prising og uforstand – ein analyse av prissetjing med ufullstendig informerte konsumentar i den norske marknaden for mobiltelefoni* SNF-rapport nr. 54/2001, Bergen.
Pedersen, Per E.	*Adoption of mobile commerce: An exploratory analysis* SNF-Report No. 51/2001, Bergen.
Gabrielsen, Tommy Stahl Vagstad, Steinar	*On how size and composition of customer bases affect equilibrium in a duopoly with switching cost* SNF-Working paper No. 26/2001, Bergen.
Berge, Laila Kristin	*Prisdiskriminering i oligopol -en teoretisk gjennomgang og eksempler fra telemarkedet* SNF-rapport nr. 13/2001, Bergen.
Bjørndal, Mette Jørnsten, Kurt	*An Analysis of a Combinatorial Auction.* SNF-Working paper No. 19/2001, Bergen.
Vagstad, Steinar	*Price discrimination with uncertain consumers.* SNF-Working Paper No. 12/2001, Bergen.
Gooderham, Paul N. Ulset, Svein	*Knowledge transfer between parent and developing country subsidiaries. A Conceptual Framework.* SNF-Working Paper No. 08/2001, Bergen.
Staahl Gabrielsen, Tommy Vagstad, Steinar	*Second-period pricing in a duopoly with switching costs: the effect of size and composition of customer bases.* SNF-Working Paper No. 09/2001, Bergen.
Pedersen, Per E.	*Adopsjon av mobil handel (m-handel) -en forstudie* SNF-rapport nr. 07/2001, Bergen.

Hundsnes, Tore	*The Management of Complexity* SNF-Report No. 58/2000, Bergen.
Knivsflå, Kjell Henry Rud, Linda Sættem, Frode	*Kapitalnettverk for små og mellomstore bedrifter* SNF-rapport nr. 72/2000, Bergen.
Foros, Øystein	*Strategic Investments with Spillovers, Vertical Integration and Foreclosure in the Broadband Access Market* SNF-Working Paper No 75/2000, Bergen
Lommerud, Kjell Erik Sørgard, Lars	*Entry in Telecommunication: Customer Loyalty, Price Sensitivity and Access Prices.* SNF-Working Paper No. 62/2000, Bergen.
Munkeby, Trygve Osvoll	*Konkurransen mellom norske internetleverandørar.* SNF-rapport nr. 48/2000, Bergen.
Pedersen, Per E. Methlie, Leif B.	*Tjenesteintegrering i elektronisk handel.* SNF-rapport nr. 21/2000, Bergen.
Methlie, Leif B. Pedersen, Per E.	*MAP-IT: A Model of intermediary Integration Strategies in online Markets.* SNF-Working Paper No. 26/2000, Bergen.
Gabrielsen, Tommy Staahl Vagstad, Steinar	*Consumer heterogeneity and pricing in a duopoly with switching costs.* SNF-Working Paper No. 25/2000, Bergen.
Ulset, Svein Gooderham, Paul	*Internasjonalisering av telesektoren. Generelle lærdommer og spesielle utfordringer for Telenor.* SNF-arbeidsnotat nr. 16/2000, Bergen.
Ulset, Svein	*Virtual Network Operation. Strategy, Structure and Profitability.* SNF-Working Paper No. 15/2000, Bergen.
Foros, Øystein Kind, Hans Jarle Sørgard, Lars	*Access Pricing, Quality Degradation and Foreclosure in the Internet.* SNF arbeidsnotat nr. 12/2000, Bergen.
Foros, Øystein Sand, Jan Yngve	*Asymmetrisk regulering innen telekommunikasjon.* SNF særtrykk nr. 03/2000, Bergen.
Ulset, Svein	*Ekspansive teleselskap. Finansiering, organisering og styring.* SNF-rapport nr. 64/1999, Bergen.

Sannarnes, Jan Gaute	*Ulike reguleringsregimer i telesektoren sett ut fra et dynamisk perspektiv.* SNF-rapport nr. 58/1999, Bergen.
Seime, Gunn Randi	*Konkurransen i det norske mobiltelefonimarkedet.* SNF-rapport nr. 49/1999, Bergen.
Methlie, Leif B. Pedersen, Per E.	*Multimedia Banking* *Bankenes strategiske situasjon. Ny teknologi – ny konkurransearena – ny struktur.* SNF-rapport nr. 41/1999, Bergen.
Pedersen, Per E.	*Multimedia Banking* *Programvareagenter i elektronisk handel. En kartlegging med vekt på agentbaserte tjenester og finanstjenestesektoren.* SNF-rapport nr. 40/1999, Bergen.
Pedersen, Per E.	*Multimedia Banking* *En agentbasert tjeneste for produkt- og leverandør-sammenlikning av finanstjenester.* SNF-rapport nr. 39/1999, Bergen.
Pedersen, Per E. Nysveen, Herbjørn Jensen, Leif Magnus	*Multimedia Banking* *En eksperimentell studie av atferdskonsekvenser ved bruken av agentbaserte tjenester i finanssektoren.* SNF-rapport nr. 38/1999, Bergen.
Fjell, Kenneth Foros, Øystein Gabrielsen, Tommy S. Hagen, Kåre P. Sørgard, Lars Vagstad, Steinar	*Problemstillinger for videre forskning på prising av tele-tjenester.* SNF-rapport nr. 27/1999, Bergen.
Fjell, Kenneth Hagen, Kåre P.	*Oversikt over forskningsprogrammet i teleøkonomi ved SNF: 1996-1998.* SNF-rapport nr. 26/1999, Bergen.
Fjell, Kenneth Foros, Øystein Hagen, Kåre P. Sørgard, Lars	*Telenor – bare lave priser ?* *Drøfting av Telenors rabattstruktur utfra et bedriftsøkonomisk og samfunnsøkonomisk perspektiv.* SNF-rapport nr. 23/1999, Bergen.
Staahl Gabrielsen, Tommy Vagstad, Steinar	*Konkurranseform i telesektoren: Hvordan rasjonalisere observert atferd?* SNF-rapport nr. 65/1998, Bergen.

Altenborg, Ellen	*Koordinering og insentiver i samarbeid om produktutvikling mellom forretningsområder i Telenor.* SNF-rapport nr. 39/98, Bergen
Methlie, Leif	*Multimedia Banking* *Strukturendring i bank. Distribusjon – grovanalyse*. SNF-arbeidsnotat nr. 31/1998, Bergen.
Methlie, Leif	*Multimedia Banking* *Strukturendring i bank. Strategisk posisjonering – grovanalyse.* SNF-arbeidsnotat nr. 30/1998, Bergen.
Foros, Øystein Ulset, Svein	*Naturlige grenser for teleselskapene.* SNF populærvitenskapelig særtrykk nr. 10/1998, Bergen.
Ulset, Svein Spiller, Pablo	*Organizing Global Seamless Networks: Contracts, Alliances and Hierarchies.* SNF Reprint No. 26/1998, Bergen.
Ulset, Svein	*Infrastruktur og konkurranse i telesektoren.* SNF særtrykk nr. 27/1998, Bergen.
Ulset, Svein	*Value-Creating Interconnect* *International Competition in Global Network Services. Technology, Organization and Performances.* SNF-report No. 28/1998, Bergen.
Ulset, Svein	*Value-Creating Interconnect* *Optimal Organization of the Converging Information and Communication Technology (ICT) Industries.* *Theoretical analysis and some illustrative data from the Norwegian market.* SNF-report No. 27/1998, Bergen.
Methlie, Leif B. Nysveen, Herbjørn	*Multimedia Banking* *Kundeatferd ved bruk av Internett og andre kanaler.* SNF-rapport nr. 29/1998, Bergen.
Ulset, Svein	*Verdiskapende samtrafikkavtaler.* *Hvordan kan organisering av infrastruktur bidra til utvikling av bedre og billigere teletjenester. En analyse av betingelsene for konkurranse og samarbeid i telesektoren.* SNF-rapport nr. 25/1998, Bergen.
Spiller, Pablo T.	*Value-Creating Interconnect.* *Unbundling and the Promotion of Local Telephone Competition: Is Unbundling Necessary in Norway?* SNF-Report No. 03/1998, Bergen.

Bjørnenak, Trond Gabrielsen, Tommy Staahl Vagstad, Steinar	*Verdiskapende samtrafikkavtaler.* *Prising av samtrafikk.* SNF- rapport nr. 02/1998, Bergen.
Andersen, Christian Sannarnes, Jan Gaute	*Analyse af tilgangsafgifter ved irreversible investeringer under usikkerhed.* SNF-rapport nr. 07/1998, Bergen.

Oversikt over publikasjoner innen teleøkonomi i perioden 1992-1997 fås ved henvendelse til tonje.skaar@snf.no, telefon 55 95 95 00.