Sanna Sintonen

OLDER CONSUMERS ADOPTING INFORMATION AND COMMUNICATION TECHNOLOGY: EVALUATING OPPORTUNITIES FOR HEALTH CARE APPLICATIONS

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ABSTRACT

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The purpose of this dissertation is to analyse older consumers' adoption of information and communication technology innovations, assess the effect of aging related characteristic, and evaluate older consumers' willingness to apply these technologies in health care services. This topic is considered important, because the population in Finland (as in other welfare states) is aging and thus offers a possibility for marketers, but on the other hand threatens society with increasing costs for healthcare.

Innovation adoption has been under research from several aspects in both organizational and consumer research. In the consumer behaviour, several theories have been developed to predict consumer responses to innovation. The present dissertation carefully reviews previous research and takes a closer look at the theory of planned behaviour, technology acceptance model and diffusion of innovations perspective. It is here suggested that there is a possibility that these theories can be combined and complemented to predict the adoption of ICT innovations among aging consumers, taking the aging related personal characteristics into account. In fact, there are very few studies that have concentrated on aging consumers in the innovation research, and thus there was a clear indent for the present research. ICT in the health care context has been studied mainly from the organizational point of view. If the technology is thus applied for the communication between the individual end-user and service provider, the end-user cannot be shrugged off.

The present dissertation uses empirical evidence from a survey targeted to 55-79 year old people from one city in Southern-Carelia. The empirical analysis of the research model was mainly based on structural equation modelling that has been found very useful on estimating causal relationships. The tested models were targeted to predict the adoption stage of personal computers and mobile phones, and the adoption intention of future health services that apply these devices for communication.

The present dissertation succeeded in modelling the adoption behaviour of mobile phones and PCs as well as adoption intentions of future services. Perceived health status and three components behind it (depression, functional ability, and cognitive ability) were found to influence perception of technology anxiety. Better health leads to less anxiety. The effect of age was assessed as a control variable, in order to evaluate its effect compared to health characteristics. Age influenced technology perceptions, but to lesser extent compared to health. The analyses suggest that the major determinant for current technology adoption is perceived behavioural control, and additionally technology anxiety that indirectly inhibit adoption through perceived control. When focusing on future service intentions, the key issue is perceived usefulness that needs to be highlighted when new services are launched. Besides usefulness, the perception of online service reliability is important and affects the intentions

indirectly. To conclude older consumers' adoption behaviour is influenced by health status and age, but also by the perceptions of anxiety and behavioural control. On the other hand, launching new types of health services for aging consumers is possible after the service is perceived reliable and useful.

Keywords: Aging consumers, innovation adoption, healthcare services, information and communication technology
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Imatra, November 2008

Sanna Sintonen

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LIST OF ABBREVIATIONS

General abbreviations:

ADL	Activities of daily living
AVE	Average variance extracted
AGFI	Adjusted goodness of fit
CR	Construct reliability
DOI	Diffusion of innovation
GFI	Goodness of fit index
IADL	Instrumental activities of daily living
ICT	Information and communication technology
IS	Information system
IT	Information technology
MP	Mobile phone
NFI	Normed fit index
NNFI	Non-normed fit index
PC	Personal computer
RMSEA	Root mean square error of approximation
SEM	Structural equation modelling
SMS	Short messaging services
TAM	Technology acceptance model
TPB	Theory of planned behaviour
TRA	Theory of reasoned action

Abbreviations in path diagrams:

ADL	Activities of daily living
ANX	Anxiety
BIU	Behavioural intention to use
CA	cognitive ability
DEPR	depression
MP	mobile phone
PBC	perceived behavioural control
PEU	perceived usefulness
PC	personal computer
PH	perceived health
REL	reliability

1 INTRODUCTION

1.1 Background

Aging and increasing public sector costs are topical issues in the society. The deepest background of the dissertation is behind the aging of population structure in Finland. At the end of 2006 the share of people older than 60 was 22.5 percentage (Väestörekisterikeskus, 2007). This share is about rise in the future (Figure 1). In 2010 it will be 25 %, and it keeps rising quite smoothly being almost 33 % in 2040 (Statistics Finland, 2007). Aging of the population has numerous consequences that do not only alter at the governmental level; the influences reach the inhabitant level very strongly. The population has strongly centred round the big cities in recent years. This development has led older people to remain in their home district, thus in worst cases they end up hundreds of kilometres away from their children.

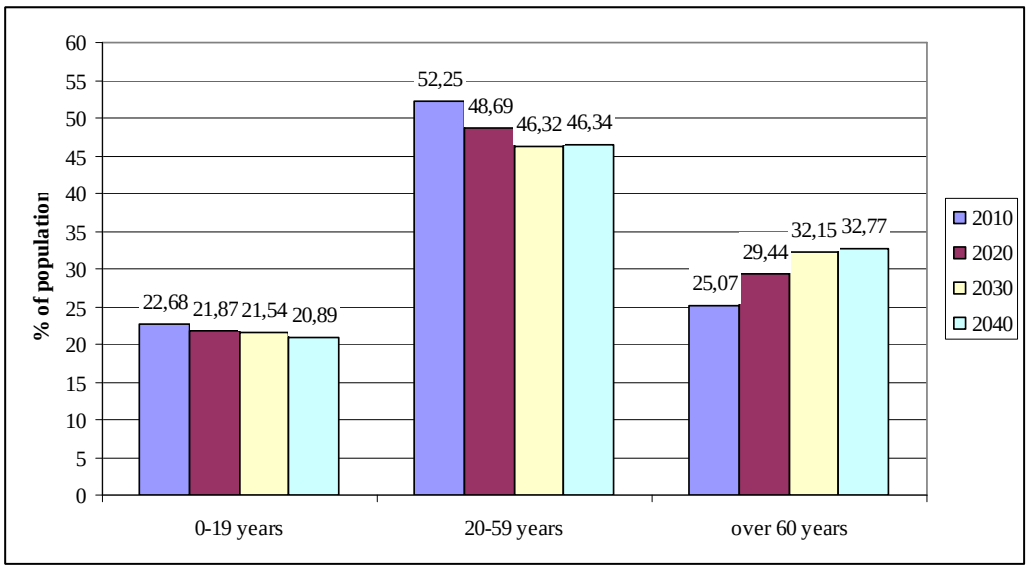

Figure 1 Forecast of age structure 2010-2040 (Source: Sotkanet Database, 2008)

Aging thus lays pressure for governments with increasing costs for health care and challenges for individual well-being. On the other hand, the far progressed diffusion of information and communication technology (ICT) offers an interesting context for research (Figure 2).

Amount of mobile subscription exceeded the amount of population in 2005, and more than half of Finnish households use broadband connections. Internet may be used by older people for communicating with family and friends, performing routine tasks such as banking or shopping, and accessing information on health, community resources, and a variety of other topics (Sharit, Czaja, Perdomo and Lee, 2004). McMellon and Schiffman (2000) consider internet as a tool for aging individuals to develop adaptive strategies that maintain their internal and external structures, especially when mobility is restricted.

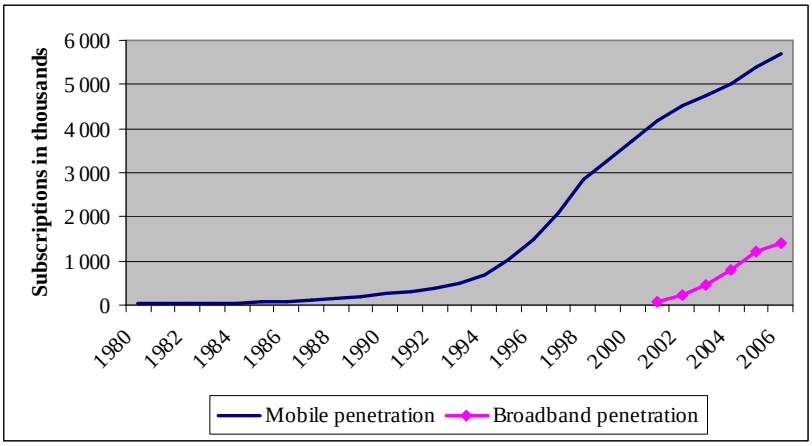

Figure 2 Mobile and broadband penetration in Finland till 2006 (Sources: Statistics Finland, 2006; GMID, 2008)

In Finland, the share of internet users of the population (between ages of 15 to 74) was rather high, 79 percent in 2007 (Figure 3). From the older users (60-74 years old), nearly 40 percent has become regular user of internet, this statistic however doesn't consider where the internet is accessed. For the elderly population, there are multiple ways to access internet (etc. libraries, internet cafes, internet access point in public service posts, friends, or relatives) besides an own broadband subscription. Rather promising is the trend that the amount of older consumers as internet users has been raising every year in this century.

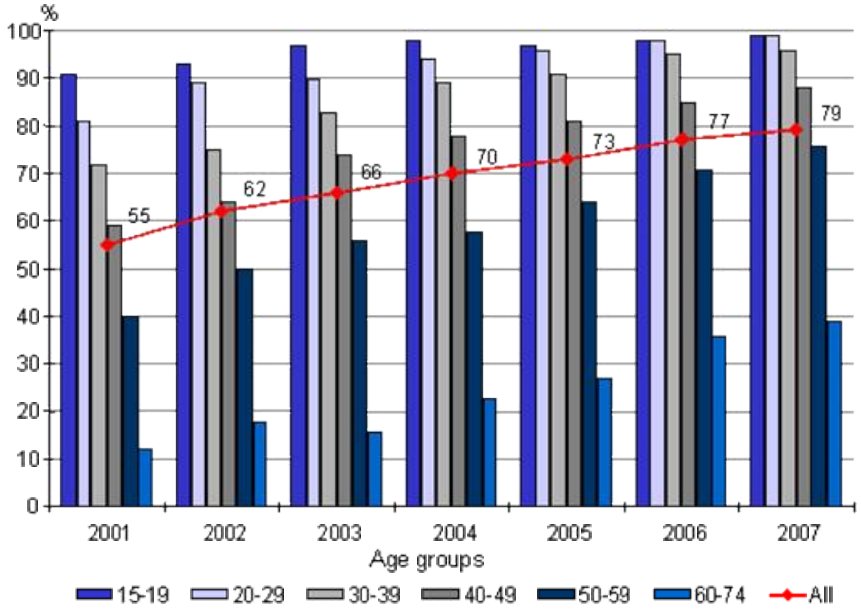

Figure 3 Percentage of internet users of 15 to 74-year-olds by age group from spring 2001 to spring 2007 (Statistics Finland, 2007)

Moschis (2003) summarizes that aging population is affecting governments, institutions and individuals, and that pension funds and health care systems are under pressure. Economic consequences reach economic growth, savings and investments. The dramatic growth in the elderly population expected in coming decades promises that the mature-consumer market will offer substantial opportunity for marketers who approach it with a solid understanding of all the factors that influence elderly consumers (Moschis and Mathur, 1993).

Besides the opportunities for health care information technology improvements, the increasing amount of elderly results new challenges for consumer markets with no exception in high-tech markets. As multipurpose information appliances become omnipresent in our daily lives, the ways that people use them and the reasons behind their usage should vary depending on the many different context of daily life (Hong and Tam, 2006). To make technology useful to, and usable by older adults, a challenge for the research and design community is to "know the user" and better understand the needs, preferences and abilities of older people (Czaja and Lee, 2007). Seniors are a large, growing and often financially secure market segment. While research shows that seniors' use of internet is expected to increase over time, marketers need to know if and how they can address this segment today with

technology to attract a senior market online, rather than wait for babyboomers to age (Iyer and Eastman, 2006). For innovation to be successful, technological opportunities need to match user need (Barlow, Bayer and Curry, 2006). Aging is a highly individualized process, and with increasing age there is an increase in inter-individual differences in rate, onset and direction of change in most functions and processes; thus one cannot draw conclusions on age-technology interaction on the basis of chronological age (Czaja and Lee, 2007).

1.2 Positioning and focus of the research

In the field of ICT innovations, the focus of innovation adoption research has mainly been in organizational adoption of innovations. These studies focus on resource benefits achieved through adopting new technologies at the organizational level (e.g. Moch and Morse, 1977; McDade, Oliva and Pirsch, 2002) and the others discuss innovation adoption within organizations at the employee level (Kim and Srivastava, 1998; Ruppel and Howard, 1998; Pae, Kim, Han and Yip, 2002). In the consumer markets, the innovation diffusion research at the macro level has however laid noticeable attention to forecasting the diffusion especially related to mobile subscription and broadband (Sundqvist, Frank and Puumalainen, 2005; Frank, Sundqvist, Puumalainen and Sintonen, 2006). Also research in innovation adoption has started to approach the micro level consumer market, but generally the studies have applied data covering the working aged consumers, as seen further in the literature review (Appendix 1). The market is however getting older everyday. This isn't just the issues in Finland; instead it is typical to every welfare state in the world.

The present study contributes mainly to the crossing of consumer marketing and information technology, but interposes also with gerontology and health care (Figure 4).

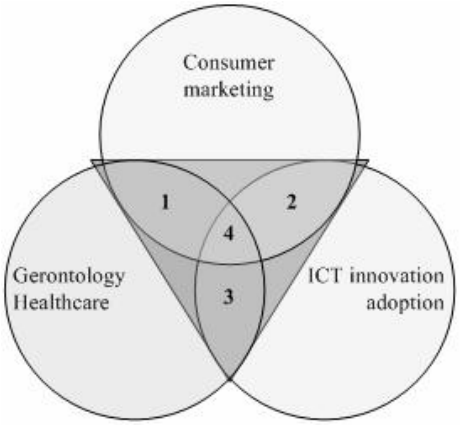

Figure 4 Positioning of the research

The positioning of the dissertation is based on the following premises in each of the gross-points:

1. Factors derived from gerontology should offer useful insights for consumer marketing. Targeting elderly just based on age cohort leaves marketing efforts rather weak and powerless.
2. ICT has the opportunity to launch new services for consumers market as the basic infrastructure is widely diffused. Consumer perceptions, especially older consumers, are important in defining, what are the preferences that lead to wider adoption of ICT.
3. Opportunities for ICT applications for health care are mutual for both organizational and individual purposes. ICT in health care can improve efficiency, but also support better quality for service and treatment.
4. The core area of the present research. Combining aging consumer markets and health care in the context information and communication technology adoption should provide beneficial outcomes for the industry, public health care and personal well-being.

The focus of the research is in the area of information and communication technology, and health care. The research field can be discussed through Figure 5. Aging in welfare states increases pressure in health care sector. There exists a huge threat to limited resources, both monetary and human. On the other hand in business world, ICT has been able to change the modes of action making cost efficiency improvements.

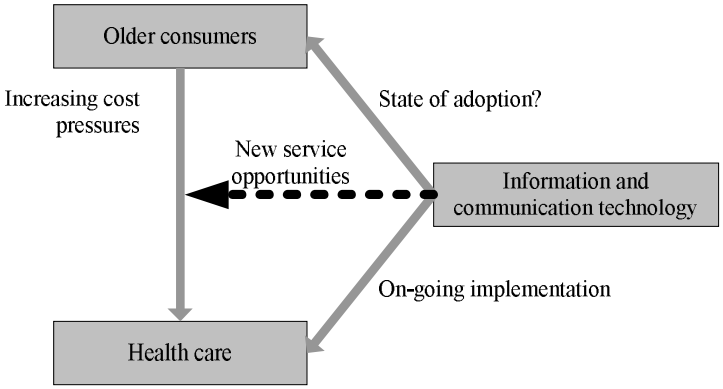

Figure 5 Focus of the research

The reason why health care is here discussed in the context of individual innovation adoption is that technology isn't completely utilized in the communication manners between health care providers and consumers. ICT has been implemented in health care organizations and at the national level; the pressure has been put upon electronic patient registers, electronic information exchange systems between organizations etc. Applications that change the mode of communication between patients and health care service providers are still waiting. The cost efficiency improvements have been noticed and the safety of patients has improved through ICT adoption at the organizational level. However, it seems that this is not enough, thus the communication and monitoring processes with the patient living at home should be under discussion. It is important to investigate whether new service technologies can be successfully introduced in health care sector and what are the factors that influence the acceptance and adoption of new technologies among end-users. Inadequate understanding of user needs, and an ensuing lack demand for products and services, is a major barrier in the implementation of 'smart homes' technologies, some of which are related to telecare systems (Barlow et al., 2006).

1.3 Research questions

The complex nature of human behaviour makes predictions related to innovation adoption rather difficult. The research in the field has resulted multiple models that include several of determinants that have had good explanatory power for predicting intentions and adoption

behaviour. Based on the discussion related research positioning and focus, the main purpose of the present thesis is

> *to analyse older consumers' adoption of ICT innovations, assess the effect of aging related characteristic, and evaluate older consumers' willingness to apply these technologies in health care services.*

Three main research questions are formed:

I. Which factors affect ICT adoption among older consumers?
II. What are the relationships between traditional factors affecting innovation adoption and aging related characteristics?
III. What is the readiness to apply existing technologies into new services and which are the main determinants behind it?

The research model is presented in Figure 6. The present study discusses aging related factors that control individuals' daily living as background factors that describe the aging market and are assumed to influence technology perceptions and innovation adoption.

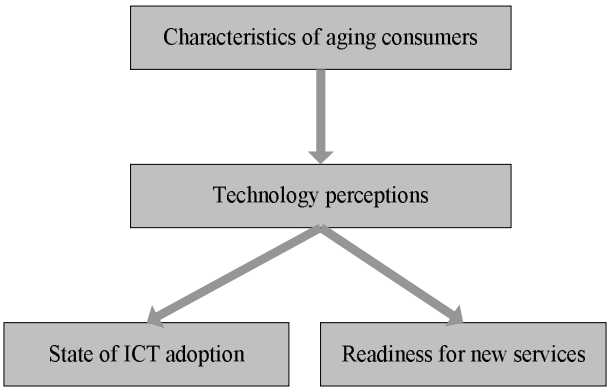

Figure 6 Research model

Simultaneously, it is suggested that the behavioural adoption models are applicable to the adoption decisions of older consumers. The interests are in the relationships of personal characteristics and the adoption related factors. Further on, the present study aims to analyse the readiness and intentions to apply existing technologies to health care services and applications.

1.4 Research method

The current dissertation represents a positivistic paradigm and lays its ground in cognitive theories (Anderson, 1986). Typical for this type of research is hypothetico-deductive inference. Hypothetico-deductive model proceeds by formulating a hypothesis based on theory in a form that could conceivably be falsified or confirmed by a test on observable data (Haaparanta and Niiniluoto, 1986). For positivistic research based on cognitive theories, it is typical that the human nature is perceived as a rational information processor who forms beliefs, attitudes and intentions that are causally determinants of his behaviour (Anderson, 1986). The research ontology is based on a premise that reality is real and apprehensible meaning that knowledge is statistically generalized to a population by statistical analysis of observations about an easily accessible reality (Sobn and Perry, 2006). The hypotheses are formulated based on cognitive theories.

The empirical evidence used for testing the proposed hypotheses was collected with a traditional mail survey in the end of 2004 consisting of people aged between 55-79 years. The survey was part of a research project called Welfare City that evaluated the propensity of efficiency improvements and cost savings probable with information and communication technology applied in health care settings (Sintonen, Kaljunen, Tuukkanen and Laaksonen, 2005).

Empirical analysis is mainly based on structural equation modelling. It is referred as a method for representing, estimating, and testing theoretical network of (mostly) linear relations between variables, where those variables may be either observable or directly unobservable, and may only be measured imperfectly (Rigdon, 1998).

1.5 Definitions

This section clarifies the key definitions used throughout the study, in order to avoid conceptual misunderstandings. The more detailed concepts are discussed in order of occurrence along the thesis.

Innovation

Rogers (1995) defines an innovation as an idea, practice, or object that is perceived as new by an individual or other unit of adoption (p. 11). Based on this definition, innovation can be almost anything as long as it is new for the adopter.

Behavioural intention

Intention is an indication of a person's readiness to perform a given behaviour, and it is considered to be the immediate antecedent of behaviour (Ajzen, 2004).

Adoption

The concept of adoption is defined by Rogers (1995) as a decision to make full use of an innovation as the best course of action available (p. 171). Correspondingly, rejection is a decision not to adopt an innovation.

Perceived health

Perceived health (self-rated health) is the individual's perception and evaluation of his or her health including perception of symptoms, well-being, general health and vulnerability (Bjorner, Kristensen, Orth-Gomér, Tibblin, Sullivan and Westerholm, 1996).

Telecare

Telecare can be defined as a service bringing health and social care directly to a service user, generally in their own homes, supported by information and communication technology (Barlow, Curry, Wardle, Bayer and Trejo Tinoco, 2004). Telecare is meant to support independent living and welfare of older or disabled people. It involves the delivery of health and social care to individuals within the home or wider community outside formal institutional settings, with the support of systems enabled by information and communication technology (Bayer, Barlow and Curry, 2007).

Telemedicine

Telemedicine is the use of modern telecommunications and information technologies to provide clinical care to individual located at a distance, and to support the transmission of information needed to provide that care (Ng, Sim, Tan and Wong, 2006).

Telehealth

Telehealth is the delivery of health-related services and information via telecommunications technologies. Telehealth delivery could be as simple as two health professionals discussing a case over the telephone, or as sophisticated as using videoconferencing to between providers at facilities in two countries, or even as complex as robotic technology (Wikipedia, 2008). It encompasses preventive, promotive and curative aspects. The meaning of telehealth has also grown to include health-related websites, health-related internet discussion groups, which may or may not be mediated by health care professionals (Hughes, 2003).

E-health

The term e-health rises from the proliferation of the internet and associated technologies as well as the impact of these technologies on health services delivery, medical information retrieval, consumer informatics, and inline distance education and training in the medical fields (Tan, Cheng and Rogers, 2002).

1.6 Structure of the study

The structure of the present dissertation is based on similar approach as the research positioning (Figure 7).

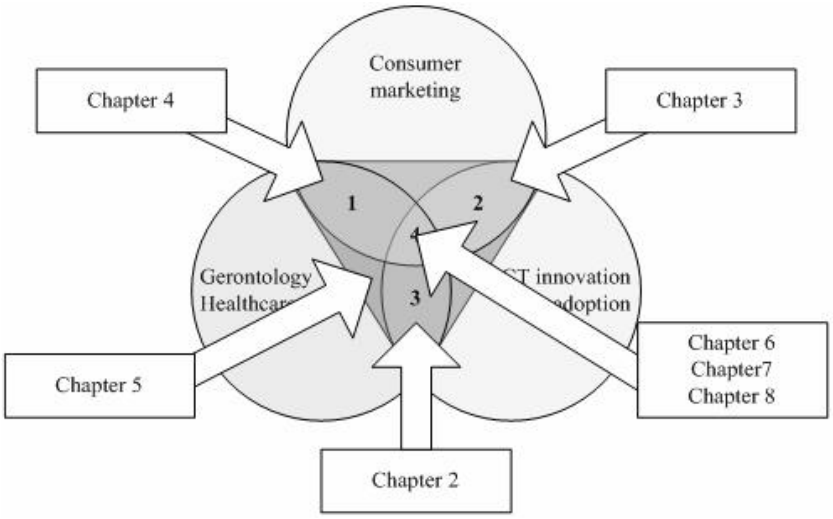

Figure 7 Structure of the study

The dissertation proceeds as follows:

Chapter 2 approaches the applicability of ICT to the context of health care. Some consideration is given to health care information systems as part of patient care and as an enabler of independent living among the aging people. ICT in health care raises questions for the information security and privacy that are discussed briefly.

Chapter 3 reviews the existing theories of innovation adoption, namely the theory of planned behaviour, technology acceptance model and diffusion of innovations. An extensive literature review was conducted in order to update the application of these theories to adoption of ICT innovation.

Chapter 4 discusses the aging consumers. A closer look is given to the issues that separate older consumers and their behaviour from the younger counterparts. Critical aspects of elderly characteristics are introduced from gerontology and health research that are considered important for the purposes of the present study. In addition, aging people are discussed in terms of ICT users and potential adopters.

Chapter 5 targets to the conceptual research model. The theoretical premises are compared from the innovation adoption research field, and the issues related to the aging consumers are combined to three separate research models. Hypotheses are formed for the empirical testing of the models.

Chapter 6 covers the methodological issues related to the empirical part of the dissertation. The main issue is the data collection and its representativeness of the selected population. In addition, the measurement structures are discussed and verified.

Chapter 7 covers empirical research of the present dissertation. Methodological issues are discussed and the measurement models are prepared and tested. A descriptive analysis represents the general characteristics of the sample. Empirical research models are tested using structural equation modelling which forms the basis for deduction of the hypotheses.

Chapter 8 discusses the results and evaluates the theoretical contribution and managerial implications of the study. The limitations of the study are discussed and some suggestions are made for further research.

2 INFORMATION TECHNOLOGY AND HEALTH CARE SERVICES

The current dissertation aims toward explaining the stage of adoption of mobile phones and personal computers among elderly in order to clarify the future prospects for development of new health care applications targeted older consumers. Therefore it is important to take a closer look at the stage of ICT development in health applications precisely developed for end-user – service provider interfaces. In general e-service is conceptualised as an interactive, content-centred and internet-based customer service, driven by the customer and integrated with related organizational customer support and technologies with the goal of strengthening the customer-service provider relationship (de Ruyter, Wetzels and Kleijnen, 2001). Telemedicine, telehealth and e-health applications involve the strategic use of telecommunication and internet-related technologies to improve health care marketing, health services delivery and research (Tan et al., 2002).

2.1 ICT as part of patient care

According to Kilbourne, McGinnis, Belnap, Klinkman and Thomas, (2006) a robust clinical information system coordinates treatment, facilitates communication between patients and care providers, helps patients to establish realistic self-management goal, helps patient and clinicians determine treatment preferences, connects patients and families to community resources and finally, tracks both clinical and financial outcomes. In addition, using wireless/mobile communications in health care results numerous benefits (Wickramasinghe and Misra, 2004): (1) improvement in patient care by enabling and facilitating more effective and efficient patient centred health care treatment, (2) reduction of transaction costs by providing much more access to key information in a timely fashion at less cost than wired counter parts, (3) increase in health care quality by enabling and facilitating better and more informed medical treatment, and (4) enhancement in teaching and research by enabling and facilitating superior access to key and relevant data and information. ICT in health care offers additional communication possibilities but the extent to which they will be used to substitute for face-to-face interaction is still uncertain (Bower, Tidd and Hull, 2003).

Despite of many benefits, a significant barrier to investment in IT in health care is the widely recognized fact that any cost savings resulting from technology changes is not always seen by the implementer and it is difficult to find clear relationship between IT, organizational improvements, quality of care and benefits realization (Rahimi and Vimarlund, 2007). Bernstein, McCreless and Côté (2007) sum up five constant in information technology adoption in health care that need to be taken closely account. These are budgeting for information technology, leaderships and support, project management, implementation and end user involvement. In relation to budgeting, both tangible and intangible benefits need to be taken into account when planning return on investment. These include increases in profitability or decreases in costs and also improvements in patient outcomes, enhancement in employee morale and improvements in service quality. Leaderships and support needs to focus on what is wanted to change with information technology, and motivate and prepare their workers for changes. Information technology projects need to have realistic goals and carefully schedule completion deadlines for all assigned tasks. Implementation should be structured stepwise. Information technology projects are meant to provide better tools for workers to perform their jobs better and lead to improvements in the service quality. Health care information technology seeks to achieve a level of sophisticated interaction between provider and patient through the use of technology (Bernstein et al., 2007). The advances of telemedicine, telehealth and e-health are impeded by the lack of clear and supportive legal infrastructures (Tan et al., 2002).

2.2 ICT assisting elderly in daily living

ICT has been raising expectations in elderly care through different pilot projects round the world. Many countries are seeking to introduce telecare, but while the technology is largely proven, service development is immature (Barlow et al., 2006). This is also true in Finland. The potential benefits are recognized, but the sustained implementation has failed. The strategies or business models of potential service providers are either undeveloped or unproven, customer needs are not clearly expressed and there are no ‘brand names’ (Barlow et al., 2006). Telecare is based on a premise that people in need of care should be able to participate in the community as much as possible, and for as long as possible (Barlow et al., 2004; Bayer et al., 2007). In addition, interactive health communication systems have been developed to supply reminders, provide guidance via tailored messages, and monitor

performance (Hughes, 2003). For instance the developing mobile applications in health care makes it possible that relevant information of patient is accessible anywhere needed, this way the patients' care can be improved as well as the quality of services. Additionally decreases in clinical errors are expected due to the access to patient information and up-to-date medical knowledge. Besides developing useful and easy to use health care systems, mobile IT/IS designers should also pay more attention to user requirements analysis to determine their expectations and requirements for mobile health care application content (Wu, Wang and Lin, 2007).

Barlow et al. (2004) suggest that the opportunities for telecare can be divided in four service categories (Figure 8). Safety and security monitoring and personal monitoring are largely designed to manage risks in associated with are outside formal care institutions (Barlow et al., 2006). This refers to monitoring activities of daily living.

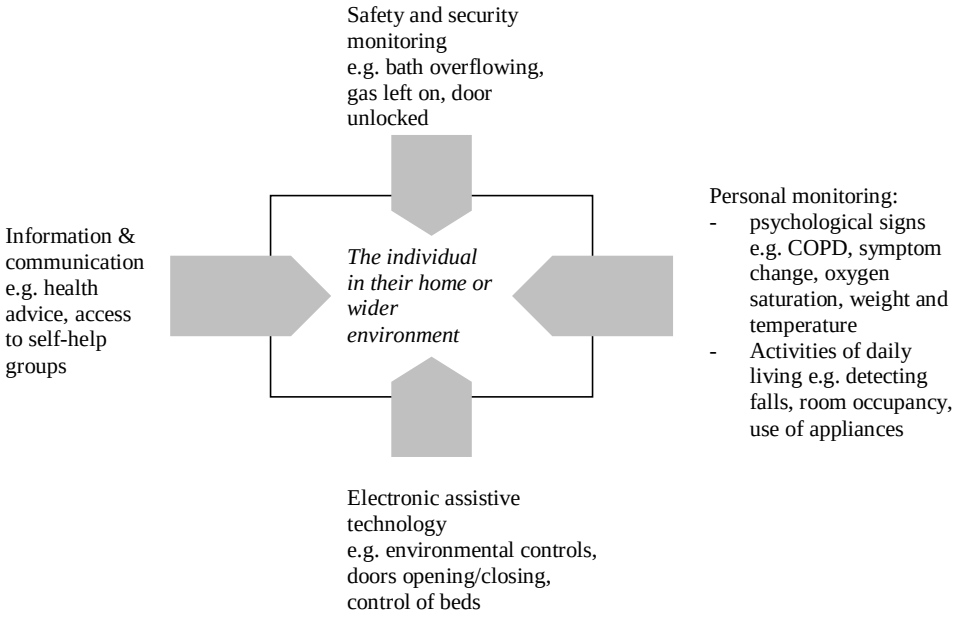

Figure 8 Features of telecare (Barlow et al., 2004)

Electronic assistive technology is designed to improve functionality of the home by providing greater control over the features such as doors, furniture and beds and can also be integrated into activity monitoring to provide carers with a better picture of how individuals are coping

with their home environment (Barlow et al., 2006). The final group of services involves care-related information delivered to individuals through the phone, internet or digital interactive TV (Barlow et al., 2006) and is of interest in this dissertation. A major function of telecare is to enable older people to remain in their own homes by providing increased safety and reassurance to them and their carers (Bayer et al., 2007). With the help of technology, the home environment can be turned into being more suitable for older people to remain in as the conditions change.

The benefits of telecare can be examined according to different focus groups (Table 1). The opportunities of telecare can thus be versatile. Besides these referred groups, telecare solutions can provide for instance health informatics for people that do not necessary need telecare assistance for daily living, at least not yet. Telecare can be useful in cases of discharge from hospitals and with patients that need regular monitoring (e.g. Williams, King, Capper and Doughty, 1996). Proofs have been provided for telecare benefits in saving costs. Magnusson and Hanson (2005) were able to evaluate significant cost savings that were achieved using a communication system between home carers and health care providers enabling the care needing person to stay at home.

Table 1 The role of telecare in supporting different patient groups (Barlow et al., 2004)

Patient group	Role of telecare
Chronic disease	Provides facilities to self-manage care at home but allow patients to stay in contact with carers
Increasing frailty	Provides facilities to allow people to remain at home for longer
Disabled people	Increases home safety and security, share risk of independent living
People with learning difficulties	Increases home safety and security, share risk of independent living
Palliative care	Provides facilities to manage end-of-life debility at home

In addition, the solution introduced in the work of Magnusson and Hanson (2005) gives a possibility for carers to communicate with each other and thus exchange and compare experience with peers. Similarly, the first solutions to increase safety with a wristband safety phone have produced decreases in the hospital admissions as well as in the number of hospital inpatient days among the subscribed users. Telecare is all the time going further; replacements

for the wristbands are developed to take advantage of software and sensor technologies in intelligent alarm systems (Doughty, Isak, King, Smith and Williams, 1999).

Telecare can be beneficial for several parties. Barlow et al. (2004) captured benefits for individuals, informal carers, professional carers, statutory services, private care and housing providers, industries and governments (Table 2). For family carers, telecare solutions can reduce sense of isolation, create sense of presence and provide easier access to care professionals (Magnusson, Hanson, Brito, Berthold, Chambers and Daly, 2002). Family carers are essential part of health and social care systems that enable frail old people to remain in their own homes. Telecare systems allow family carers to maintain social relationships and share experiences with others in similar situations (Magnusson et al., 2002). The well-being of family carers benefits the individual being taken care of as well as society through resource and cost savings.

Table 2 Potential benefits to care system stakeholders (Barlow et al., 2004)

Stakeholder	Key benefits
Individual	Quality of life – access to care in the location of choice, reduction in anxiety, providing reassurance, sustaining independence
Informal carer	Quality of life – reduction in anxiety and stress, providing reassurance
Professional carer	Additional options for care, better information on progress and outcomes for individual users and across professional communities, reduction in the volume of inappropriate work
Statutory services (social services)	Better management across populations, better resource management, avoidance of hospital admission, fewer delayed transfers of care, prompt discharge, development of self-care and prevention
Private care and specialist housing providers, alarm service providers	New market opportunities
Industry (telecommunication and equipment suppliers)	New market opportunities
Government	Modern, responsive care service; better coordination between different departments involved in care delivery; better resource management

Not having access to and being able to use technology may put older adults at a disadvantage in terms of their ability to live independently. For example, the Internet is rapidly becoming a

major vehicle for communication and information dissemination about health, community and government services. Technology also offers potential for enhancing the quality of life of older people by augmenting their ability to perform a variety of tasks and access information. For example, use of internet can help mitigate problems with social isolation and foster communication with family and friends. Use of internet can also facilitate the performance of activities such as banking and shopping and can enhance educational and employment opportunities for older adults. Technology may also allow older people to taka a more active role in their own health care and enable those with some type of chronic condition to remain home. (Czaja and Lee, 2007). Attracting consumers in an online environment is far more challenging than in traditional operating environments because substantive behavioural changes required by adopter in learning how to use e-services, trusting such technologies, and making informed decisions using these technologies.

ICT applications have also been developed for self-care and maintenance of cognitive skills. Interaction with the computer system can alleviate depression and appear to improve cognitive functioning (McConatha, McConatha, Deaner and Dermigny, 1995). Also putting patient records online means patients can have access to their own records and make changes and additions, as necessary (Telingator, 2000). Reducing sick person's input through the use of, for example, internet-based self-diagnosis system may improve patient perceived quality, patient satisfaction and reduce provider's costs at the same time (Lanseng and Anreassen, 2007). The profit gained by the service provider can be seen as liberation of scarce resources for the public sector that operates as a service provider in Finland.

Telemedicine includes a two-folded interaction between consumer informatics and public health (Tan et al., 2002). In Figure 9, first, care provides are recognizing the importance of engaging their patients in order to provide more meaningful and effective health services. This indicates to the importance of preventive care and consumer informatics and making consumers aware of accurate medical information and knowledge. Second, significant improvements to health care and public health services may also be achieved if there are innovative and effective means of collecting feedback and epidemiological statistics from the public.

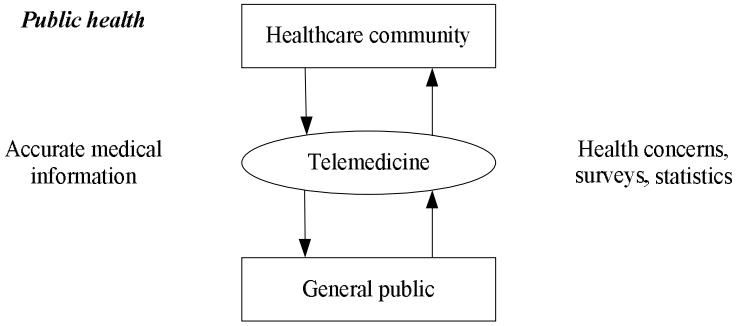

Figure 9 Telemedicine for public health and consumer informatics

Deremis (2004) stresses that when introducing and launching electronic home health care systems, it is necessary to evaluate its appropriateness and ethical issues such as patient's stability of disease processes, level of functional limitations, infrastructure at the patient's home, patient's mental state, and attitude toward the system and willingness to provide informed consent. Following the division of telecare by Barlow et al. (2004), it is seen that not all of telecare's dimensions fit simultaneously for all types of patients. Including electronic solutions for health care has the opportunity to revolutionise the field of care systems.

3 THEORIES OF INNOVATION ADOPTION

With the growth of new technologies, it is important to explore the ability and willingness of customers to use these new technologies (Meuter, Ostrom, Bitner and Roundtree, 2003), and also apply existing technologies in services. Innovation adoption research has produced several models, and these models are revised continuously. The literature on behavioural intention can be divided into behavioural and cognitive learning models. Behavioural learning theories are based on the premise that observable behaviour takes place as a response to specific external stimuli, and on the other side cognitive learning models are important in a situation that require problem solving or attitude formation before responding to external stimuli (Schiffman and Kanuk, 1983). A literature review was conducted in order to form a clear picture of current and past research and summarize the most important theories behind research models. Following here, the findings of the literature review conducted for innovation adoption research related ICT is summarized and thereafter, the essential theory bases are discussed in more detail.

3.1 Overview of the literature review

The literature review was conducted for 54 articles that were obtained from databases such as ABI and EBSCO. The keywords applied were combinations of innovation adoption, information technology, computer, mobile phone, technology acceptance model, theory of reasoned action and innovation diffusion. The amount of articles resulting from database searches was delimited first for individual level adoption and technology acceptance. The second limitation was made carefully leaving the pure intraorganizational studies out of the review such as information systems acceptance among organizations. The next step to evaluate appropriateness or research articles was the case innovation in question. Innovations like spreadsheet or other occupation specific innovations were mainly left out. The reviewed articles mainly used theories such as theory of reasoned action (TRA), theory of planned behaviour (TPB), technology acceptance model (TAM), and diffusion of innovations (DOI). Few studies existed without any specific theoretical background model drawn from past literature. The application of these models had a great variety. Technology acceptance model was used in 31 cases, theory of planned behaviour in 14 cases, theory of reasoned action in

eight cases and diffusion of innovation theory in 14 cases. However the research models were rarely formed for just one theoretical aspect, typically the model were formed based on combination of different theories and on the other hand external variables were tested in order to increase the predictive power of baseline models. In addition to DOI, TAM and TRA/TPB, social cognitive theory has been applied in technology acceptance research, usually together with other theories. The innovations or research target were mainly internet technology based services, but also such issues as computer use, SMS (short messaging services) use or mobile internet or broadband adoption were studied. The theoretical constructs of interest were usually intentions or pure usage. The explanatory factors depended on the background theory, but external variables of wide variability existed that were used to explain technology perceptions such as perceived ease of use and usefulness. 22 of the articles applied student samples from different education levels. A standard justification is that students are a kind of consumer (Zinkhan, 2006), although the generalization into larger populations is rather precarious. Few studies used organizations' employees and another typical characteristic in nowadays data collection is internet or email surveys. For instance the generalization of the results should be very careful if the data collection is student and the actual research population isn't limited. The data collection methods rarely used true sampling methods; for instance samples were collected from particular courses in universities or perhaps from customers of shopping centres or from participants in an internet news group. Comparison of response rates among different studies is difficult due to the sampling methods. Structural equation modelling (including partial least squares analysis) has become very popular analysis method for predicting and explaining intentions as the whole hypothesized model can be tested simultaneously and the causal relationships can be estimated. In addition, regression is often used for similar purposes.

The present dissertation takes a closer look at the cognitive learning models, namely technology acceptance model and theory of planned behaviour. Rogers's (1995) diffusion of innovation perspective is also discussed more properly because many of the current and past research have been built upon it. The theory of planned behaviour, technology acceptance model and the diffusion of innovation perspective serve as a good starting points in investigating individual-level factors affecting the adoption of last-mile technology (Oh, Ahn and Kim, 2003).

3.2 Theory of planned behaviour

Ajzen (1985, 1991) proposed a theory of planned behaviour (Figure 10), which has widely been used in innovation research. Theory of planned behaviour is refined from the theory of reasoned action developed by Fishbein and Ajzen (1975). According to them, theory of reasoned action consists of behavioural intention measure that will predict the performance of any voluntary act, unless intent changes prior to performance or unless the intention measure does not correspond to the behavioural criterion in terms of action, target, context, time-frame and/or specificity. A meta-analysis of Sheppard, Hartwick and Warshaw (1988) analysed the usage of theory of reasoned action, and found that most studies failed to meet the restrictions originally set for the model, although the model performed extremely well in the prediction of situations and activities outside the boundary conditions originally specified for the model. Although volitional control is more likely to present a problem for some behaviours more than others, personal deficiencies and external obstacles can interfere with the performance of any behaviour (Ajzen, 1985). The theory of planned behaviour is an extension of the theory of reasoned action made necessary by the original model's limitations in dealing with behaviours over which people have incomplete volitional control (Ajzen, 1991). Bhattacherjee (2000) evaluated the suitability of theory of planned behaviour to e-commerce context in terms of its focus on cognitive effort and social desirability instead of monetary costs. This means that the theory is applicable to acceptance contexts such as B2C e-commerce, because the services are basically free and only investment needed is the time and effort in leaning how to use them. Excellent model replications have been made for instance by Taylor and Todd (1995).

As in the original theory of reasoned action, a central factor in the theory of planned behaviour is the individual's intention to perform a given behaviour (Ajzen, 1991). Ajzen (1991) assumed that intention captures the motivational factors that influence behaviour. The behaviour in question should be under volitional control meaning that the person can decide whether or not to perform the behaviour. Intentions are indications of how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform the behaviour (Ajzen, 1991).

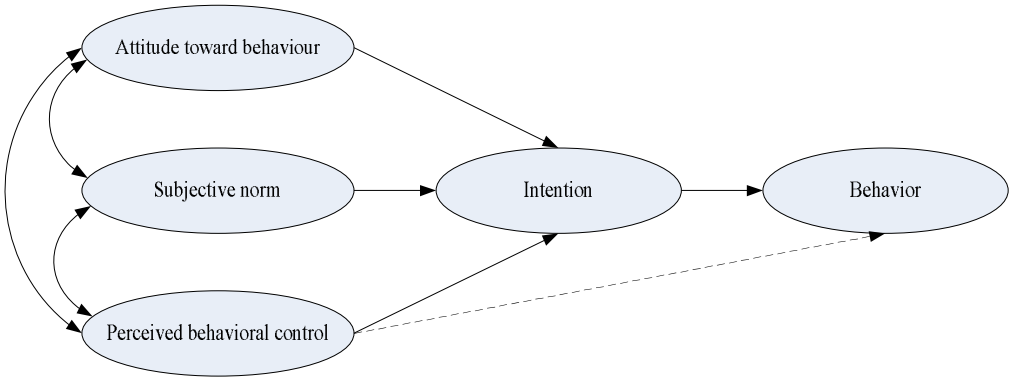

Figure 10 Theory of planned behaviour

Attitude toward the behaviour refers to the degree to which a person has a favourable or unfavourable evaluation or appraisal of the behaviour in question (Ajzen, 1991). This means that the more favourable the attitude toward behaviour, the stronger should be an individual's intention to perform the behaviour in question (Ajzen, 1991). Attitudes are then influenced by behavioural beliefs and evaluations.

Subjective norm refers to the perceived social pressure to perform or not to perform behaviour (Ajzen, 1991). A global measure of subjective norm is usually obtained by asking respondents to rate the extent to which "important others" would approve or disapprove of their performing a given behaviour (Ajzen, 1991). Subjective norm consists of normative beliefs and motivations. Favourable subjective norm has a positive effect on intention to perform the behaviour under discussion. Subjective norm has been found to be dependent on external influence from mass media, expert opinions and other nonpersonal information as well as on interpersonal influence referring to word-of-mouth influence by friends, colleagues and other persons prior known by the adopter (Bhattacherjee, 2000). Proposed by Taylor and Todd (1995), peer influence and superior's influence are determinants of subjective norm in a decomposed model of theory of planned behaviour.

Perceived behavioural control is an additional element added to the theory of reasoned action. The importance of actual behavioural control is self evident: the resources and opportunities available to a person must to some extent dictate the likelihood of behavioural achievement (Ajzen, 1991). Perceived behavioural refers to people's perception of the ease or difficulty of

performing the behaviour of interest (Ajzen, 1991) and is formed from control beliefs and facilitation. As seen in Figure 10, perceived behavioural control can directly predict actual behaviour. Holding intention constant, the effort expected to bring a course of behaviour to a successful conclusion is likely to increase with perceived behavioural control and additionally, perceived behavioural control can often be used as a substitute for a measure of actual control (Ajzen, 1991). The greater the perceived behavioural control the stronger should be the intention to perform the behaviour and it will more likely occur. The harder the person tries, and the greater his control over personal and external factors that may interfere, the greater the likelihood that he will attain his behavioural goal (Ajzen, 1985). The perception of control can be a contradictory factor. A person who has a pessimistic view of his control over the behaviour may never try and may thus fail to find out that he was wrong (Ajzen, 1985). This makes perceived control to correlate with behavioural performance; although (Ajzen, 1985) suggest that the correlation is strong when perceived control corresponds reasonably well to actual control. The study of Bhattacherjee (2000) found self-efficacy related to skills and ability to perform as determinants of behavioural control as well as the facilitating conditions in terms of resource availability. The decomposed model of theory of planned behaviour (Taylor and Todd, 1995) suggests that self-efficacy and resource facilitating conditions influence perceptions of behavioural control.

According to the reasoned action approach, the major predictors of intentions and behaviour follow reasonably from behavioural, normative and control beliefs (Ajzen and Fishbein, 2005). Clearly, a multitude of variables could potentially influence the beliefs people hold: age, gender, ethnicity, socioeconomic status, education, nationality, religious affiliation, personality, mood, emotion, general attitudes and values, intelligence, group membership, past experiences, exposure to information, social support, coping skills and so forth (Ajzen and Fishbein, 2005). These factors can further our understanding of the behaviour by providing insight into the origins of underlying beliefs, but their effects on intentions and behaviour tend to be indirect (Ajzen and Fishbein, 2005). Indeed, even when a background factor is found to explain additional variance in intentions or behaviour, the amount of variance accounted for is usually very small, and rarely have investigators proposed that personality or demographic variables be considered proximal determinants of intentions and actions (Ajzen and Fishbein, 2005). Morris and Venkatesh (2000) studied the effect of age on individual adoption and sustained usage of technology in the workplace using theory of planned behaviour as ground model for predicting behaviour. Their results suggested that

there are clear differences with age in the importance of various factors in technology adoption and usage in the workplace. Initial acceptance decisions of younger workers found attitude toward using a new technology to be more salient than older workers; conversely, older workers weighted the importance of subjective norm and perceived behavioural control more strongly than younger workers in determining usage of a new technology in a short term (Morris and Venkatesh, 2000). However, at the time of the study, the older workers had had less opportunity to interact with information technology before entering the workplace, and the youngest workers had become familiar with information technology already in high school. This is true in the present society. Children are familiar with ICT as they start school, but many older people must gain motivation for technology adoption elsewhere.

Researchers have established linkages between theory of planned behaviour and technology acceptance model. The research in ICT field has made effort to find explaining factor for attitude, and the study of (Bhattacherjee, 2000) found that attitude is determined by perceptions of perceived usefulness and ease of use adapted from the technology acceptance model. Similarly, Liao, Shao, Wang and Chen (1999) found that perceived ease of use influences attitude as well as beliefs of relative advantage, result demonstrability and compatibility when analysing the adoption of virtual banking. In the context of ICT, perceived usefulness has been found to significantly influence attitudes (Taylor and Todd, 1995). Social influence is seen important with behavioural intention related to ICT usage. For instance in the case of multipurpose information appliances, a strong and direct/indirect impact of social influence on intention indicates that the appliances provide users with a means to reinforce their social links and their feelings of group affiliation (Hong and Tam, 2006).

3.3 Technology acceptance model

Technology acceptance model (TAM) constitutes innovation adoption for technology perceptions that are perceived usefulness and perceived ease of use (Figure 11). The model was originally created by Davis (1985), as an adaptation to theory of reasoned action tailored for the acceptance of information systems. The goal of TAM is to provide an explanation of the determinants of computer acceptance that is general, capable of explaining user behaviour across a broad range of end-user computing technologies and user populations (Davis,

Bagozzi and Warshaw, 1989). An individual's behavioural intention to use a technology can be explained by their perception about the usefulness of the technology in question and their attitude towards technology use (Davis, 1989). Although TAM in the original work of Davis (1985) was developed to study technology acceptance in organizations, it has been widely used also in consumer research; in both cases, the research has always focused on individual acceptance of new technology.

Behavioural intention to adopt or use an innovation is usually in the interests of researchers. Although the goals of the research are very similar, the depended variables usually differ among conducted studies. Chan and Lu (2004) studied intention to adopt internet banking and additionally intention to continue to use internet banking. However, McKechnie, Winklhofer and Ennew (2006) used TAM to predict the extent of adoption of the internet as a new technology based distribution channel for financial services. They define the extent of usage as a continuum that captures information research and the number of online financial service purchases made accommodating the critical and prevalent activity of information search within the buying decision-making process. The focus of the research targets hasn't thus always been on the pure behavioural intention, but researchers have still found TAM to be useful.

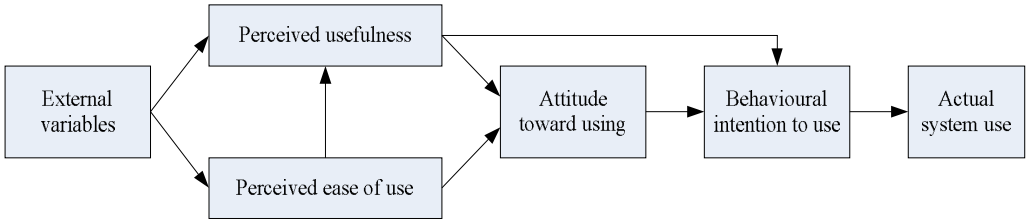

Figure 11 Technology acceptance model (Davis et al., 1989)

Perceived usefulness is defined as the degree to which an individual believes that using a particular system would enhance his or her job performance (Davis, 1985), i.e. the extent to which using that technology provides benefits in performing certain activities. Perceived usefulness is assumed to affect behavioural intentions directly and indirectly through attitudes. An on the other hand, perceived usefulness is dependent on external variables and perceived ease of use.

Perceived ease of use is defined as the degree to which an individual believes that using a particular system would be free of physical and mental effort (Davis, 1985) meaning that a technology is perceived as being easy to understand and use. According to the model, perceived ease of use is a determinant of attitude together with perceived usefulness, but Davis et al. (1989) found that perceived ease of use affects behavioural intentions in two ways: (1) directly and (2) indirectly through perceived usefulness and attitude.

The results using TAM haven't always been consistent. For instance perceived usefulness was found to have rather weak impact on adoption intention, when multipurpose information appliances where studied by Hong and Tam (2006). Their explanation was that the information appliances have become so pervasive that very few people dispute their usefulness. They conclude that depending on IT innovations and their usage context, the prominence of usefulness over ease of use may not always hold meaning that usefulness isn't always more important than ease of use in making adoption decisions. Karahanna and Straub, (1999) studied the psychological origin of perceived ease of use and usefulness focusing on email use in the organizational context. Their study indicated that perceived usefulness is determined by the social influence exerted by one's supervisor with respect to email use, perceived ease of use and social presence of email as a communication medium. In the consumer context the social aspects of email and other electronic medium should be discussed also.

The results are neither consistent considering perceived ease of use. Perceived ease of use appeared to be non-significant predictor of intention to adopt and intention to continue use of internet banking in the study of Chan and Lu (2004). Their findings suggested that perceived ease of use affect intentions only through perceived usefulness. Bruner and Kumar (2005) received similar results in their study of handheld internet devices. In the study of Karahanna and Straub (1999), perceived ease of use was determined by the perceived accessibility of information technology, i.e. the more accessible an information systems is, the less effort is needed to use it. In the study of older consumers adopting e-government services, Phang, Sutanto, Kankanhalli, Li, Tan and Teo (2006) found that computer anxiety and computer support influence perceptions of ease of use.

Different extensions to TAM have been conducted as the research in the field of ICT develops further. Researchers have added various complementary elements to TAM such as perceived risk (Chan and Lu, 2004), self-efficacy (Igbaria and Iivari, 1995; Venkatesh and Davis, 1996; Chan and Lu, 2004), systems usability and direct experience (Venkatesh and Davis, 1996), computer anxiety (Igbaria and Iivari, 1995), and other innovation related characteristics (Chan and Lu, 2004). Venkatesh and Davis (1996) analysed the antecedents of perceived ease of use and introduced user-specific and system independent computer self-efficacy (drawn from social cognitive theory) as a determinant of perceived ease of use of a specific computer system. However, the determinations of self-efficacy and perceived ease of use are very similar, which lead Venkatesh and Davis (1996) to use same measurement to computer self-efficacy as they would have used for perceived ease of use of a computer. The distinction was that the computer self-efficacy was expected to influence on the perceived ease of use of a specific computer system. They found that relationship to be significant meaning that self-efficacy had a positive effect on perceived ease of use. This was supported by Chan and Lu (2004) in their case of internet banking adoption and usage intention. Another extension of TAM conducted by Venkatesh and Davis (2000) added a number of determinants to TAM (extension referred as TAM2). Perceived usefulness and usage intention are predicted by subjective norm, voluntariness and image as well as job relevance, output quality and result demonstrability and perceived ease of use. This model was verified with four longitudinal field studies, however not relevant for the present thesis due to the organizational settings.

External variable added to the model by Agarwal and Prasad (1999) were prior experience, level of education and role regarding to technology as determinant for perceived ease of use, and training as a determinant for perceived usefulness. Bruner and Kumar (2005) used consumer visual orientation and selection of internet device as external variables and found that visual orientation and internet device were determinants of perceived ease of use.

In today's digital world, the issues related to internet security are important and individuals form beliefs based on their knowledge concerning information security and service providers. Gefen, Karahanna and Straub (2003b) included trust antecedent in their modification of TAM, by hypothesizing that heightened levels of trust as specific beliefs about the e-vendor, are also associated with heightened levels of intended use. Trust helps reduce the social complexity consumer faces in e-commerce by undesirable yet possible behaviours of the vendor, including inappropriate use of purchase information (Gefen et al., 2003b). In the same study,

trust had a positive influence on intention to use online shopping, although the target of the study was formed on experienced online shoppers and the items related to trust all referred to prior experience the respondent had concerning the online vendor.

The literature is undecided as to whether demographic factors such as age and gender would have a bearing directly on perception of usefulness and ease of use (McKechnie et al., 2006). Gender effect on email usage has been attached to TAM by Gefen and Straub (1997) suggesting that gender has an impact on IT adoption, and they showed that women perceived a higher value for perceived usefulness than men, and that men tend to feel more at lease with computers.

The literature review of Legris, Ingham and Collerette (2003) concluded that TAM is a useful theoretical model helping to understand and explain use of behaviour in information system implementation. Most of the research reviewed concerned employees and students; the use of students as a target group however is a limitations in using TAM, although it minimizes the costs of research. They suggested that TAM could be beneficial in studies of business process applications in addition to the office automation software or system development applications, but TAM has also been used in various studies concerning consumers as end-users. Technology acceptance model provides a parsimonious set of constructs for predicting the adoption behaviour of information technology than the theory of planned behaviour while disregarding some of the constructs that may be important in some other situations (Oh et al., 2003). Common construct for both theories is the attitude which is considered quite important in explaining the behavioural intentions. While the original model was developed to predict user acceptance of computer technology within the workplace, it has been considered suitable as a theoretical basis for understanding the use, behaviour and acceptance of new internet-based technologies (e.g. McKechnie et al., 2006). The results received when applying TAM are various. Deng, Doll, Hendrickson and Scazzero (2005) suggested that the comparison of studies and the ability to draw conclusions concerning the relative efficacy of perceived usefulness and ease of use is difficult because inconsistent structural weights, variety in the applications studied, difference in the type of data gathered, differences in the dependent variables utilized and differences in the items used to measure perceived usefulness and ease of use. Due to the various research targets in which TAM has been utilized, Deng et al. (2005) conducted a multigroup analysis of structural invariance concerning the structural weights of perceived usefulness and ease of use on intention to use. Their results provide evidence that

the structural weights of perceived usefulness and ease of use vary across different innovations (etc. word processing, spreadsheet, database and graphic applications).

Comparisons have been made between technology acceptance model and theory of planned behaviour, because of their similarities. No massive differences however have been found for the power to predict intention. For instance Mathieson (1991) used successfully both models to predict spreadsheet usage intentions finding only marginal difference in favour for the TAM.

3.4 Diffusion of innovations

Rogers (1995) definition of diffusion as a process by which an innovation is communicated through certain channels over time among the members of a social system includes the four main elements of diffusion process: (1) the innovation, (2) communication channels, (3) time, and (4) the social system. A Major concern in diffusion research has been on how to develop and market innovations to enhance more rabid acceptance (Damanpour, 1988). Diffusion theory has been studied extensively in the literature from the point of view of different disciplines and with respect to different types of products, services and ideas, as not all innovations that enter the market are diffused at the same speed (Martinez, Polo and Flavián, 1998).

The diffusion of an innovation in a population involves the adoption of the innovation by individuals in the relevant population. According to the diffusion model created by Bass (1969), the acceptance of new products follows an S-shaped curve, and that adoption is influenced by internal and external influence, the rate of diffusion is thus influenced by consumer innovativeness and imitation. The differences in diffusion among different innovations may be explained with the differences between potential adopters (Geroski, 2000). As the S-shaped curve indicates the cumulative numbers of adopters, the numbers of adopters at time *t* follows normal distribution (Rogers, 1995) and the time when the adoption occurs, indicates the innovativeness of a consumer. From this, researchers have been identifying different adopter categories (Mahajan, Muller and Srivastava, 1990; Rogers, 1995; Martinez and Polo, 1996). Based on Rogers's (1995) work, the main categories are innovators (the first 2.5 percent of adopters), early adopters (the next 13.5 percent), early majority (the

next 34 percent), late majority (the next 34 percent) and laggards (the last 16 percent of adopters). The assumption is that these categories differ from each other based on individual characteristics. It has been noticed that the shares of adopters belonging to each category varies across innovations (Mahajan et al., 1990), therefore innovativeness has been studied differently and domain specific innovativeness has been successfully used for detecting innovation adopter categories (Goldsmith and Flynn, 1992; Goldsmith, d'Hauteville and Flynn, 1998; Goldsmith, 2001). In the case of online shopping, Goldsmith (2001) identified three adopter categories (early adopter, majority and laggards) with domain specific innovativeness and found it to be a determinant of internet use, previous online buying and future online buying intentions. Yi, Fiedler and Park (2006) approached empirically and rather successfully adopter categories by developing description for each category (Table 3). These descriptions were made during a research of online buying intention and PDA usage intention.

Table 3 Adopter category descriptions (Yi et al., 2006)

Adopter category	*Description*
Innovative adopters	You buy into a new product's concepts very early in its life cycle. You find it easy to imagine, understand, and appreciate the benefits of a new technology and dbase buying decisions upon this belief. You do not base these buying decisions on well-established references, preferring instead to rely on your own intuition and vision.
Early majority	You share some of the previous category's ability to relate to technology but are ultimately driven by a strong sense of practicality. You know that many newfangled inventions end up as passing fads, so you are content to wait and see how other people are making out before you buy yourself. You want to see well-established references before investing substantially.
Late majority	You do not buy unless comfortable with your ability to use the technology. As a result, you wait until something has become an established standard, and even then you want to see lots of support and tend to buy, therefore, from large, well-established companies.
Laggards	You are very cautious about new technology. You will only purchase when you feel it has become a necessity.

According to Rogers (1995), innovators are interested in new ideas and they need an ability to understand and apply complex technical knowledge, and they must also cope with a high degree of uncertainty about an innovation at the time of adoption. The acceptance of innovation by innovators is critical for its success and further adoption. Rogers (1995) characterizes early adopters as opinion leader and role models in the social system, and by

adopting an innovation they speed up the diffusion process. When the early majority adopts an innovation, their decision period is much longer compared to innovators and early adopters, and Rogers (1995) sees that early majority adopts innovations just before the average members of a social system. Scepticism is describes the late majority that are more cautious toward innovations and who wont adopt until most others have done so (Rogers, 1995). Laggards are the last ones to adopt innovations. Rogers (1995) sees this group as behaving based on traditional values and what has been done before. This group has the longest period from the awareness of an innovation to adopting and using it.

As the diffusion of an innovation in a population involves the adoption by individuals in the relevant population, adoption itself in turn preconceives the individual to make a deliberate choice decision, especially in the case of high involvement products (Chatterjee and Eliashberg, 1990). According to Rogers (1995), the innovation decision process is the process through which an individual or a decision making unit passes (1) from first knowledge of an innovation, (2) to forming attitude toward the innovation, (3) to a decision to adopt or reject, (4) to implementation of the new idea, and (5) to confirmation of this decision (Figure 12).

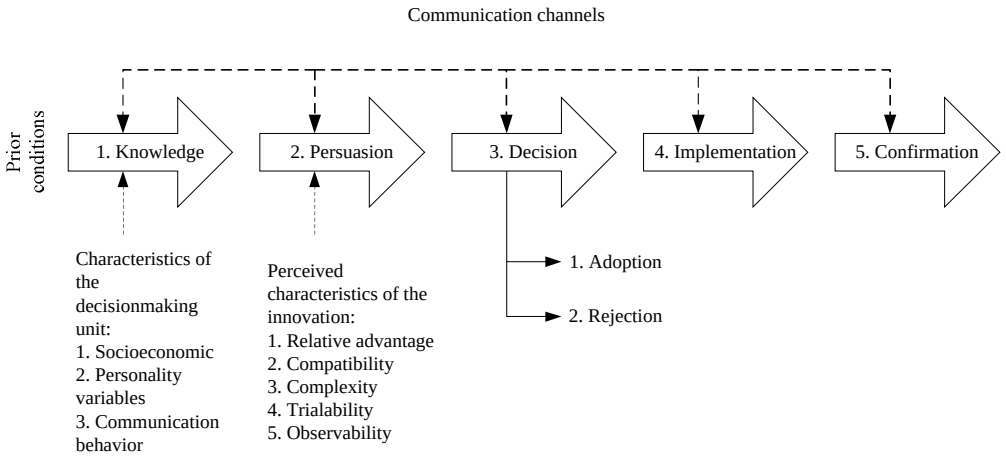

Figure 12 Stages of the innovation decision process (Rogers, 1995)

The knowledge stage occurs when the potential adopter first becomes aware of the innovations existence and gains some understanding of how it functions. Together with knowledge comes the need for innovation which Rogers (1995) defines as a state of

dissatisfaction or frustration that occurs when one's desires outweigh one's actualities, when wants outrun gets. This is followed by persuasion when the attitudes toward innovation are formed. At this stage Rogers (1995) sees that the perceived innovation characteristics influence the adoption decision. If the attitudes toward the innovation are favourable, the adoption is a decision to make full use of an innovation as the best course of action available (Rogers, 1995). After the decision to adopt is made begins the implementation i.e. the concrete use of innovation. Eventually the new idea becomes institutionalized and regularized part of the adopters' ongoing operations (Rogers, 1995). As a last phase, Rogers (Rogers, 1995) distinguishes confirmation including reinforcement for the adoption decision already made or reversing a previous decision to adopt or reject the innovation if exposed to conflicting messages about the innovation. There is always a possibility that the innovation is rejected after first adopting it.

Shih and Venkatesh (2004) proposed an interesting use-diffusion model. Their model aims to specify the determinant of post-adoption behaviour. Table 4 presents the differences between adoption of innovation perspective and use-diffusion model proposed by Shih and Venkatesh (2004). Their model is based on the classification of consumers according to the rate and variety of use that are used to form four clusters: (1) intense users, (2) specialized users, (3) non-specialized users and (4) limited users. Intense use describes situations in which an innovation is used to a significant degree in terms of both variety of use (number of applications) and rate of use (time spent per week) (Shih and Venkatesh, 2004). Specialized users focus on fewer applications shifting the focus on increasing rate of use. In contrast, the non-specialized users prefer the variety of use instead of the rate of use. Limited use refers low rate of use and low variety of applications. This model however limits to the household context, and due to this Shih and Venkatesh (2004) present four dimension that affect the usage patterns: (1) the household social context in which the user operates, (2) the technological dimension (characteristics associated with the innovation), (3) the personal dimension (e.g. innovativeness), and (4) the external factors (external communication and media exposure).

Table 4 Comparing characteristics of adoption-diffusion (AD) and use diffusion (UD)

	Variable of interest	*Typology of population*	*Relevant criteria*	*Elements unique to each model*	*Elements common to models*
AD	Adoption	Innovators Early adopters Early majority Late majority Conservatives	Timing or rate of adoption	Observability Compatibility Trialability	Innovativeness Social communication Complexity Influence of media Relative advantage
UD	Use	Intense users Specialized users Nonspecialized users Limited users	Rate of use Variety of use	Product experience Competition for use Sophistication of technology Satisfaction	

General technology perceptions are established beliefs about technology usage (Hong and Tam, 2006). Perceived innovation characteristics are essential part of Rogers's (1995) diffusion of innovation theory. Originally his work separates five key characteristics: relative advantage, compatibility, complexity, observability and trialability. In addition to these, Moore and Benbasat (1991) extended the model with image, visibility, result demonstrability and voluntariness.

Rogers (1995) defines relative advantage as the degree to which an innovation is perceived better than the idea it supersedes, and it can be measured in economic terms, but social prestige, convenience, and satisfaction are also important factors. Different modification have been made to the perception of relative advantage, for instance Eastin (2002) split this construct into perceived conveniences and perceived economic advantages when studying adoption of online services.

Rogers (1995) defines observability as the degree to which results of an innovation are visible to others. This term has been split into visibility and result demonstrability by Moore and Benbasat (1991). Visibility is seen as the extent to which an innovation is perceived to be widely diffused in the relevant adoption setting (Plouffe, Vandenbosch and Hulland, 2001). Result demonstrability implies readily discerned the unique features and benefits of an innovation are by the potential adopter (Plouffe et al., 2001).

Based on Rogers's (1995) definition, compatibility is the degree to which an innovation is perceived as being consistent with existing values, past experiences, and needs of potential adopters. According to Tornatzky and Klein (1982) compatibility may refer to the values or norms of the potential adopters or may represent congruence with the existing practices of the adopters. Compatibility can be understood as "goodness-of-fit" between a new technology and the needs of its potential users (Kim and Srivastava, 1998). This definition was used in an intra-organizational diffusion context, but seems to fit to consumer fields also.

Image relates to the social approval associated with innovation adoption and represents the degree to which an individual believes that an innovation will bestow them with added prestige or status in their relevant community (Plouffe et al., 2001).

Complexity of an innovation is critical to its acceptance and has a negative impact on adoption. Rogers (1995) defines complexity as the degree to which an innovation is perceived as difficult to understand and use. Complexity as a concept is very similar to that of perceived ease of use.

Rogers (1995) defines trialability as the degree to which an innovation may be experimented with on a limited basis. New ideas that can be tried on the instalment plan will generally be adopted more quickly than innovations that are not divisible. An innovation that is trialable represents less uncertainty to the individual who is considering it for adoption, as it is possible to learn by doing.

Perceived risk is an additional concept used together with perceived innovation characteristics. Perceived risk is defined as the uncertainty that customers face when they cannot foresee the consequences of their purchase decision (Chan and Lu, 2004). Perceived risk can take many forms, depending on the product and consumer characteristics (Chan and Lu, 2004). According to Sheth (1981) there are three types of risks: (1) aversive physical, social or economic consequences; (2) performance uncertainty; and (3) perceived side affects associated with the innovation. According to Walker and Johnson (2006) perceived risk has two main elements related to technology enabled services. The first concerns the technical performance or functional reliability of the service delivery systems, and the second concerns issues of personal privacy and security. These are related to the absence of human contact during the service delivery process and the performance of the service delivery system. In

contrast to the perception of risk, research has shown that in the internet environment trust perceived toward the counterparty is important for behavioural intentions (etc. online shopping, returning to a vendor) (Gefen et al., 2003b; Gefen, Karahanna and Straub, 2003a). Tatnall and Lepa (2003) criticized diffusion of innovation theory to be too concentrated on the characteristics of the technology itself instead of looking at the formation of networks of human and nonhuman actors.

3.5 Trust and reliance as critical concerns for ICT applications in health care

As earlier discussed with TAM trust has been seen as an important determinant when adopting internet based services. Trust however has been studied in form of trusting the vendor and the quality of the product or services received from the vendor (Järvenpää and Tractinsky, 1999; Järvenpää, Tractinsky and Vitale, 2000), but also in form of trusting internet as a transaction medium (Martínez-López, Luna and Martínez, 2005). Trust is here also considered important in relation to electronic health care services, especially in terms of personal data send/received through wired or wireless channels. Information processing in virtual health services requires the identification of parties, encryption of data communications and the verification of message delivery, genuineness and solidity (Ylipartanen, 2004).

When considering consumers using electronic health care services, their perceptions of information security can be suggested to prompt adoption or rejection. Previous research discusses information under concepts of perceived reliability, security and privacy. Privacy was defined in the study of Vijayasarathy (2004) as the extent to which a consumers believes that shopping online will not compromise his/her privacy and security as the extent to which a consumer believes that making payments online is secure. Reliability was referred in the study of (Lee, Lee and Eastwood, 2003) as the degree to which a consumer believes that a new technology will perform a job consistently and accurately and in the same study perceived security concern indicated concerns about transaction security in terms of cyber crime or errors in transactions. This concept of security includes the aspects of feeling safety when transmitting personal information through the network, and is thus important for the present study. Reliability and security together with perceived benefits, complexity and

Trialability can facilitate adoption of internet services (Lee et al., 2003). Perceived risk in terms of security aspects has also been found to decrease perceptions of usefulness and that way diminish intentions to adopt and continue to use online services (Chan and Lu, 2004). In the context of health care, privacy and confidentially is one of the major barriers besides costs and lack of interoperability for health information technology diffusion (Anderson, Frogner, Johns and Reinhardt, 2006).

4 CHARACTERISTICS OF AGING CONSUMERS

Interest in older people as consumers is a relatively new phenomenon, thus too recent to have resulted in a substantial body of broadly accepted theory about their behaviour (Wolfe, 1997). The share of older consumers in the markets is continuously growing, and it is thus important to recognize that older adults as a group are very heterogeneous and individual differences are very prevalent throughout the life course (Czaja and Lee, 2007). However, Wolfe (1997) suggests that our culture is disregarding the value of knowledge transfer between generations and that it also regards people over 50 as obsolete. Aging is generally understood in negative way, and according to Wolfe (1997) the inability to feel positive about one's own aging is a barrier to understanding older people. The purpose here is to discuss the characteristics that change along aging and leave the lifestyle related characteristics out of the discussion, although lifestyle issues are usually discussed in consumer behaviour literature (Solomon, 1996). The typical characteristics of this greying market are discussed at first. Thereafter a focus is laid to the characteristics of aging concentrating on health related aspects of elderly lives drawn from gerontology. Finally, the aging population is considered as information technology users and potential adopters.

4.1 The greying market

Aging has psychological, biological, social and economic influences on consumers. These are illustrated in Figure 13 adapted from Pak and Kambil (2006). Biological changes cover changes in mobility, vision and hearing, which all influence consumers' customs. For marketers the biological issues create challenges for product and service designs and communication methods. Changes in memory and information processing result in declining rate of learning and avoiding situations that aren't familiar. Economic situations change due to retirement; however it is considered the elderly have high discretionary income (Lunsford and Burnett, 1992). Along with aging, people also change with experiences like grandparenting. These types of dimensions clearly demonstrate different aspects that need to be taken into account when considering aging people as a consumers market. It has to be noticed that each of these phenomena take place in an individual trait. Some of the changes

never occur for some individual, while some other might process all presented dimension simultaneously.

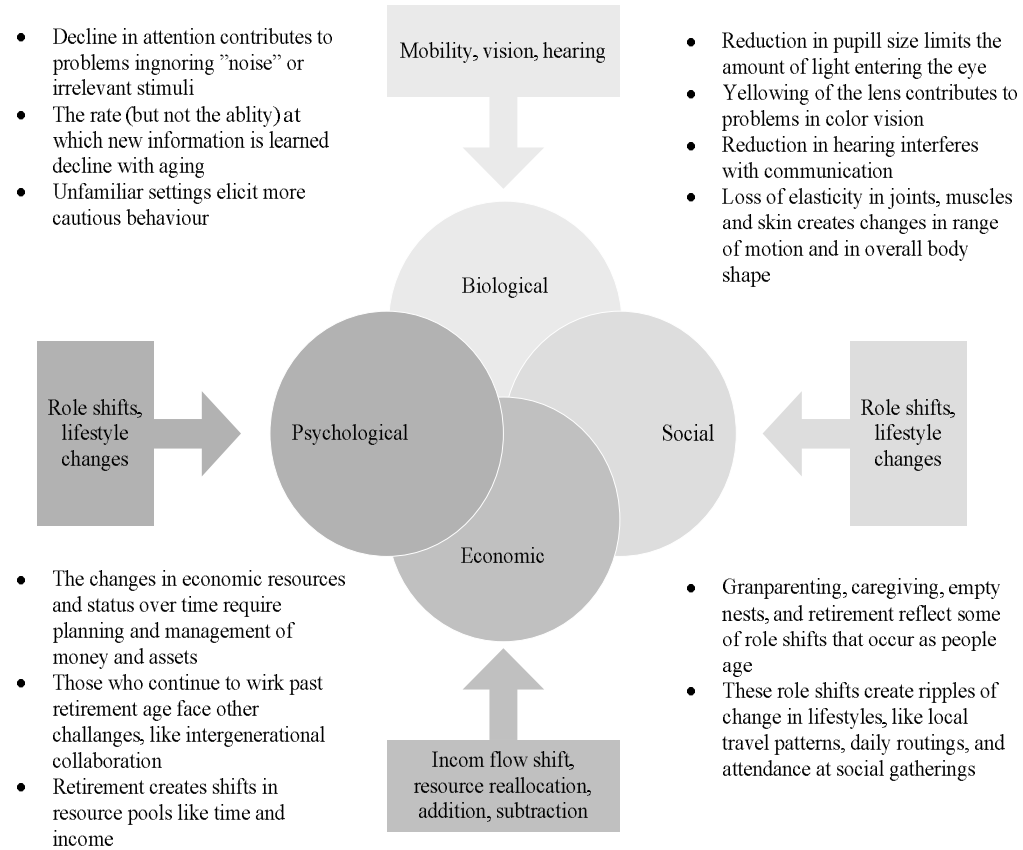

Figure 13 Transform of consumers through aging (adapted from (Pak and Kambil, 2006)

People age differently and aging itself is a multidimensional process, differences in consumer responses among older people are not likely to be the result of any specific factor (Moschis, 1992), it is therefore necessary to become familiar with aging related characteristics. People age biologically, psychologically, socially, and even spiritually, and these aging processes are manifested in differences in attitudes and behaviours even among people of the same age (Moschis, 1992). Moschis (1992) has introduced a segmentation model that succeeds in describing aging consumers' characteristics (Table 5). Health and psychological issues have thus been considered to be important when analysing the behaviour of older consumers. The

suggested segments are strongly based on health status and social communications between other people and society.

Table 5 Gerontographic segments

Healthy indulgers • rather good health • independent • active • relatively wealthy	Healthy hermits • good health • psychologically withdrawn from the society • concerned with day-to-day tasks • employed • have few social contacts • little interested in staying active
Ailing outgoers • health-conscious • poor physical condition • socially active • interested in learning and doing new things	Frail recluses • poor health • inactive • socially isolated • psychologically withdrawn from the society • security conscious (physical and home safety)

The characteristics of older consumers vary from those of younger adults. Wolfe (1994) suggests that the effect of peers declines through aging and consuming decisions are made more individualistically (Table 6).

Table 6 Characteristics of older and young-adult consumers

Mature adults	***Young adults***
Declining influence of peers	Heavily influenced by peers
Declining materialistic values	Highly materialistic values
More subjective	More objective
More introspective	More extrospective
High sensitivity to context	Low sensitivity to context
Perceptions in shades of grey	Perceptions in black and white
More flexible	More rigid
More individualistic	More subordinated to others
More discretionary behaviour	More predictable behaviour
Less price sensitive	More price sensitive
Complex ways of determining values	Simple ways of determining values
Whole-picture oriented	Detail oriented

Older consumers are more intent on making decisions with minimal influence from others than are younger consumers (Wolfe, 1997). Wolfe (1994) suggests that values related to autonomy and self-sufficiency, social and spiritual connectedness, altruism, personal growth and revitalization are the roots of motivations of older consumers.

Besides individual characteristics, older consumers seem to differ in preferred product or service attributes. Moschis (2003) suggests that there are certain product and vendor attributes that older consumers generally value regardless of type of offering or segment (Table 7).

Table 7 Product and vendor attributes preferred by older consumers

Attribute	Relationship to older consumer
Convenience	• convenient location of vendor
	• ease of doing business by phone of mail
	• ease of using products and services
Functionality	• intrinsic benefits of a product of service
	• objective characteristics of a product of service
	• indifferent to social benefits of a product or service
Quality	• quality-conscious
	• higher price for better quality
	• price matters only when the quality of different offerings is the same
Dependability	• risk-averse consuming
	• preferring of familiar and reputable brands
	• preferring of well-established of well-known vendor
Personalized service	• personal attention for face-to-face situations
	• personal relationship with the service providers
Product development	• not specially developed product for older person
	• offerings that have intergenerational or universal appeal
	• easy-to-open packages and containers

Older consumers thus prefer avoiding complexity when buying services or products, and also when using them. Offerings are accepted if they are beneficial and they need to match the expectations of the consumer in functioning and quality. Consuming is risk averse and decisions are based on previous experiences.

When older people are analysed as a market, it should also be noticed that many times people tend to feel younger than they actually are. Wilkes (1992) proposed and empirically validated a model that suggest cognitive age to be influenced by marital status, income and chronological age, and that cognitive age influences the entertain activities, fashion interests and work orientation suggesting that the chronological age shouldn't be the base for approaching the greying market.

4.2 Essential health-related issues

The older people in the study of Bowling (1995) rated own health, relationship with family and relatives, and financial security related to housing and standard of living as the most important issues in their lives. This gives on interesting point to the present study, as information technology should provide support for these issues, especially as people with longstanding illness/condition perceive that illness or other limiting condition affects mostly on social life activities and the ability to maintain activities of daily living. The present dissertation concentrates on health related issues when exploring older consumers' characteristics. Concepts of self-rated health, functional ability, cognitive function and depression are discussed more properly below.

4.2.1 Self-rated health

The definitions of health vary across scientific fields and based on definer's point of view, there is no one uniform concept for health (Leinonen, 2003). The constitution of WHO defines health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, 1946). This positive definition of health considers health as an all-inclusive well-being in terms of objective and subjective health. According to Blaxter (1990), it is necessary to consider whether different people are thinking of health in entirely different ways in terms of attitudes to health, ideas about causes of illness, and the relationship between attitudes and behaviour. The way that health is understood, affects level personal functioning and decisions at the individual and health politics at the societal level (Leinonen, 2003). Health as a subjective experience is situational (Blaxter, 1990), and in epidemiological research the terms self-assessed health, self-rated health, self-perceived

health, self-evaluated health, perceived health, subjective health and experienced health can be seen to represent same concept (Bjorner et al., 1996).

Perceptions of health vary among different social groups and depend very much on age and experience and thus self-assessments can be very individual and eccentric (Blaxter, 1990). Self-rated health is considered to be a concept that refers to individual responses to physical, mental and social effects of illness on daily living and considered to be one part of quality of life (Vaez, Kristenson and Laflamme, 2004). Bjorner et al. (1996) define self-rated health as the individual's perception and evaluation of his or her health including perception of symptoms, well-being, general health and vulnerability. According to Leinonen (2002), self-rated health is determined by the existence or absence of chronicle diseases, level of functioning, way of living, psychological well-being, socio-demographic and socio-economic factors and adaptation to changes emerging through aging. The person's resources and limitations, and the demands and resources of the environment, are perceived to be in balance when self-rated health is good (Håkansson, Svartvik, Lidfeldt, Nerbrand, Samsioe, Scherstén and Nilsson, 2003).

Idler and Benyamini (1997) gathered some possible interpretations of perceived health after reviewing 27 community studies:

(1) Self-rated health is a more inclusive and accurate measure of health status and health risk factors than the covariates used (p. 27). This means that self-rated health captures the full array of present illnesses and even symptoms of undiagnosed disease. Self-rating of health represents complex human judgements about the severity of current illness and it also reflects family history.
(2) Self-rated health is a dynamic evaluation, judging trajectory and not only current level of health (p. 29).
(3) Self-rated health influences behaviours that subsequently affect health status (p. 29). It is suggested that poor health may lead to less engagement in preventive practises or self-care. Poor perception of health may also produce nonadherence to screening recommendations, medication, and treatment.
(4) Self-rated health reflects the presence or absence of resources that can attenuate decline in health (p. 30). These resources are provided by the external social environment (e.g. social networks), but it may also reflect within-person resources.

Perceived health is considered to be a good predictor of needed doctor's consultation and use of medication (Fielding and Li, 1997), and additionally it has turned out to be a predictor of mortality as well (Idler and Angel, 1990). Self-assessed health status is a major factor determining if, when and where care is sought (Pak and Pol, 1996). Self-rated health (SRH) is a really complex concept, as a person may be diagnosed with a chronic condition but still feel relatively healthy (Alpass and Neville, 2003; Stein Wellner, 2003). Self-rated health seems to be an important indicator of several aspects of functioning and may be focused on preventing morbidity, functional limitations, sick leave and disability pension and promoting health (Håkansson et al., 2003). Little is known, however, of the factors that contribute to self-rated health, and it is therefore interesting to explore factors that promote or limit good self-rated health (Håkansson et al., 2003). The extensive review conducted by Bjorner et al. (1996) revealed that in many studies functional status and mental health (depression) are indicators of self-rated health. Functional ability has almost always been one of the strongest correlates of self-rated health. Bjorner et al. (1996) also summarized results related to socio-demographic factors' effect on self-rated health. Most consistent results have been found on the association of low education and poor self-rated health. Most of the studies they reviewed revealed no gender differences. Both negative and positive relationships have been discovered for age and self-rated health, for instance the study of Johnson and Wolinsky (1993) suggests that older elderly perceive their health better than younger elderly. Kempen, Miedema, van den Bos and Ormel (1998) studied the relationship of perceived health and domain-specific measures of health (e.g. depressive symptoms, mental health, physical functioning). Their results suggest that domain-specific health constructs explained less than half of the variance in perceived health. Farmer and Ferraro (1997) analysed longitudinal data and their results indicate that perceived health constitutes from chronic illness, disability and distress at concurrent measurement point, and that perceived health has a predictive role for changes disability at the second point of measurement, thus supporting the suspect that there is self-pertaining process from illness and disability to perceived health. The role of psychological well-being on perception of overall health status was already found by Tessler and Mechanic (1978) with four different datasets. Self-rating of health among older people isn't always very linear with age or chronic conditions, in spite if the difficulties that they experience due to psychological disorders, they tend to express a more positive view of their own health (Ferraro, 1980). Self-rated health is also part of life satisfaction along with internal control and organizational activity (Palmore and Luikart, 1972).

Existence of individual diseases can affect self-rated health, but for instance only atherosclerosis, hypertension and coronary heart disease had direct impact on self-rated health (Johnson and Wolinsky, 1993). The structural modelling of Johnson and Wolinsky (1993) suggest that disability (in lower or upper body) is a determinant of functional limitation instead of disease, and that disability and functional limitations both influence self-rating of health.

Gender roles exert a direct effect on the process of rating one's own health, with women more likely to tolerate a higher degree of impairment for any given level of assessment (Stoller, 1984; Johnson and Wolinsky, 1993). Age differences also exist as an older person with a given set of health status is more likely to rate his/her health better than that of age peers (Stoller, 1984) and own health is usually estimated to be better than others in same age. One possible explanation for this is that along with aging, people tend to increase their own status by underestimating the health of others. Johnson and Wolinsky (1993) also found education level to influence perceived health in terms that better educated tend to evaluate their health much better than subjects with lower level of education.

Self-rated health has also been found to be a determinant of cognitive performance. Jelicic and Kempen (1999) studied cognitive performance through mini-mental status examination (MMSE) and found that participants of the study with poor self-rated health had lower MMSE scores than those with good self-reported health. Their results thus indicate that health related factors influence the cognitive function in the elderly even after controlling for depression.

4.2.2 Functional ability

WHO (2002) defines disability in two parts. The first part views disability as a feature of the person, directly caused by disease, trauma or other health condition, which requires medical care provided in the form of individual treatment of professionals. The other definition sees disability as a socially-created problem and not at all an attribute of an individual. According to Verbrugge, Merrils and Liu (1999), disability is a multifaceted phenomenon. Disability can be defined as difficulty doing a task on one's own due to health (Verbrugge and Yang, 2002). Health-related limitations can occur in numerous roles and activities such as job, bathing, going shopping, socializing with friends, and active recreation (Verbrugge, 1997). Person's

ability to continue living independently at his/her own home is usually evaluated with functional abilities (Nyholm and Suominen, 1999). Disability can be short term or long term, and due to acute or chronic conditions (Verbrugge et al., 1999).

Functional ability is a wide concept related to well-being, and the diagnosed diseases are only one small part of it. Functional abilities can be approached from three dimensions: physical, psychological and social abilities. Typically, the discussion concerns of functional limitations occurring in performing the routine tasks of daily living. Activities of daily living (ADL) and instrumental activities of daily living (IALD) are measures commonly used as one of the criterion for the eligibility. ADLs generally are the ability to eat, dress, walk, toilet, and bathe, activities considered necessary for a person to care for him or herself directly or independently (Slivinske, Fitch and Wingerson, 1998). IADLs on the other hand include ability to shop, prepare meals, do housework and take medication. Emphasis on ADLs and IADLs stems from three features: these activities are universal or nearly so in a society; trouble doing them implies serious dysfunction; and personal of equipment assistance is needed to counter ADL/IADL dysfunctions, thus entailing public and private costs (Verbrugge, 1997).

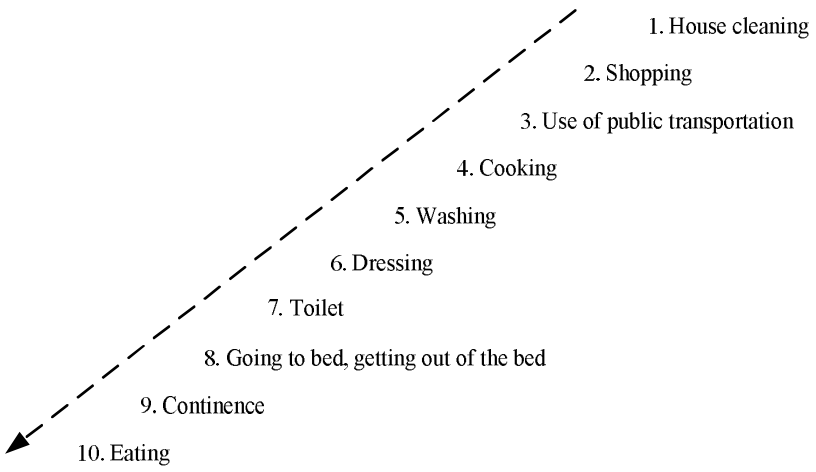

Figure 14 Decline of functioning (Nyholm and Suominen, 1999)

Illustrated in Figure 14, the first disabilities appear in housecleaning and shopping. When the level of functioning continues to decrease problems are found in usage of public

transportation and cooking. Finally, when the ability to live independently is very low people find difficulties in getting to and out of bed, in continence, and in eating. At the latest nor later than this institutional care is necessary if homecare cannot be arranged. Functional abilities are thus one critical aspect to the need for home care services.

Weakening ability to move may eventually leads to rendering of going outside one's own apartment, according to Laukkanen (2003) this lowers the amount of social contacts and might even lead to depression. On behalf of depression it is known that it accelerates the weakening of physical condition. In this kind of case, the person might end up to a circle that leads to ever accelerating weakening of physical abilities. The occurrence of functional limitations decreases the amount of physical exercises. The study of Hassmén, Koivula and Uutela (2000) found that individuals who exercise at least two to three times a week experienced less depression, anger, cynical distrust and stress than those exercising less frequently or not at all.

Chronic diseases and their steadiness and symptoms, lowered cognitive functioning, extent of depressive symptoms, as well as weakened hearing, sight, balance and physical functioning are all connected to difficulties and need for help in daily activities (Laukkanen, 2003). The nature of functional ability can be challenging. Doeglas, Suurmeijer, van den Heuvel, Krol, van Rijswijk, van Leeuwen and Sanderman (2004) revealed the changes in course of functional abilities due to the fluctuations of rheumatoid arthritis. The course of functional ability thus isn't always the same from better to worse.

According to Nyholm and Suominen (1999), the social networks of elderly are strongly attached to their homes. A new person arriving to the network can be experienced as an insult toward privacy. Home represents both private and social life of elderly more when the disabilities increase. Aging people that are no more able to maintain continuous, active relationships and whose functional ability has substantially decreased, spend almost all of their time at home. This means that the contacts outside their home are limited, and the more limited the functioning and availability of services, the less the social extent in life might remain. Remaining at home itself includes elements that weaken both physical and mental health. Relationship between functioning and depression has been studied, but for instance Doeglas et al. (2004) found that the depressive feelings are not linearly related to the level of functional ability. According to Laukkanen (2003), good socio-economic status is connected

to excellent functioning and it has been pointed out to have predictive power for later functional ability. Most often income level and education are used as indicators of socio-economic status.

4.2.3 Cognitive function and intellectual ability

Cognitive functions are the functions needed for processing information form the central part of psychic functioning. Suutama (2004) lists the basic functions of information processing to be: observation, psycho-motor functions, attentiveness, conceptualisation of time and space, linguistic functions, control of activities, memory and learning. The more complicated and extensive cognitive functions (e.g. thinking, planning, reasoning, problem solving and decision-making) are built upon these basic functions. Decline in cognitive functioning has variety of consequences in the daily lives of elderly (Saarenheimo, 2004). This appears through notions, that previously almost automatic matters take more time and effort. The decision to institutionalize someone is usually made when the person can no longer solve essential problems such as feeding, cleaning, or dressing themselves well enough to preserve their social and biological integrity (Charness, 1985). Problem solving is defined by Charness (1985) as the activity that enables someone to attain a desired state from an initial one in which it is nor immediately clear how to reach the desired state. Older people tend to learn more slowly than younger, to recall less, and often complain of difficulty in remembering (Welford, 1985).

The concept of intelligence includes both a potential ability, or a capacity, and an actual ability to think, reason, and learn (Botwinick, 1967). This includes a potential and actual ability to behave appropriately when coping with and solving problems. The differences between intellective potential and intellective ability are related to motivational, environmental, cultural and health factors (Botwinick, 1967). Increased age is generally associated with a decline in aspects of fluid intelligence, which is generally referred to as the processing and reasoning components of intelligence and related aptitude for learning (Czaja and Lee, 2007). With respect to fluid intelligence, working memory which refers to the ability to keep information active while processing or using it, declines with age as does the ability to select or attend to cues/information in the environment (Czaja and Lee, 2007). For learning to occur, five stages are necessary (Welford, 1985). In the beginning, material needs to be

perceived and comprehended. In the second phase it is held in some form of dynamic-short term memory system until thirdly takes place in a longer term registration. In the fourth stage, it must be held in this long-term storage until required for use leading to fifth stage in which it must be recovered from store. All of these issues make learning more difficult in older age. The slowing rate of information processing leads to "vicious spiral" effect (Rabbit, 1977): the greater the memory load, the greater the time for each operation. The greater the time, the greater the probability of memory inaccuracies. The greater the probability of memory inaccuracies, the greater the probability of incorrect decision which have to be modified by extra operation. The greater the number of extra operations, the greater the time and interference by extra activity, and the greater the probability of memory inaccuracies etc. Based on Botwinick (1967) intellectual processes are related to speed and the loss of speed due to aging is important and involved in a wide variety of behaviours such as learning performances.

Prospective memory or the ability to remember to do something in the future also declines with age (Czaja and Lee, 2007). One of the most common diseases in old age is dementia, which gives an increasing loss of memory with a decreasing ability to perform everyday tasks independently, along with difficulties (Holmén, Ericsson, Andersson and Winblad, 1992). This has significant effects on cognitive functioning.

Age-related changes in cognition have important implications for the design of technical systems. Essentially, human-technology interaction is an information-processing task. (Czaja and Lee, 2007) Learning is closely tied to memory functioning and even the normal decline of memory through aging renders difficulties in learning (Suutama, 2004). Cognitive abilities are thus related to technology adoption. The adoption of new technology requires new learning, which relies heavily on component cognitive abilities underlying fluid intelligence (Czaja and Lee, 2007). Fluid intelligence includes abstract thinking, reasoning, some of the memory functions and quick problem solving capacity in new situations (Suutama, 2004).

Intellectual functioning has been found to affect mental health and self-efficacy (Shifren, Park, Bennett and Morrell, 1999). Kiessling and Henriksson (2004) suggests that cognitive function reflecting ability to concentrate, activity drive, memory and problem solving is main explanatory factor of health related quality of life. Parallel results were obtained by Wood, Reyes-Alvarez, Maraj, Metoyer and Welsch (1999). Cognitive function (memory functioning)

is also associated with loss of independence in activities of daily living (Greiner, Snowdon and Schmitt, 1996). Three types of factors affect cognitive functioning (Suutama, 2004): health related issues, lifestyles issues and motivation. Besides illnesses (short term or long term), physical, psychological and social activities are related to information processing capabilities and vice versa. Suutama (2004) also highlights that the will to remember and learn things and use information processing functions maintains these operations.

4.2.4 Depression

The psychological challenges in aging originate from physical illness and adaptation to it, death of a close person, changes in health and functioning of oneself and close persons (e.g. spouse) and negligence (Pajunen, 2004). These all are possible causes for depression. Depressed elderly typically restrict themselves from their previously habitual communications with other people, and no longer take care of themselves or daily activities of life (Pajunen, 2004).

The fall of depression in the early adulthood and rise in the late life mostly reflects life-cycle gains and losses in marriage, unemployment, economic well-being, and it reaches its highest level in adults over 80 years old or older, because physical dysfunction and low personal control add to personal and status losses (Mirowsky and Ross, 1992).

Alpass and Neville (2003) found that diagnosis of a long-term illness or disability was unrelated to depression, but self-reported health was with those reporting poorer health experiencing greater depressive symptomatology. The main result found by Alpass and Neville (2003) was that loneliness had the strongest relationship to depression. They also found evidence that social isolation may be a more salient influence on the experience of depressive symptomatology among older males than the commonly suggested relationship that depression is a response to declining health and functional impairment. The study of older males revealed that self-rated physical health was related to depression but diagnosis of long-term disability/illness was not (Alpass and Neville, 2003). The results of Sonnenberg, Beekman, Deeg and van Tilburg (2000) showed the existence of sex differences in the prevalence of depression in the elderly indicating that older women appear to be at a higher risk. In the same study however, it was noticed that in certain circumstances men where more

prone to depression. The kind of life events such as no longer being married, lower income and low emotional support received can raise the risk of depression among older males. In general, females are more likely to be depressed and males (Mirowsky and Ross, 1992), this is also found to be true in the older population (Heikkinen, Berg and Avlund, 1995; Chiu, Chen, Huang and Mau, 2005). Depression is also linked with integrity and hope in the elderly population (Chimich and Nekolaichuk, 2004). Marital status influences depression together with education and financial situation (Brown, Gary, Greene and Milburn, 1992; Heikkinen et al., 1995). Married persons are likely to be less depressed compared to widowed or divorced people (Idler and Kasl, 1992; Mirowsky and Ross, 1992; Chiu et al., 2005), and higher education and better incomes are associated with lower level of depression. Penninx, Leveille, Ferrucci, Van Ejik and Guralnik (1999) summarize that depressed people are usually older more likely female, less educated and have lower incomes.

Beekman, Penninx, Deeg, Ormel, Braam and van Tilburg (1997) found that minor depression is related to physical health and major depression is strongly related to self-perceived health and functional limitations. A longitudinal study by Hays, Saunders, Flint, Kaplan and Blazer (1997) suggests that depression predicts change for worse not only for basic activities but also for strength/range-of-motion and stamina/mobility. Similar results have been found by other researchers that among older people there is a higher risk for depressed persons to became physically disabled (Heidrich and D'Amico, 1993; Penninx et al., 1999; Kivelä and Pahkala, 2001). Bruce, Seeman, Merril and Blazer (1994) however suggested that both depressive symptoms and physical disability can initiate a spiralling decline in physical and psychological health.

Limitations in functional abilities provoke depressive symptoms (Idler and Kasl, 1992; Chiu et al., 2005). Specific disease can also alter to depression, such as cardiovascular disease and hip fracture (Chiu et al., 2005) or arthritis, asthma, heart failure and gastric problems (Niti, Ng, Kua, Ho and Tan, 2007). Niti et al. (2007), however, suggest that the associations of depressive symptoms and chronic illnesses are mostly explained by subjective health and functional status. The study of van Gool, Kempen, Penninx, Deeg, Beekman and van Ejik (2005) verified a disablement process with a longitudinal study with three measurement points. Existing diseases lead to impairment, which eventually lead to disability through functional limitations. In this cycle they found that depression has an accelerating effect. This highlights the role of depressive symptom among elderly and the reduction and treatment of

depression thus may help slow down the process of disablement. Another path analytic model can be found in Gallo, Rebok, Tennstedt, Wadley and Horgas (2003). Their study linked cognitive processing and depressive symptoms to functioning. According to their work, existence of depressive symptoms lowers the level of memory and problem-solving ability, which then affect functional ability.

4.3 Aging as ICT users and potential adopters

Computers can present unique opportunities for older adults to socialize and establish social networks that can help alleviate loneliness and alienation (Karavidas, Lim and Katsikas, 2005). Information technology nowadays can bring contents to life for instance by helping communications between relatives and friends. For older adults with mobility problems or whose extended family live far away from them, the internet with tools such as email, instant messaging, and even web-based cameras can provide the virtual social support they need (Karavidas et al., 2005). But before none of these can happen, older consumers have to be capable and willing to utilize new ways of coping with technology. In the case of elderly, the anxiety toward new technology might be a major inhibitor of further utilization.

On the other hand, information technology has a huge potential in its applicability to health care services. Older adults can benefit from computer use by having daily tasks simplified provided if they receive the proper training and information on computer use and its applications to daily living tasks (Karavidas et al., 2005). Information and communication technologies can also be considered as potential reducers of health care costs for seniors. Typical examples are e-mail consultation and health related websites.

Szmigin and Carrigan (2000) proposed that cognitive age could be a determinant of domain specific innovativeness among elderly. They, however, didn't find any support for this proposition meaning that no significant relationship was found, and also their investigation included chronological age, but it appeared to have no effect on innovativeness. Vuori and Holmlund-Rytkönen (2005) found similar results in their study of 55+ internet users. Cognitive age had no relationship with internet use; instead, health was found to be a predictor of internet use. The elderly cohorts have been rarely under research related to innovation adoption and technology usage. Reisenwitz and Iyer (2007) conducted a cohort

based comparison of internet behaviour among the older and younger baby boomers resulting no differences between the two age groups. Age cohorts aren't thus enough powerful source of variation among older consumers; the behavioural differences should be sought somewhere else.

Typical for elderly adopting innovations is the fear that it will not perform as desired (Lunsford and Burnett, 1992). This kind of functional risk increases along with the technological complexity of an innovation. Among older consumers and technology, a common issue under research is the fear for technology, i.e. technology anxiety. According to Meuter et al. (2003), technology anxiety focuses on the user's state of mind regarding their ability and willingness to use technology-related tools. In the information technology research the focus has been on computer anxiety. According to Izard and Tomkins (1966), anxiety in general can be seen as a negative affect that tends to be sensed as noxious and difficult to tolerate and to instigate avoidance of and/or nonconstructive relations with the object.

Computer anxiety has been defined as emotional fear, apprehension and phobia felt by individuals towards interactions with computers or when they think about using computers (Chua, Chen and Wong, 1999), referring to the negative attitudes toward using the computer. Computer anxiety is a kind of state anxiety, which can be changed and measured along multiple dimensions (Chua et al., 1999). It is an irrational emotional distress and one experiences it when using or considering the use of computers (Igbaria and Iivari, 1995). Likely the anxiety rises from the inability or lack of self-confidence in effectively managing or controlling the technology (Oyedele and Simpson, 2007). The findings of Korukonda (2005) suggest that technophobia is related to extraversion and neuroticism. People characterized as extrovert are less phobic and in contrast people with characteristics of neuroticism are more phobic. In addition, the findings also suggested that people with high range of interest and tendency to seek novelty are less technophobic. This gives us a clear link for aging consumers' characteristics in Table 6, as mature adults turn out to be more individualistic and introspective. Based on the work of Beckers and Schmidt (2001), computer anxiety seems to be part of a process of cumulating experiences and it appears that its occurrence and its magnitude can be manipulated by altering the conditions under which these experiences are acquired and by guiding the perception of these experiences. The first experience with computer influences different aspects of computer anxiety, the more positive the first experience the lower the level of computer anxiety (McIlroy, Bunting, Tierney and

Gordon, 2001). According to Chua et al. (1999), there exist four characteristics typical for the nature of computer anxiety: (1) computer anxiety is a fear for computer when using or considering the possibility of computer use; (2) computer anxiety is a kind of "state anxiety" which can be changed; (3) computer anxiety is measurable in multiple dimensions; and (4) computer anxiety causes computer use avoidance. Computer anxiety has been introduced as an external element in TAM by Igbaria and Iivari (1995). In their research, computer anxiety had a negative direct effect on perceived ease of use, but the relationship between anxiety and perceived usefulness was insignificant. Computer attitudes in a general level have appeared to be good predictors of computer understanding and experience (Potosky and Bobko, 2001). Different antecedents have been tested to explain computer anxiety. Igbaria and Parasuraman (1989) studied managers' computer anxiety and predicted computer anxiety with several variables. From demographics, education was the only significant predictor. Personality explained anxiety through external locus of control and math anxiety.

Several researchers have found gender effects on computer anxiety indicating that females have less positive attitudes toward computers (Dyck and Smither, 1996; McIlroy et al., 2001; Gilbert, Lee-Kelley and Barton, 2003). However, as Dyck and Smither (1996) concluded, the results of analysing the relationship between gender and computer attitudes are rather inconsistent. Chua et al. (1999) made a meta-analysis including gender effect on computer anxiety and found female to be more anxious among university students that have mostly been target population in computer anxiety research. Gender – anxiety relationship however has been also studied with psychological gender revealing that there is a positive relationship between anxiety and femininity and a negative relationship between masculinity and anxiety (Todman and Day, 2006).

In addition, researchers have found support to the notion that computer experience has been associated with a more positive attitude (Glass and Knight, 1988; Dyck and Smither, 1996; Gaudron and Vignoli, 2002), and the inverse relationship between computer anxiety and experience was also supported in the meta-analysis of Chua et al. (1999). Computer anxiety also decreases the subjects' expectations and confidence of performing computer related tasks (Glass and Knight, 1988). In the study of Beckers and Schmidt (2003), gender had no direct effect on computer anxiety, the effect of sex was moderated by computer experience meaning that the anxiety typically found for females is due to the less computer experience compared to men. Wilfong (2006) found self-efficacy believes and computer experience to be negatively

correlated with computer anxiety, and indicated with regression analysis that computer self-efficacy believes were better explainer for computer anxiety than computer experience. The computer self-efficacy is a measure that captures subjects' believes of accomplishing computer related tasks with relevant help such as other people or manuals. The study of Levine and Donitsa-Schmidt (1998) suggests that computer attitudes and computer self-confidence are determinants of perceived computer knowledge, indicating that attitudes and self-confidence influence the perceived ability handle different computer related tasks. Kinzie, Delcourt and Powers (1994) proposed similar results as computer comfort and anxiety were good predictors of computer self-efficacy related to different computer tasks. Measurement of ability to use computers in different tasks thus does not indicate the general control felt over computers; instead the measures consist of different task based approaches such as spreadsheet and word processing (Kinzie et al., 1994; Levine and Donitsa-Schmidt, 1998). Laguna and Babcock (1997) compared older and younger adults through computer assisted tasks and found that older adults had higher computer anxiety and the performance of computer related tasks differed only in the duration of decision-making not in the amount of correctly performed tasks. Technology anxiety driven from computer anxiety was found to be a good predictor of self-service technology usage (Meuter et al., 2003).

Previous research introduces explaining factors for computer anxiety such as computer experience, age and both biological and psychological gender (e.g. Beckers and Schmidt, 2003; Gilbert et al., 2003; Hackbarth, Grover and Yi, 2003; Karavidas et al., 2005; Todman and Day, 2006). On the other hand, findings on elderly attitudes toward computers suggest that a positive attitude depends upon multiple variables including health status. Additionally, there has to more behind the anxiety than demographic factors. For instance, Igbaria and Parasuraman (1989) argued that cognitive style is a determinant of computer anxiety, and that individual high on thinking and sensing would experience lower computer anxiety. People not so familiar with computers need to learn and increase their knowledge of computers and thus, it could be argued that the anxiety could be related to personal abilities and health status, especially in the case of older consumers.

5 CONCEPTUAL MODEL AND HYPOTHESES

Model and hypotheses are formed here for the basis of empirical research. At first, it is seen important to compare the key concepts that rise from the innovation adoption literature and select the concepts that are applied from now on. Thereafter, the key for the dissertation i.e. the research model and hypotheses are set for proceeding with the empirical part of the work.

5.1 Selecting the essential concepts

After reviewing extant literature and research papers it can be said that the concepts in different models used to evaluate adoption of ICT innovations are quite similar, although named differently. Table 8 summarizes these concepts. For further proceeding in the present dissertation, it was considered important to select the key concepts that apply best for current purposes.

All three background theories include similar concepts referring to the ease or difficulty of performing the behaviour (in this case using the innovation under research), namely perceived behavioural control, ease of use and complexity. The social aspects are included in subjective norm and observability. Technology acceptance model has ignored the effect of social issues on behavioural intention, although attitude toward using has similarities with compatibility. At this point it is necessary to take computer anxiety into account as one important indicator of aging consumers' attitudes toward computers.

Table 8 Central concepts in three ground theories of innovation adoption

Theory of planned behaviour (TPB)	*Attitude toward the behaviour* The degree to which a person has a favourable or unfavourable evaluation or appraisal of the behaviour in question
	Subjective norm The perceived social pressure to perform or not to perform behaviour
	Perceived behavioural control The perception of the ease or difficulty of performing the behaviour of interest.
Technology acceptance model (TAM)	*Perceived usefulness* The degree to which a technology is perceived as providing benefits in performing certain activities
	Perceived ease of use The extent to which a technology is perceived as being easy to understand and use
	Attitude toward using
Diffusion of innovation (DOI)	*Relative advantage* The degree to which an innovation is perceived better than the idea it supersedes
	Observability The degree to which results of an innovation are visible to others
	Compatibility The degree to which an innovation is perceived as being consistent with existing values, past experiences, and needs of potential adopters.
	Complexity The degree to which an innovation is perceived as difficult to understand and use
	Trialability The degree to which an innovation may be experimented with on a limited basis

Table 9 concludes the selected concepts and their definitions that hold throughout the rest of the dissertation, and it also represents the corresponding concepts compared to each theoretical model discussed earlier. For the technology perceptions, the selected concepts are technology anxiety (for both computer and mobile phone) and perceived behavioural control. These attributes are used when the current technology usage behaviour is analysed. The small size of the mobile phone makes it necessary to take the physical restrictions of the device into account. This element is included because the nature of mobile phones is that they are small, thus making text smaller and reading more difficult compared to computers. Through aging it is assumed that small buttons and small screen make the use of mobile phones more restricted than among younger consumers. Instead of taking the device selection into account as a dichotomous variable as done by Bruner and Kumar (2005), the perceptions of physical

limitations using mobile phones are discussed as independent construct related to mobile phone usage. The physical size may be a possible inhibitor for mobile phone usage as the disabilities increase along aging. As discussed earlier, aging consumers are more introspective and individualistic and they are less altered by peer influence (see Table 6), subjective norm or social influence was left out of further inspection.

Table 9 Concepts and definitions applied in the study

Concept	Definition	Correspondence to original models
Technology anxiety (mobile and computer)	The degree to which the usage or an idea of using the technology arouses unfavourable feelings and fear.	TAM (attitude toward using) TPB (attitude)
Perceived behavioural control	The degree to which the innovation is understandable and easy to use.	TAM (perceived ease of use) TPB (perceived behavioural control) DOI (complexity)
Physical restrictions	The degree of problem arising due to the size of mobile phone.	
Technology usage behaviour	The stage describing the adoption in terms of technology ownerships and skills.	TAM (actual system use) TPB (behaviour)
Perceived usefulness	The degree to which the innovation is seen as useful for the adopter and for the society.	TAM (perceived usefulness) DOI (relative advantage)
Reliability	The degree to which the innovation is considered to maintain privacy and data secured.	
Behavioural intention to use	The degree to which the potential adopter sees the possibility of becoming a users of an innovation.	TAM (behavioural intention to use) TPB (behavioural intention to use)
Perceived health	The degree to which individuals perceives ones on well-being in terms of health conditions.	TAM (external variables)
Functional ability	The degree of being able to take care of activities of daily-living.	TAM (external variables)
Depression	The degree of the existence of depressive symptoms.	TAM (external variables)
Cognitive ability	The degree of the ability to learn and take care of matters.	TAM (external variables)

When analysing the behavioural intention to use a non-existing service, the technology perceptions are complemented with perceived usefulness and reliability. Perceived usefulness is elected to indicate potential adopters' attitudes over relative advantage, because perceived

usefulness is a straight concept for potential benefit of new service model and relative advantage moreover indicates potential benefits of an innovation compared to some existing service or manner.

In the context of behavioural intention to use health service via ICT, the issue of trust or reliability is a bit different as in the interaction between customer and service provider as it doesn't aim toward monetary transactions. The reliability of the service provider as a health care professional isn't considered as a threat to new service adoption. Instead, the technology, that allows the new type of interaction related to health issues, is seen as a major risk for the potential adopter, in other words how reliable the system is perceived. In addition to the technology related characteristics, the concepts discussing the health-related characteristics are also determined, i.e. self-rated health, functional ability, depression and cognitive ability.

5.2 Research model and hypotheses

Based on the discussion above, three main research models are formed based on the target behaviour (i.e. PC usage behaviour in Figure 15, MP usage behaviour in Figure 16 and behavioural intention to apply these devices for new health-related services in Figure 17). Each of the main models is divided into three sub models for testing the proposed hypotheses gathered in Table 10.

The first hypotheses (H1-H3) are formed to elaborate the antecedents of self-rated health based previous discussion, i.e. assumptions are that self-rated health is determined by level of functioning, existence of depressive symptoms and perception of cognitive abilities. The interrelations between functional ability, depression and cognitive state are left out of analysis. This is partly due to the fact that one-way causal relationships do not always exist in reality, rather there might exist circular interactions between the different constructs (Heikkinen, Kauppinen and Laukkanen, 2003). These hypotheses are verified with model 1, which is uniform element in the three main research models.

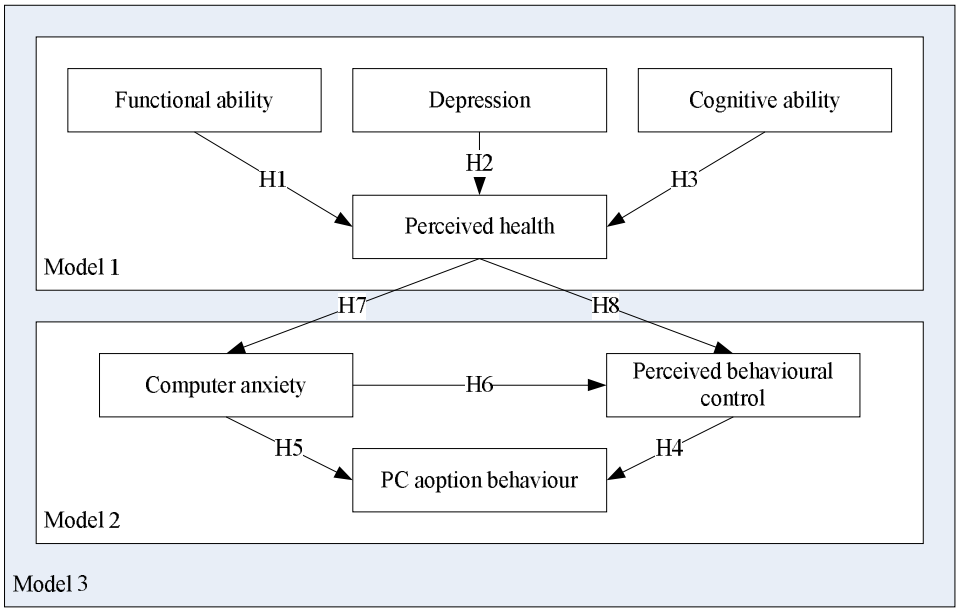

Figure 15 Hypotheses for PC usage behaviour

Figure 15 thus illustrates the research model for studying PC adoption behaviour. Model 2 assesses the relationships between technology perceptions and adoption behaviour (H4-H6). It is suggested that both computer anxiety and perceived behavioural control influence the behaviour, and that anxiety has also an indirect effect through behavioural control. Model 3 unifies the health related characteristics to the technology perception, and suggests that the perceived health status influences the development of different technology perceptions (H7 and H8).

The research model for mobile phone (MP) adoption behaviour in Figure 16 includes the same model 1 as mentioned before. It follows the similar logic as the research model for PC adoption behaviour. Model 4 discusses the technology perception related to mobile phones and their influence on actual adoption behaviour. The concept of computer anxiety is modified for mobile phones it has been considered that what has been learned can easily be extended to apply to anxiety in relation to technological tools in general (Meuter et al., 2003). Similarly, the mobile anxiety is hypothesized to have a direct and indirect effect on MP adoption behaviour (H11 and H12). Physical restrictions are suggested to influence on the perceived behavioural control and also directly on the adoption behaviour (H9 and H13).

Finally it is suggested the behavioural control influences the adoption behaviour (H10). Model 5 again unites health concepts and technology perception (H14-H16).

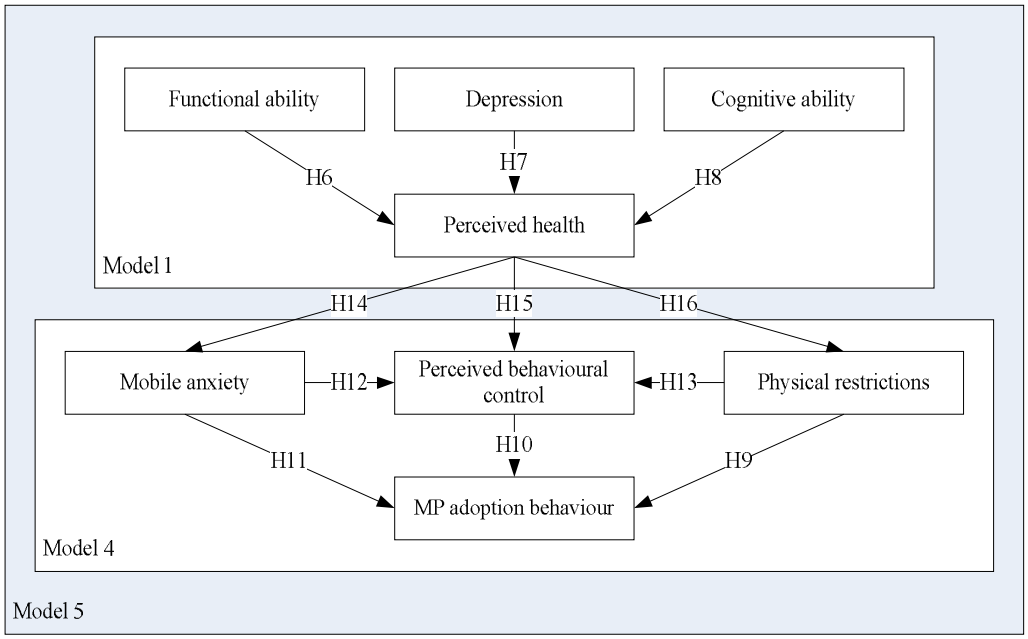

Figure 16 Hypotheses for MP usage behaviour

The last of the main models concern the behavioural intention to use a hypothetical service innovation with mobile phone or with personal computer (Figure 17). Once again, model 1 holds here the same, but model 6 attempts to explain the perceptions related to the new service and the intention itself.

Starting from the top, H23 is in line with the previous models; anxiety (now a unified concept of technology anxiety) is suggested to influence perceived behavioural control (also a unified concept of the separate technologies). The perception of reliability of service applications is determined with the technology anxiety and perceived behavioural control (H20 and H21). Perceived behavioural control is also proposed to alter the perceived usefulness (H22). It is suggested that the more reliable the older consumer sees the electronic medium as a communication channel the more useful it is perceived (H19) and the more likely they are intended to adopt ICT-assisted health care services (H17).

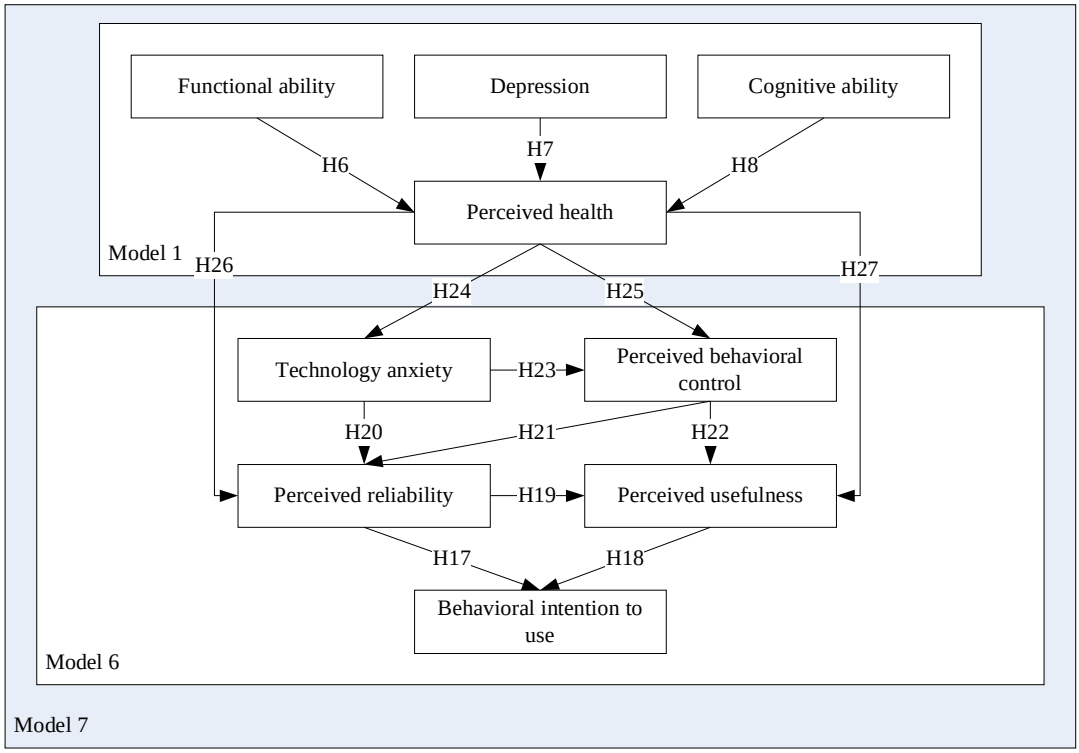

Figure 17 Hypotheses for behavioural intention to use new health services with PC of MP

The perception of risk is entitled in the reliability component due to the transmitting of private data through network. Finally, perceived usefulness is considered to affect behavioural intention (H18). Perceived usefulness is only taken into account in the behavioural intention model, because the mobile phone and computer adoption discusses a real existing product, and therefore it wasn't considered necessary to assess the perceived usefulness in that context. However, in the context of the hypothetical service, the respondent has to imagine the new type of communication manner with the existing technology and form perceptions of its usefulness, thus there is a real basis for comparing current services to the new service innovations. Model 7 unites perceived health with technology anxiety (H24) and perceived behavioural control (H25). In addition, perceived health is also suggested to affect the reliability (H26) and usefulness (H27) perceptions related to the new service idea.

Table 10 Research hypotheses

Model 1	H1	Good functional ability has a positive effect on perceived health status.
	H2	Existence of depressive symptoms has a negative effect on perceived health status.
	H3	Good cognitive ability has a positive effect on perceived health status.
Model 2	H4	Perceived behavioural control has a positive effect on PC usage behaviour.
	H5	Computer anxiety has a negative effect on PC usage behaviour.
	H6	Computer anxiety has a negative effect on perceived behavioural control.
Model 3	H7	Good perceived health has a negative effect on computer anxiety.
	H8	Good perceived health has a positive effect on perceived behavioural control.
Model 4	H9	Physical restrictions have a negative effect on MP usage behaviour.
	H10	Perceived behavioural control has a positive effect on MP usage behaviour.
	H11	Mobile anxiety has a negative effect on MP usage behaviour.
	H12	Mobile anxiety has a negative effect on perceived behavioural control.
	H13	Physical restrictions have a negative effect on perceived behavioural control.
Model 5	H14	Good perceived health has a negative effect on mobile anxiety.
	H15	Good perceived health has a positive effect on perceived behavioural control.
	H16	Good perceived health has a negative effect on physical restrictions.
Model 6	H17	Reliability on the electronic information transmission has a positive influence on behavioural intention to use
	H18	Perceived usefulness has a positive influence on behavioural intention to use.
	H19	Reliability on the electronic information transmission has a positive influence on perceived usefulness.
	H20	Technology anxiety has a negative influence on perceptions of reliability.
	H21	Perceived behavioural control has a positive influence on perceptions of reliability.
	H22	Perceived behavioural control has a positive influence on perceived usefulness.
	H23	Technology anxiety has a negative effect on perceived behavioural control.
Model 7	H24	Good perceived health has a negative influence health on technology anxiety.
	H25	Good perceived health has a positive influence on perceived behavioural control.
	H26	Good perceived health has a positive influence on perceived reliability.
	H27	Good perceived health has a negative influence on perceived usefulness.

Based on the literature review, age will be added as a control variable on technology perceptions in order to test the role of health characteristics independently of age.

6 RESEARCH METHODOLOGY

The empirical part of the present dissertation begins with the introduction to the research design discussing the questionnaire development, sampling and analysis methods. After these issues the measurement issues are discussed.

6.1 Research design

The research design of the dissertation is presented here. The issues related to empirical data collection are discussed in forms of questionnaire development and sampling. The research methods are briefly introduced.

6.1.1 Sampling

The population of interest was aging people, those of already retired and those just under retirement. The mail survey was targeted to people aged between 55-79 years. A random sample of 1000 people stratified with five year age categories was drawn from the Finnish Population Register Centre. The share of each age category in the sample was then the same as it is in the true population. Age was considered important stratification variable in order to avoid cohort bias. The sample size corresponds about eleven percent of the target population.

6.1.2 Data collection

The survey questionnaire was developed in a research project that studied public health care processes in a mid-sized city in Southern Finland. The development of the questionnaire began with the pooling of topics under research. The essential literature was reviewed in order to find appropriate measures. The questionnaire was rather massive, because it was designed to serve the purposes of the larger research project. It was divided in sections of (1) background information; (2) health status, activities of daily living and usage of health services; (3) usage of computers and mobile phones; and (4) control of additional life issues

and free time activities. Appendix 2 represents the part of the questionnaire relevant for the present thesis. At the development stage of the questionnaire, a careful attention was paid to the fact that the respondents were aging people and had different kind of abilities. Instruction were attempted to make as clear as possible and answering as easy as possible. The questions were staggered appropriately in order to avoid frustration of the respondent. The scope of the information needed and the age of the respondents made it necessary to avoid long measurement scales and keep the amount of measurement items as low as possible, however maintaining the validity of measurement.

The questionnaire was carefully pretested. The prestest included 14 older customers of local health care centre. The questionnaire was informally gone through with each of the respondents separately and comments were received for additional improvements. Based on the comments the questionnaire was finalized. At this point the feedback was very positive and encouraging.

The mail survey as a data collection method was selected based on comparing it for two alternative methods. First, telephone interviews were considered to be too expensive and slow for the purposes, and such a long questionnaire would have tied the respondents to remain in contact too long with the interviewer. Second, internet or email survey was considered to lead to biased results considering the older target population, and the population would have been much more difficult to address, since no official registry exists for email addresses.

The questionnaires were mailed in the last quarter of 2004. The mail included a cover letter with specific information of the research and contact information of the researcher and confirmation of the anonymity. A prepaid return envelop was also included. As an incentive, the respondents were offered a possibility to take part in raffle that had three prizes selected carefully for the target audience.

The respondents had two weeks time to send the response. After the mailing, few phone calls were received from respondents that needed further advice. A close relative of one respondent sent an email that the respondent was no more able to answer the questions. The eventual response rate of the survey was 55.6 percent, which can be considered outstanding. Similar studies have been conducted and for comparison, Eastman and Iyer (2004) captured a response rate of 13.2 percent from a survey targeted for senior aged between 65 and 85, and

McMellon and Schiffman (2000) a nine percent response rate from a survey targeted for elderly. Although an incentive was provided in the present study in order to increase the response rate, the raffle itself appeared not to be the source of primary motivation for answering, only 78 percent of the respondents wanted to take part in the raffle. It could be suggested that the topics discussed in the survey were considered as caring for the older people's matters in the local community. The received questionnaires were all completed, and only one of them had to be rejected from the analysis, as the respondent was much younger than the target population.

6.1.3 Sample representativeness

The representativeness of the sample was tested by comparing the respondents' age distribution to that of the original population. Sample fit to the population was verified with χ^2-test (Table 11). The youngest respondents were less active than expected, and the age category of 65-69 replied over expectancy. The lower activeness of 55-59 year old respondents might be due to the type of questions included in the survey. For instance disabilities aren't very topical for most members of this age group. Altogether, the responses received can be considered as very representative compared to the original population in terms of age.

Table 11 Verifying the sample representativeness

	Observed %	Expected %	Residual
55-59	25.1	29.5	-4.4
60-64	20.5	20.3	.2
65-69	23.2	19.9	3.3
70-74	17.3	16.4	.9
75-79	13.9	13.9	.0
	$\chi^2 = 6.949$	p = .139	

From the respondents, 56.8 percent were females. The original share of women on the target population was 54.4 percent. Simple binomial test supports the assumption that the sample is representative for gender also.

6.2 Methods of analysis

The empirical analysis is based on structural equation modelling, because it has a potential for depicting and testing a theory as a whole including causal relationships (Huba and Harlow, 1986), thus fits for the purposes of the present study. Before testing the models proposed in previous chapter, structural equation modelling is at first applied for testing the measurement models with confirmatory factor analysis. Causal modelling assumes the following structural equation model (Huba and Harlow, 1986):

$$\eta = \mathrm{B}\eta + \xi \qquad \textbf{Equation 1}$$

where η = qx*1* matrix of latent dependent and independent variables
B = qxq matrix among regression weights among latent variables
ξ = qx*l* matrix of residuals or disturbances in the latent variable
q = number of latent variables

The measurement model for the observed variables is given by:

$$\mathrm{Y} = \Lambda\eta + \varepsilon \qquad \textbf{Equation 2}$$

where Y = px*1* matrix of observed dependent and independent variables
Λ = pxq matrix of weights relating latent variables to observed variables
ε = px*1* matrix of error variables for observed variables

Unweighted least squares was used as an estimation method. Equation 3 represents the fitting function which minimizes one half of the sum of squares of each element in the residual matrix. The residual matrix consists of the differences between the sample variances and covariances and the corresponding ones predicted by the model (Bollen, 1989).

$$F_{ULS} = \left(\frac{1}{2}\right) tr\left[(S - \Sigma(\theta))^2\right] \qquad \textbf{Equation 3}$$

where, S = sample covariance matrix
Σ (θ) = implied covariance matrix of structural parameters

Unweighted least squares is a full information technique, and an iterative procedure, whereby final parameter estimates are obtained through a numerical search process which minimizes the value of the fitting function by successively improving the estimates (Diamantopoulos and Siguaw, 2000). It is suggested to be used together with polychoric correlations (Rigdon, 1998). The unweighted least squares method has no assumption about the distribution of observed variables (Long, 1983).

Besides structural equation modelling, Heckman regression model with two step estimation procedure (Heckman, 1976; Greene, 2003) is applied to test the selection bias for the datasets applied in the structural models. Self selection by the individuals or data units being investigated is one of the main reasons for sample selection bias (Heckman, 1979), and as mentioned earlier, the questionnaire was very structured and carefully staggered in order to avoid respondent's frustration, thus it was considered necessary to analyse the possible selection bias based on the health-related variables.

6.3 Measurement

This section covers the necessary issues for measurements. The selection on the measurement items is discussed at first. Thereafter the measurement models are verified using exploratory and confirmatory factor analysis. Reliability assessment is conducted based on the confirmatory analyses.

6.3.1 Item selection for the questionnaire

Most of the measurement items were collected from existing literature and adjusted for the topics under interest. As discussed earlier, the measurement scales were kept as short as possible in order to avoid frustration among the respondents. Table 12 summarizes the literature sources used for measurement selection.

Functional ability was measured using similar methods as previous research (Verbrugge and Yang, 2002). All the basic activities and instrumental activities of daily living were included in the questionnaire. The questionnaire included four response alternatives (Appendix 2,

questions 45-60). For the analysis purposes two of the response alternatives were combined, and thus the level of coping with different issues was measured with a three point ordinal scale (1=cannot cope at all, 2=has difficulties, 3=copes independently). People who use personal or equipment assistance for the task due to health were assumed to have difficulty doing it (Verbrugge and Yang, 2002).

Self-rated health was measured with a global measure for self-rated health (Jelicic and Kempen, 1999; Vaez et al., 2004). It had five response alternatives varying from poor to excellent (Appendix 2, question 34). This measure of self-rated health is a non-comparative measure that indicates the perception of current state of health, and it is widely used in research of self-rated health. The global measure of self-rated health was complemented with additional statements (measured with 1=completely disagree…5=completely agree) in order to form a multi-item scale and thus increase the reliability compared to one item measurement (Appendix 2, question 35).

Measurement reflecting depressive symptoms was partly based on CES-D scale (Radloff, 1977), namely represented a dimension of depressed affect. Additional items included were modified from the study of functional model of mental health conducted by Sohlman (2004). The items were all measured with the five-point Likert-scale ranging from totally disagree to totally agree (Appendix 2, question 96).

The measurement items selected to cover the level of cognitive capacity were drawn from the cognitive factor of Zung Self-Rating Depression Scale (Passik, Lundberg, Rosenfeld, Kirsh, Donaghy, Theobald, Lundberg and Dugan, 2000). The limitation to only two items was due to the perspective of comparing the current and previous state of cognitive functions. The measurement items had similar Likert-scale as depression measures (Appendix 2, question 35).

Technology related measures were mainly collected from previous research. The focus of the research however made it necessary to modify the measures related to ICT use and intention. As mobile phones are almost at the position of everyday consumption commodity, the traditional measurement for behavioural intention was out of the question. In order to make the measurement comparable with computers also, the measurement for mobile phones and PCs were developed to reflect the current stage of adoption, in both owning the computer as

well as the level of computer skills were taken into account (Appendix 2, questions 68, 69, 74,75). Both of these included intention also, but only as one answer opportunity. This is partly inline with the measurement used by Gaudron and Vignoli (2002), who had two measures indicating computer use and experience, namely time spend with computers and the level of experience and expertise. In the case of future services related to health care, the behavioural intention was measured as suggested in the literature (e.g. Venkatesh, Speier and Morris, 2002) (Appendix 2, question 81).

Attitudes toward computers have been measured with numerous scales (see historical summary of computer attitude scales in Shaft, Sharfman and Wu, 2004). The focus related to computer attitudes is in the present study in computer anxiety, which is typically included as one dimension in computer attitude scales. Different scales of computer attitudes and computer anxiety were compared in order to elaborate an effective but reasonably short and valid measurement for computer anxiety. The items included cover such elements as fear, uncomfort and embarrassment that have been part of the scales used in previous research (e.g. Loyd and Gressard, 1984; Loyd and Loyd, 1985; Cohen and Waugh, 1989; Brock and Sulsky, 1994; Kinzie et al., 1994; Selwyn, 1997; Shaft et al., 2004). The measurement of computer anxiety have been extended to measure anxiety related to technology in general (Meuter et al., 2003), thus similar extension was made here for mobile phones. Appendix 2 includes anxiety statements for PC in questions 72 and 73, and similar statements for mobile phones in questions 78 and 79.

Perceived behavioural control items were based on studies of Morris and Venkatesh (2000) and Taylor and Todd (1995). Revisions were made to match the present context. Similar items were applied for PCs and mobile phones. Measurement level was a five point Likert-scale. (1=totally disagree…5=totally agree). Appendix 2 includes statements reflecting perceived behavioural control for PC in questions 72 and 73, and similar statements for mobile phones in questions 78 and 79.

Perceived physical restrictions for mobile phone usage were reflected with two statements (Appendix 2, question 78). The items discuss the small buttons and small size of the screen in mobile phones. Level of measurement was a five-point Likert-scale varying from totally disagree to totally agree.

Perceived usefulness was measures with multiple statements adopted from Venkatesh et al. (2002). The items were roughly modified for the purposes of present study. Items were in a form of statements measured with Likert-scale from totally disagreeing to totally agreeing. Reliability measurement used same scaling as perceived usefulness and the items were modified from the study of Lee et al. (2003), concentrating on privacy issues in sending and receiving personal information. The statements for perceived usefulness and reliability are in Appendix 2 in question 81.

Table 12 Key measures adopted from previous literature

Construct	Source/Reference
Perceived behavioural control	(Taylor and Todd, 1995; Morris and Venkatesh, 2000)
Computer Anxiety	(Loyd and Gressard, 1984; Loyd and Loyd, 1985; Cohen and Waugh, 1989; Kinzie et al., 1994)
Behavioural intention to use	(Venkatesh et al., 2002)
Perceived usefulness	(Venkatesh et al., 2002)
Reliability	(Lee et al., 2003)
Functional ability	(Karppi and Ollila, 1997; Verbrugge and Yang, 2002)
Perceived health	(Jelicic and Kempen, 1999; Leinonen, 2002; Bobak, Kristenson, Pikhart and Marmot, 2004; Vaez et al., 2004)
Cognitive ability	(Passik et al., 2000)
Depressive symptoms	(Radloff, 1977; Sohlman, 2004)

6.3.2 Validating the measurement models

The main method for evaluating and verifying the measurement models was confirmatory factor analysis. The items in psychometric assessments are assumed to reflect a level of ability or state of mind (Fayers and Hand, 2002), meaning that each of these variables are assumed to have some relationship to an underlying concept attempted to measure (the latent variable). Confirmatory factor analyses were made in four parts in order to validate the measurement constructs. This was considered necessary because asymptotic covariances and polychoric correlations are recommended for the analysis of ordinal data (Olsson, 1979; Rigdon, 1998; Diamantopoulos and Siguaw, 2000), and the number of measurement items was too high compared to the number of observations, thus leading to measurement modelling in smaller parts. The constructs were divided into categories based on the subject, i.e.

measures for health related issues, measures for PCs, measures for mobile phones, and measures for intention to use health service applications. The method of unweighted least squares was used in the estimation of the models. The goodness of fit of each measurement model was evaluated through khi square divided with degrees of freedom, goodness of fit index (GFI), normed and non-normed fit index (NFI and NNFI), and root mean square error of approximation (RMSEA). The short descriptions and recommendations for the selected fit statistics are in Table 13 (see Hayduk, 1989; Hair, Anderson, Tatham and Black, 1998; Kelloway, 1998). The selection of the different indices was based on the notion that the different indices cover a little bit different aspects of the success of the modelling, and together give support to make the right conclusions.

Table 13 Criterion for model fit

Index	*Range*	*Recommendation*	*Description*
χ^2/df	<0, unlimited	< 3.0 a very good fit, < 5.0 a reasonable fit	Assesses the difference between the model-implied covariance matrix and the observed sample covariances adjusted by the degrees of freedom.
RMSEA	from 0 to 1	< 0.05 a very good fit, <0.10 a good fit	Root mean square error of approximation. Based on the analysis of residuals.
GFI	from 0 to 1	> 0.9	Goodness of fit index. Based on a ratio of the sum of the squared discrepancies to the observed variances.
NFI	from 0 to 1	> 0.9	Normed fit index. Indicates the percentage improvement in fit over the baseline independence model.
NNFI	from 0 to 1, not limited to 1	> 0.9	Non-normed fit index. NFI adjusted for the number of degrees of freedom.

The measurement reliability for all the constructs was assessed with composite (or construct) reliability coefficient, (Equation 4) and average variance extracted, (Equation5) (Fornell and Larcker, 1981; Diamantopoulos and Siguaw, 2000).

$$\rho_c = \frac{(\sum \lambda)^2}{(\sum \lambda)^2 + \sum \theta}$$ **Equation 4**

where ρ_c = composite reliability

λ = item loading

θ = item error variance

$$\rho_v = \frac{\sum \lambda^2}{\sum \lambda^2 + \sum \theta}$$ **Equation 5**

where ρ_v = average variance extracted

λ = item loading

θ = item error variance

The construct reliability coefficient should exceed .50, which roughly corresponds to a standardized loading of .7 (Hair et al., 1998). If average variance extracted is less than .50 the variance due to the measurement error is larger than the variance captured by the construct (Fornell and Larcker, 1981).

Unidimensionality of the measurement was analysed by interpreting the modification indices resulting from the confirmatory factor analysis (see Segars, 1997). For each measurement model, the results didn't indicate any significant modification indices, thus the assumption of measurement unidimensionality was confirmed. Discriminant validity was also assessed. In every measurement model, the discriminant validity was assessed with pairwise analysis of the latent structure. To establish discriminant validity, a model which constrained the correlation between to latent variables to unity was estimated (Segars, 1997). This was compared to a model which allowed the correlation to be freely estimated between the two constructs. For every latent construct, the results indicated discriminant validity, thus the nested models analysed illustrated that the correlation between the latent variables was unequal to one.

Aging related characteristics included functional ability measured with instrumental activities of daily living (ADL), perceived health status, cognitive ability and level of depressive symptoms. The basic activities of daily living were left out of analysis as there wasn't much variance in the items, i.e. respondent's were all capable of eating, bathing, wearing etc.. Thus only six items had enough variance to be included in the empirical analysis. Functional ability includes coping in activities of small home repairs, shopping, housecleaning, cooking and washing. An exploratory factor analysis with varimax-rotation was made at first to verify the measurement (Table 14). This was considered necessary, because the scales used to measure the key concepts weren't completely original. The four factor solution explained 63.3 percent of the total variance. One of the functional abilities loaded incorrectly to the factor implying

perceived health, and two abilities (cleaning and shopping) cross-loaded on perceived health with stronger loadings on the ADL factor.

Table 14 Exploratory factor analysis for aging related characteristics

	1	2	3	4
srh	**0,686**			
ph3	**0,676**			
ph4	**0,666**			
ph2	**0,660**			
ph5	**0,647**			
adlrep	***0,612***		**0,294**	
ph6	**0,556**			
depr3		**0,808**		
depr4		**0,804**		
depr2		**0,781**		
depr1		**0,770**		
adlcook			**0,873**	
adlwash			**0,855**	
adlclean	*0,489*		**0,621**	
adlshop	*0,524*		**0,550**	
ca2				**0,843**
ca1				**0,775**

Table 15 represent the results of confirmatory factor analysis and the statements behind the items. All the indicators of model fit suggested a good fit, meaning that the measurement model was properly formed. The separate ADL items reflected the latent construct extremely well and no cross-loadings were observed based on the modification indices. Construct reliability was excellent and AVE exceeded the acceptable level. Self-rated health was originally measured with six items, but two of these were left out of the measurement model due to the low loadings. For these four remaining items, the CR is fairly good and AVE is just over satisfactory level. Cognitive ability had two indicators that produced good construct reliability and an excellent coefficient for AVE. The existence of depressive symptoms was explored with four items, and for this construct both CR and AVE suggests a good reliability.

Table 15 Statistics for confirmatory factor analysis of aging related factors

Abbreviation	*Item*	*Loading*	*Error variance*	*CR*	*AVE*
Adl	*Activities of daily living*				
adlrep	Small home repair (changing lamps etc.)	.800	.359	.916	.652
adlshop	Shopping	.915	.162		
adlclean	House cleaning	.942	.113		
adlcook	Cooking	.744	.447		
adlwash	Washing	.725	.474		
Ph	*Perceived health*				
srh	Global measure for self-rated health	.858	.264	.853	.510
ph4	I get tired without any specific reason.*	.720	.481		
ph5	I feel myself completely healthy.	.837	.300		
ph6	I'm in a good shape compared to my age/mates.	.653	.573		
Ca	*Cognitive ability*				
ca1	I can handle different things as easily as ever before.	.971	.058	.866	.767
ca2	I can think as clearly as ever before.	.769	.409		
Depr	*Depression*				
depr1	I often feel a need to cry.	.676	.543	.888	.667
depr2	My moods fluctuate almost continuously.	.858	.265		
depr3	I often feel myself sad.	.813	.338		
depr4	I often feel myself depressed.	.902	.186		

Model fit: χ^2=219.66, df=84, χ^2/df=2.615, GFI=.981, NFI=.976, NNFI=.979, RMSEA=.061

* Item coding reversed for the analysis

Excluded items:

I'm concerned about my health status. (ph2)

I'm afraid that I can't take care of myself in the future. (ph3)

Table 16 summarizes the final measurement model for computer related variables. The adoption stage resulted a reasonable reliability and average variance extracted, although the item measuring owning the PC had quite low loading. One of the items reflecting perceived behavioural control had to be dropped out as the loading was below .500 and it didn't cross-load anywhere else. This improved also the fit for the model. The remaining three indicators resulted and excellent reliability and almost 80 percent of the variance was extracted. Computer anxiety had five measurement items yielding an excellent reliability and an acceptable level of variance explained. In summary, the measurement model had excellent indices for fit to the data.

Table 16 Result of confirmatory factor analysis for the computer related constructs

Abbreviation	*Item*	*Loading*	*Error variance*	*CR*	*AVE*
Pc	*Adoption stage of pc using*				
pc_own	Stage of owning PC	0.571	0.674	.751	.615
pc_skill	Stage of skills using PC	0.951	0.096		
Pbc_pc	*Perceived behavioural control for PC*				
pbc_pc1	Computers are easy to use.	0.960	0.366	.919	.792
pbc_pc3	I have the knowledge necessary to use a PC.	0.913	0.166		
pbc_pc4	I have control over using a PC.	0.920	0.153		
Anx_pc	*Computer anxiety*				
anx_pc1	I feel comfortable when using a PC.*	0.688	0.526	.850	.532
anx_pc2	Using a PC makes me feel nervous.	0.674	0.546		
anx_pc3	Computers do not frighten me.*	0.816	0.333		
anx_pc4	I don't feel like an outsider when others talk about computers.*	0.671	0.55		
anx_pc5	Computers make me feel ill at ease.	0.785	0.384		

Model fit: χ^2=58.4, df=33, χ^2/df=1.770, GFI=.994, NFI=.992, NNFI=.1.004, RMSEA=.057

* Item coding reversed for the analysis

Excluded items:

I need further guidance for PC usage. (pbc_pc2)

Following the PC measurement model, the similar measurement was verified for the mobile phones (Table 17). Mobile phone usage and skills provided good reliability and average variance explained was high enough. For the construct of perceived behavioural, all the four items provided rather high loadings with excellent reliability and high value for average variance extracted. Computer anxiety items translated to measure mobile anxiety succeeded with high reliability and acceptable level of variance was extracted also. Physical restriction construct developed for the present situation produced an outstanding reliability and more the 80 percent of variance was extracted. In line with the previous measurement model, the latent structure of mobile phone attributes provided good fit to the data.

Table 17 Results of confirmatory factor analysis for mobile phone related constructs

Abbreviation	*Item*	*Loading*	*Error variance*	*CR*	*AVE*
Mp	*Mobile phone usage and skills*				
mp_use	Degree of MP usage	0.868	0.246	.758	.613
mp_skill	Stage of skills using MP	0.687	0.527		
Pbc_mp	*Perceived behavioural control for mobile phone*				
pbc_mp1	I have control over using a MP.	0.888	0.211	.904	.705
pbc_mp2	I have the knowledge necessary to use a MP.	0.887	0.213		
pbc_mp3	Mobile phones are easy to use.	0.901	0.189		
pbc_mp4	I need further guidance for MP usage.*	0.657	0.568		
Anx_mp	*Mobile anxiety*				
anx_mp1	I feel comfortable when using a MP.*	0.696	0.516	.843	.521
anx_mp2	Using a MP makes me feel nervous.	0.846	0.284		
anx_mp3	Mobile phones do not frighten me.*	0.76	0.422		
anx_mp4	I don't feel like an outsider when others talk about mobile phones.*	0.581	0.662		
anx_mp5	Mobile phones make me feel ill at ease.	0.698	0.513		
Pr	*Physical restrictions*				
pr_mp1	Small screen makes it difficult for me to use MP.	0.848	0.282	.902	.822
pr_mp2	Small buttons make it difficult for me to use MP.	0.963	0.073		

Model fit: χ^2=121.5, df=59, χ^2/df=2.059, GFI=.990, NFI=.986, NNFI=.995, RMSEA=.056

* Item coding reversed for the analysis

The measurement model for intention to use health services included constructs of behavioural intention, perceived usefulness, reliability, technology anxiety and perceived behavioural control. The measurement model was verified in two parts. The first part included behavioural intention, perceived usefulness and reliability (Table 18). The value of χ^2 and RMSEA didn't suggest a very good fit, but based on the other indicators, the model provided a reasonable fit for going further.

Table 18 Results of the confirmatory factor analysis for behavioural intention, perceived usefulness and reliability

Abbreviation	*Item*	*Loading*	*Error variance*	*CR*	*AVE*
Biu	*Behavioural intention the use*				
biu1	If I had a home computer of cell phone, I would like to apply it for health care services.	.882	.222	.901	.822
biu2	If it would be possible to use home computer or cell phone in health care services, I would be delighted to use that kind of services.	.931	.133		
Peu	*Perceive usefulness*				
peu1	Using home computer or cell phone would be beneficial for health care.	.777	.397	.905	.705
peu2	It would be useful for me, if I could see my health records with home computer or cell phone.	.833	.305		
peu3	Using home computer or cell phone might result clear benefits for following up my own health and treatment.	.919	.155		
peu4	Benefits acquired with home computer or cell phone could ease up the work of nursing staff.	.823	.323		
Rel	*Perceived reliability*				
rel1	I see that transferring my personal information through home computer or cell phone would be as safe as during traditional phone call contact.	.779	.393	.890	.669
rel2	I believe that my medical records are safe, although home computers of cell phones would be taken into advantage merely in health services.	.754	.431		
rel3	I believe that using home computer or cell phones in health services is reliable.	.888	.212		
rel4	Information received through home computer or cell phone is as reliable as they would be on paper.	.845	.287		

Model fit: χ^2=143.09, df=32, χ^2/df=4.47, GFI=.992, NFI=.990, NNFI=.994, RMSEA=.110

The second model was a high-order factor model (Figure 18) in which the above validated measures for computer and mobile anxiety and computer and mobile phone related perceived behavioural controls where combined to reflect two latent constructs indicating overall technology anxiety and perceived behavioural control. The goodness of fit statistics suggested a fair fit for further analysis.

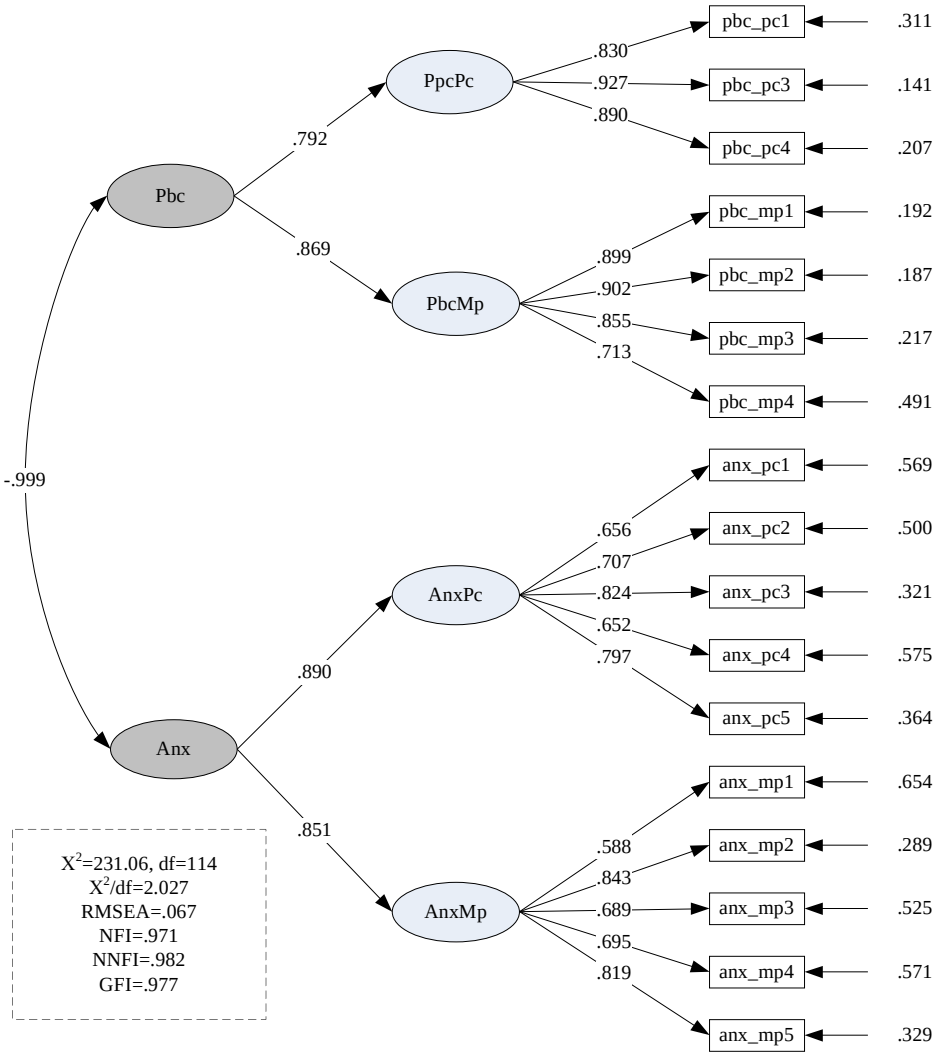

Figure 18 Results of the high-order factor analysis of combined technology anxiety and perceived behavioural control

7 EMPIRICAL FINDINGS

Empirical findings become absorbed to describing the respondents more strictly, a look is given to the descriptive information of the respondents and thereafter, the research hypotheses are tested. Last part of this chapter discusses the conclusions of the empirical analysis.

7.1 Description of the data

The respondents are at first described in terms of socio-demographic factors. Thereafter the key constructs for the models are descriptively analysed against age and gender.

7.1.1 Basic respondent information

The age distribution by gender is in Figure 19. The amount of females is higher in each age group.

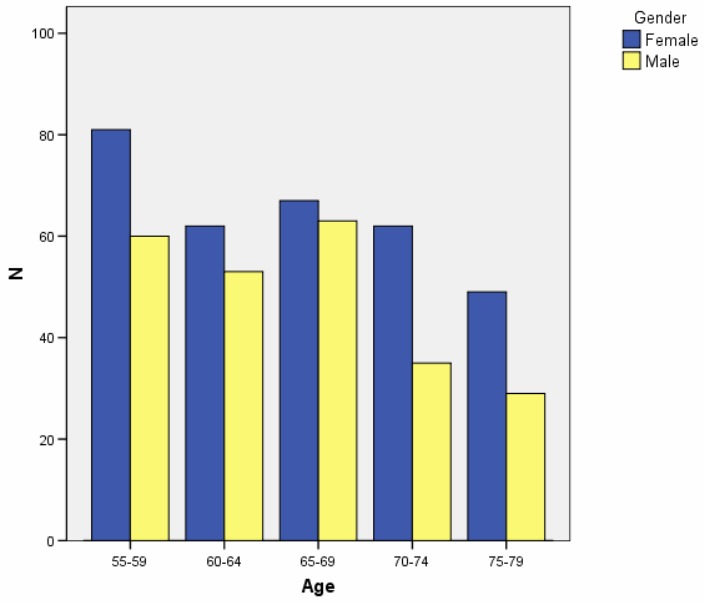

Figure 19 Age distribution by gender

The education level was explored with two questions. The first discussed the level of basic education and the later one occupational education. At the time when the target population was born Finnish education system had elementary and middle school system as representing the standard education. In addition to this, they had to opportunity to attend high school before occupational education. The occupation education included choices of occupation course, vocational school, vocational high school, and the university degree. Approximately 90 percent had basic education on the level of elementary or middle school. Almost one third had no occupational education, 26 percent had attained to an occupational course and 17 percent had vocational education. About 19 percent of the respondents had carried out the vocational high school and only five percent had university degree.

Marital status the respondents is illustrated in Figure 20. As can be seen nearly one third lives alone, is divorced or widowed. From this it can be see that the future health care faces challenges with these types of people that do not have a spouse as a family carer when the disabilities start to occur.

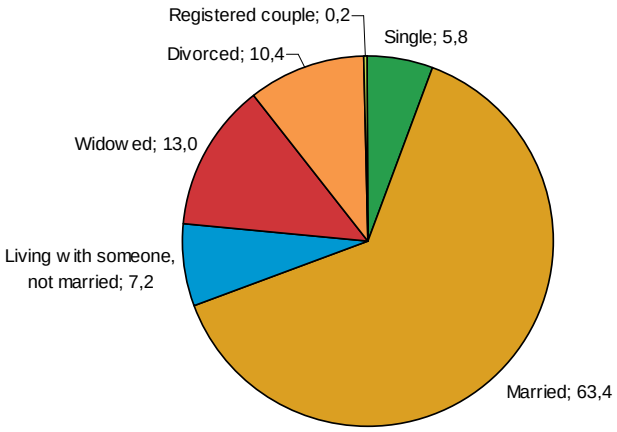

Figure 20 Distribution of respondents by marital status (%)

The last basic socio-economic descriptive is the incomes. As can be seen in Figure 21, most of the females had lower income compared to men. This may due to the fact that many women have remained at home taking care of family instead of working.

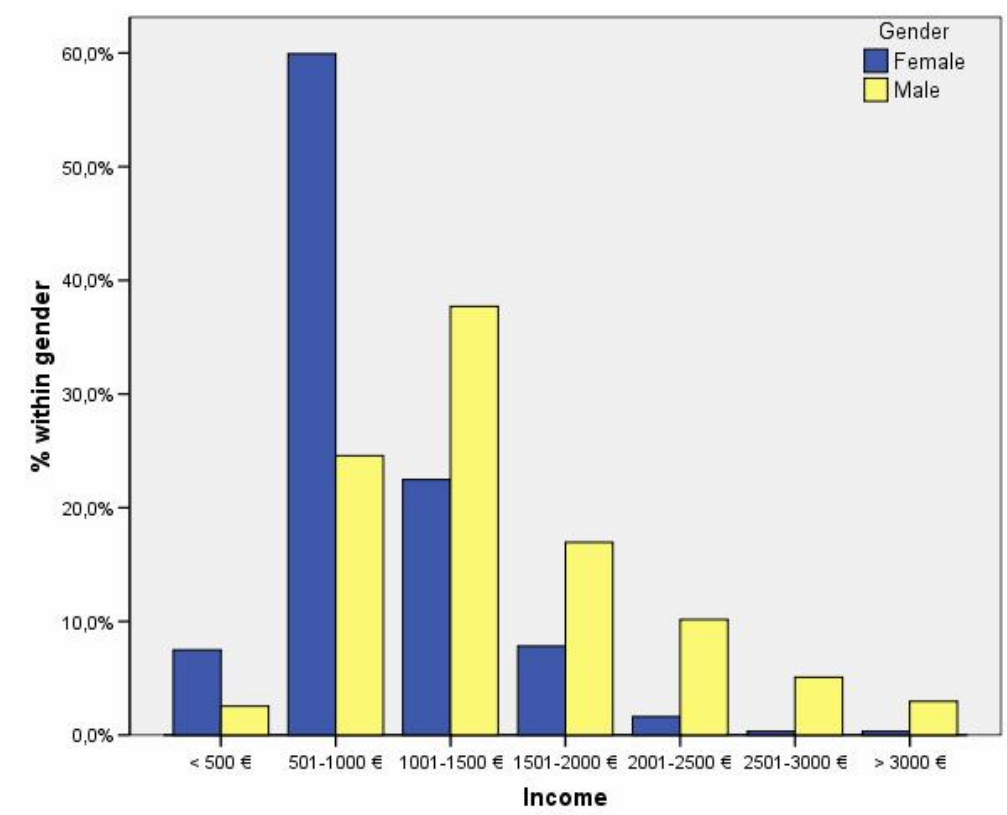

Figure 21 Income by gender

7.1.2 Descriptive analysis of the key constructs by age and gender

The key constructs of the present thesis were assessed separately for male and female and by five year age categories. Starting with health issues, gender differences were found in perceived health and depression (Table 19). Male respondents rated their health being better than female, and women also felt that they were more depressed compared to men.

Table 19 Differences in health dimensions between females and males

	Functional ability		Perceived health		Cognitive ability		Depression	
	Female	Male	Female	Male	Female	Male	Female	Male
Mean	2,706	2,641	3,250	3,423	3,562	3,589	1,993	1,744
Std. Dev.	0,463	0,568	0,940	0,958	1,257	1,182	1,003	0,826
t (p)	1.443 (.150)		2.148 (.032)		2.600 (.795)		3.082 (.002)	

Significant differences exist in health aspects when the comparison is made across age groups (Figure 22). Perceived health and functional ability seemed to decline in parallel manner when respondent's age increases. Similarly pattern is also found in depression, thus the existence of depressive symptom increases with age. Cognitive ability starts to decline after age of 65.

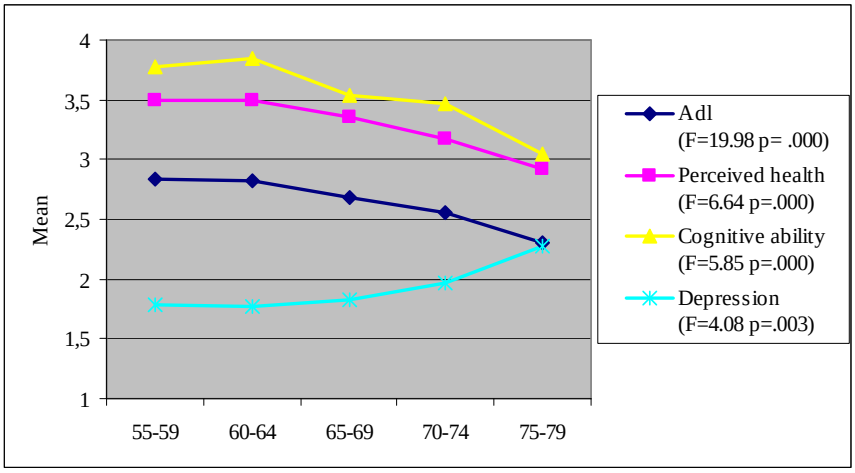

Figure 22 Age differences in health and coping

No gender differences were found when discussing the owning of the appliances of interest (Figure 23). About 80 percent of both females and males have a mobile phone. About 30 percent of females own a PC, for males this share is a bit higher. The share of respondents that plans to acquire a PC is a bit larger for women than for men.

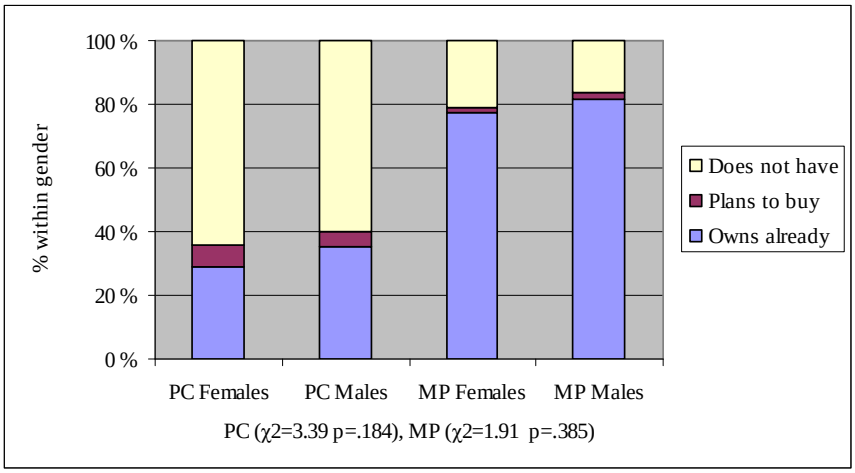

Figure 23 PC and mobile phone ownership by gender

The using skills of PC did only differ between genders (Figure 24). There were larger share of females that had no computer skills or willingness to learn compared to their male counterparts. Majority of respondents considered that they have excellent skills of using mobile phone and the corresponding share for computer was a bit under 20 percent for females and a bit over 20 percent for males. Almost 50 percent of females has no skills and no interest to learn computer usage, for males this share was little lower. For mobile phones, about 10 percent of respondents had no skills or will to learn. Despite of the large share of elderly, that doesn't want to interact with computer, computers are clearly in interest for elderly to some extent.

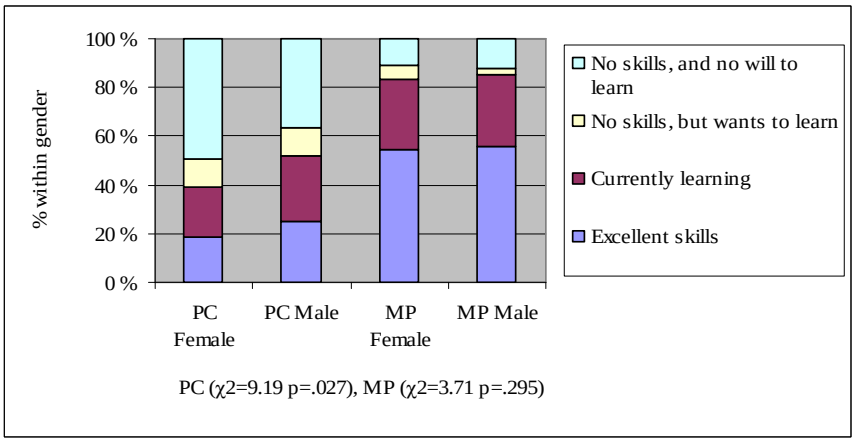

Figure 24 Computer and mobile phone usage skills by gender

The current technology adoption examined by age reveals some differences. Clearly, the younger respondents have adopted PC to larger extent than the older ones (Figure 25).

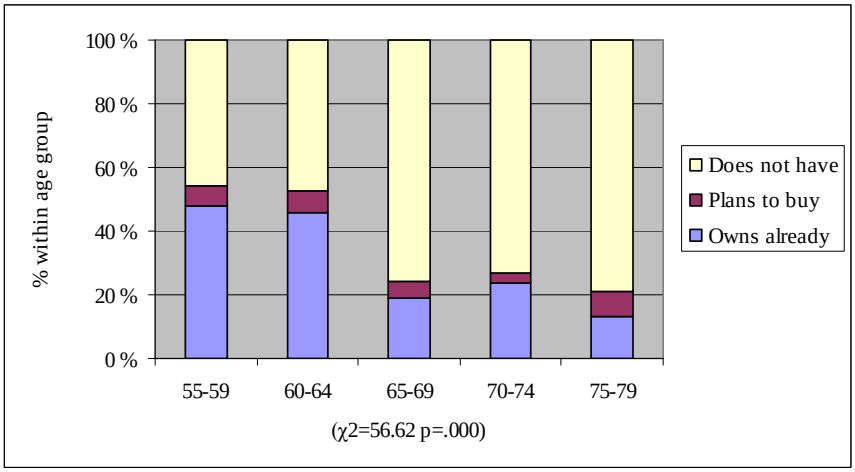

Figure 25 PC adoption by age

For mobile phone adoption, there weren't such clear differences as with PC adoption. However, similar trend is observable as the share of adopters decreases by age (Figure 26).

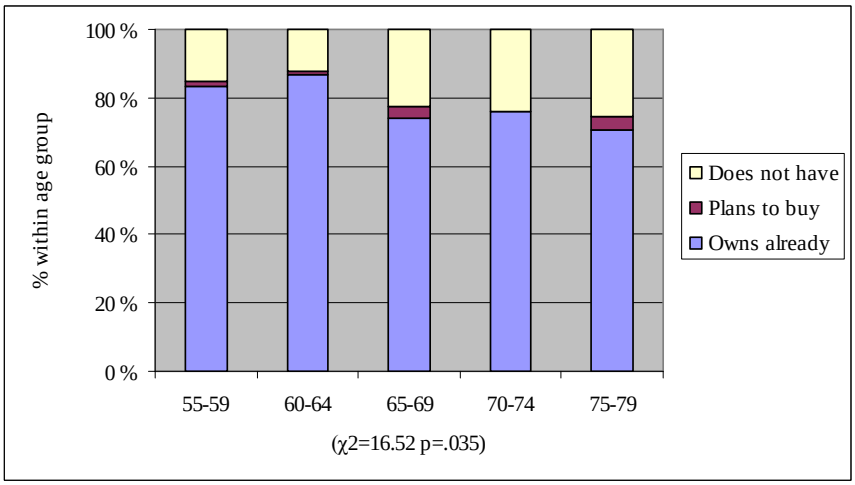

Figure 26 Mobile phone adoption by age

Age has definitely a relationship with computing skills and willingness to learn as illustrated in Figure 27. Almost 80 percent of the members in the two youngest age groups have good

computing skills and learning willingness. This array goes upside down when the oldest age group is considered, almost 80 percents don't want to use or learn to use computers.

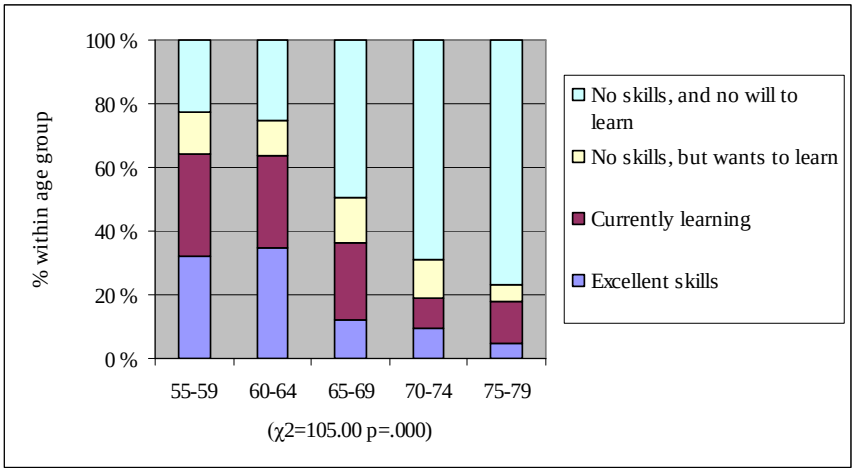

Figure 27 Computing skills by age

The differences in mobile phone usage skills are much smaller than for computing skills. The willingness to learn using mobile phone decreases with age, but not very much. For the oldest group, almost 80 percent still has skills or wants to learn to use the phone.

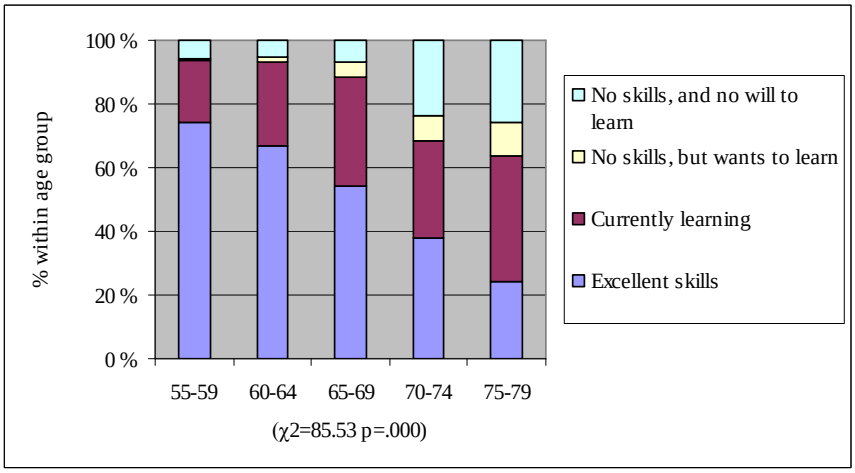

Figure 28 Mobile phone usage skills

A comparison was made between men and women for the current technology perception (Table 20). The only significant differences was found for computer anxiety, females had higher perceptions. This is thus inline with previous research. However, an interesting outcome is that the other perceptions indicated no gender differences.

Table 20 Gender differences in technology perceptions

Technology perception	Gender	Mean	Std. Dev.	t(p)
Perceived behavioural control for computer	Female	2,983	1,282	-.829 (.408)
	Male	3,106	1,135	
Computer anxiety	Female	2,348	1,106	2.324 (.021)
	Male	2,127	1,003	
Perceived behavioural control for mobile phone	Female	3,667	1,103	-.301 (.764)
	Male	3,698	1,068	
Mobile anxiety	Female	1,710	0,813	-.302 (.749)
	Male	1,732	0,792	
Physical restriction	Female	2,847	1,442	-.043 (.966)
	Male	2,853	1,295	

A comparison of current technology perceptions by age cohorts revealed more differences (Figure 29). All perceptions had significant differences according to age. Perceived behavioural control for both devices declines with age in a similar manner. Perceptions of physical restrictions related to mobile phones increase with age but not consistently. Anxiety related to mobile phones and computers also increases with age, but the changes between age categories are not very large.

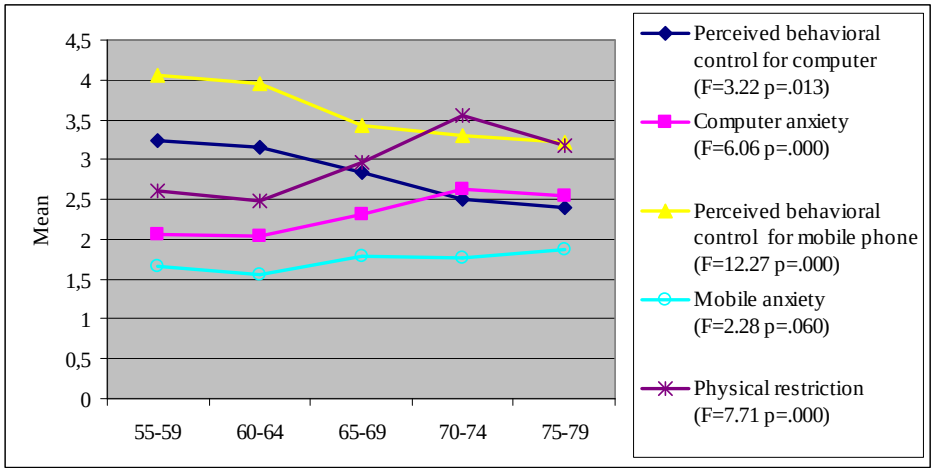

Figure 29 Current technology perceptions by age categories

There occurred no significant gender differences in future service perceptions and intention to adopt. Surprisingly, also no differences were found between age groups.

7.2 Testing the hypotheses

The proposed hypotheses were tested using structural equation modelling. At first, the basic component behind all the models is tested, i.e. the model self-rated health is analysed. Thereafter, the PC and mobile phone adoption is modelled, and finally, the focus is on intention to apply existing technologies to new types of services.

7.2.1 Modelling self-rated health

The first model analysed was the proposed model 1, dealing with health and aging related characteristics. The same model is part of the further analysis. Polychoric correlations and asymptotic covariance matrix were used in the analysis. The full factor structure represented the indicators of functional ability, depression, cognitive ability and self-rated health. The hypotheses assumed that perceived health is a function of functional ability (H1), depression (H2) and cognitive ability (H3). The result of the analysis is presented in Figure 30. The model produced fit indices that suggest a reasonably good fit for further analysis. The R

square for perceived health was excellent (.747). All three hypotheses (H1-H3) were supported. Higher functional ability leads to higher perception of health status, the existence of depressive symptoms decreases the perception of health, and high level of cognitive capacity leads to better perceived health.

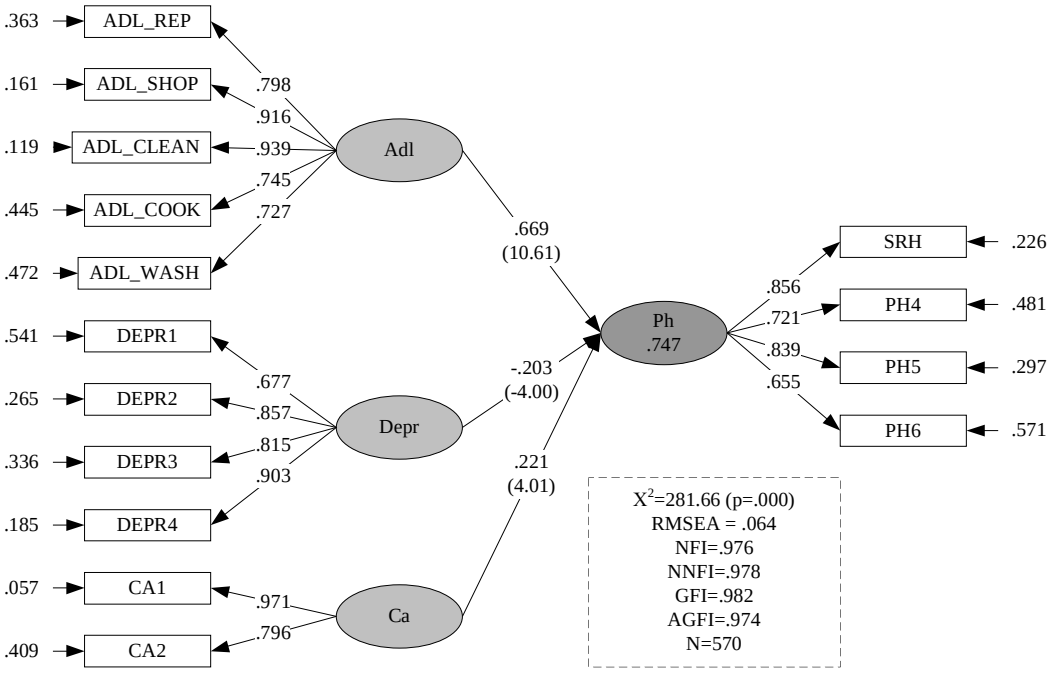

Figure 30 Results of the hypothesized model 1, path coefficients (t-values), R^2 below the latent variable

7.2.2 Modelling PC adoption stage

The initial model for PC adoption (hypothesized model 2) was conducted with the same dataset as the measurement model thus including the full factor structure. The polychoric correlations and asymptotic covariances were used as input data. Fit indices suggested that the model fit to the data very well. This model tested the hypotheses H4, H5 and H6, suggesting that PC usage behaviour is a function of computer anxiety and perceived behavioural control, and that computer anxiety also effects usage behaviour indirectly through behavioural control. As seen in Figure 31, anxiety had no direct effect on usage behaviour, hypothesis H5 is thus rejected. Computer anxiety had a strong effect on perceived behavioural control (R^2=.730)

supporting hypothesis H6. The path leading from perceived behavioural control to usage behaviour was significant supporting hypothesis H4. In other words, this means that high anxious people perceived lower control over PCs and are at the lower stage in PC adoption. People less anxious about computers perceive higher control and are thus in a more advanced stage of adoption.

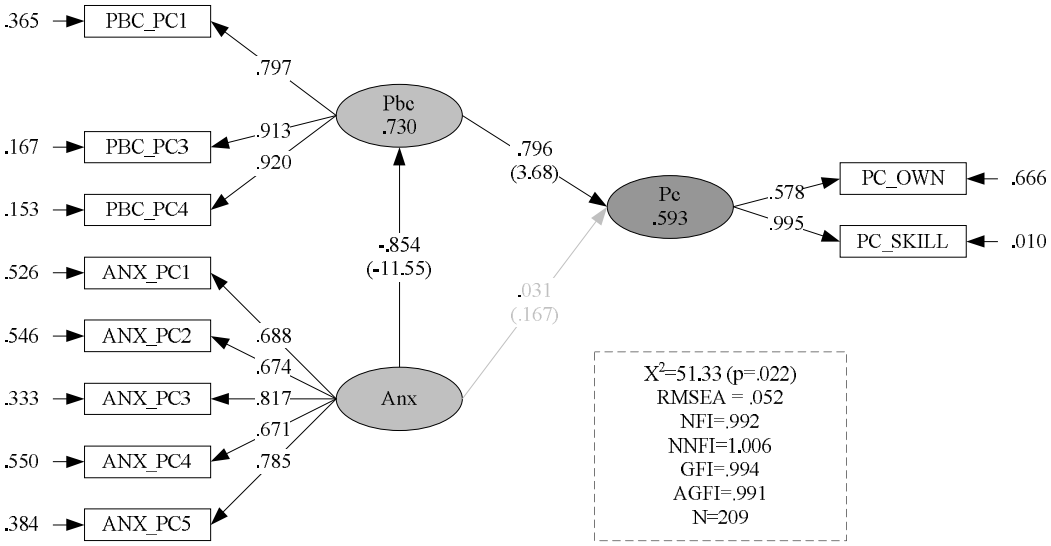

Figure 31 Results of the hypothesized model 2, path coefficients (t-values), R^2 below the latent variable

The latent constructs were modified for the purposes of analysing the total model including the health perceptions. For testing models that include both health variables and technology perception, the data runs out of observation for calculating asymptotic covariance matrices. Therefore, summated scales are computed for each latent variable from its indicators. The error term variance for each was retrieved from summated scale variance and latent variable's composite reliability using Equation 6 (e.g. Fisher and Price, 1992; Childers, Carr, Peck and Carson, 2001). The similar method is used further when mobile phones and behavioural intentions are analysed.

$$\Theta_\delta = (1-\rho_c)\sigma^2 \qquad \textbf{Equation 6}$$

where Θ_δ = summated scale error variance

ρ_c = construct reliability

σ^2 = summated scale variance

For analysing the proposed model 3, the covariance matrix was used as input data as the observed variables turned to be continuous through the summated scales. The results received from the previous model were taken into account, i.e. the path from computer anxiety to PC usage behaviour was left out. The purpose of this model was to assess the effect of health status on anxiety and control (H7 and H8). Results are in Figure 32. The fit indices suggested and excellent fit. As can be seen, perceived health had negative effect on computer anxiety thus leading to the acceptance of hypothesis H7. Respondent with good perceived health had less anxious attitudes toward computers. Hypothesis H8 however has to be rejected, an insignificant path coefficient was found between perceived health and perceived behavioural control.

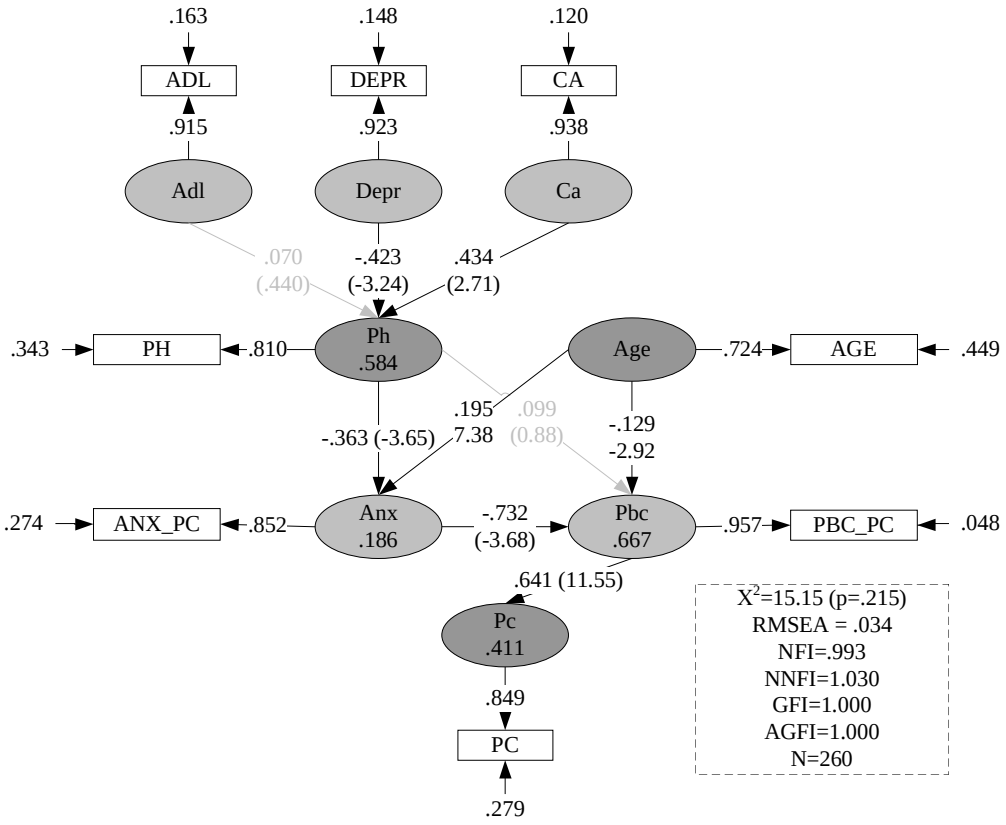

Figure 32 Results of the structural model 3, path coefficients (t-values), R^2 below the latent variable

Anxiety was still a good predictor of perceived behavioural control and perceived behavioural control was a significant predictor for the PC usage behaviour. Age was added for the model

to test whether perceived health has an effect on technology perception independent of age. This appeared to be true, perceived health influenced anxiety, and had even a stronger path coefficient compared to age. Age had significant relationships with both anxiety and perceived behavioural control, and it can be concluded that older individuals have higher perception of computer anxiety and they perceive less control. It has to be noticed that the R^2 for anxiety is rather small; indicating that there exists other factors that effect computer anxiety, but more importantly perceived health was found to be a significant predictor of computer anxiety together with age. In regards to the upper part of the model, functional ability became insignificant factor in explaining perceived health. This may be due to the scaling used in the questionnaire, and will be analysed later. On the other hand, the usage of PC might not be disposed to limitations in functioning, and therefore the contribution that functional ability has on perceived health might be lower.

7.2.3 Modelling mobile phone adoption stage

The usage behaviour related to mobile phones was analysed in a similar manner as PC. The first analysis tested the hypothesized model 4 using polychoric correlations and asymptotic covariances as input data. In the case of mobile phones is was proposed that physical restrictions (H9), perceived behavioural control (H10) and mobile anxiety (H11) influence mobile phone usage and that mobile anxiety and physical restriction influence usage also indirectly through control (H12 and H13).

Based on the analysis (Figure 33) the only factor that strictly affects mobile phone usage behaviour is perceived behavioural control, hypothesis H10 is thus accepted, and hypotheses H11 and H9 are rejected. Mobile anxiety influences perceived behavioural control supporting hypothesis H12. Physical restrictions influence perceived behavioural control as well, hypothesis H13 is thus accepted. Subjects, that are less anxious and perceive physical restrictions minimal, have higher perceptions of behavioural control. Further on, the higher the perception of control, the more advanced the usage of mobile phone is.

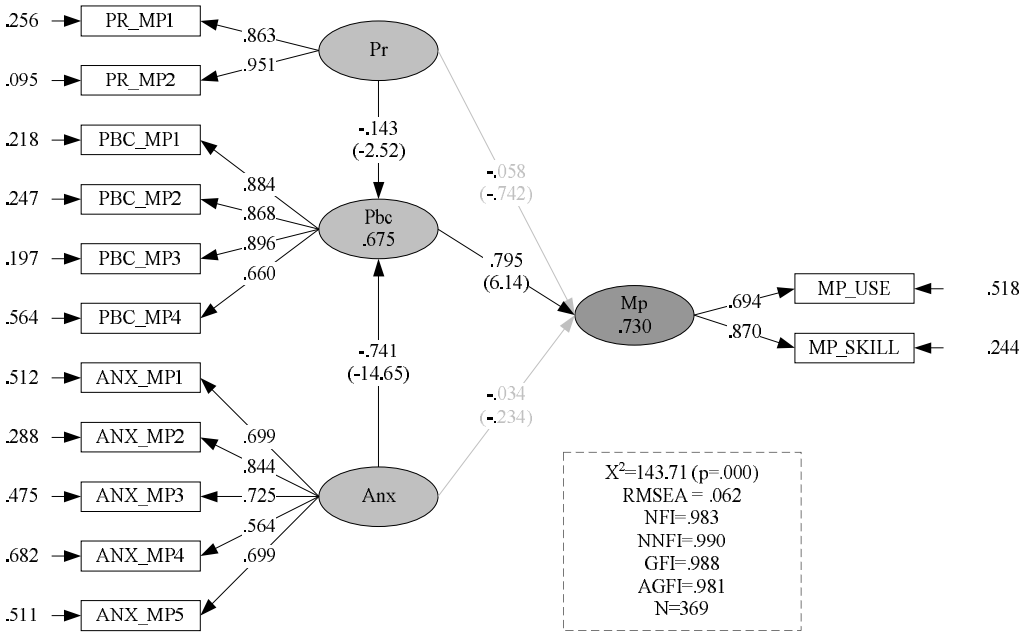

Figure 33 Results of the structural model 4, path coefficients (t-values), R^2 below the latent variable

For the next step of the analysis, summated scale indicators were computed for each latent variable and error variances were constrained for each indicator. A covariance matrix was analysed to test the proposed model 5. The RMSEA and χ^2 suggested a poor fit, but the other indices gave support for a moderate fit to the data. The main purpose was to evaluate the effect of health on technology perceptions (H14-H16). The paths from anxiety and physical restriction to mobile phone usage were left out of the analysis based on the previous model. The results (Figure 34) gave support for hypothesis H14 and H16. Perceived health had a negative effect on both anxiety and physical restriction. Better perception of one's own health leads to less anxious attitudes toward mobile phones and the physical restriction related to the device are minor. The R squares of anxiety and physical restrictions are rather low, thus other explanatory variables exist besides perceived health and age, which proved to be a significant predictor of anxiety. The effect of perceived health was however stronger than that of age. Similar, results can be found for the relationship of age and physical restrictions. Age is a significant determinant of perceived physical restrictions, but not as strong as perceived health. Perceived health had an insignificant path coefficient to perceived behavioural control, hypothesis H15 thus is rejected.

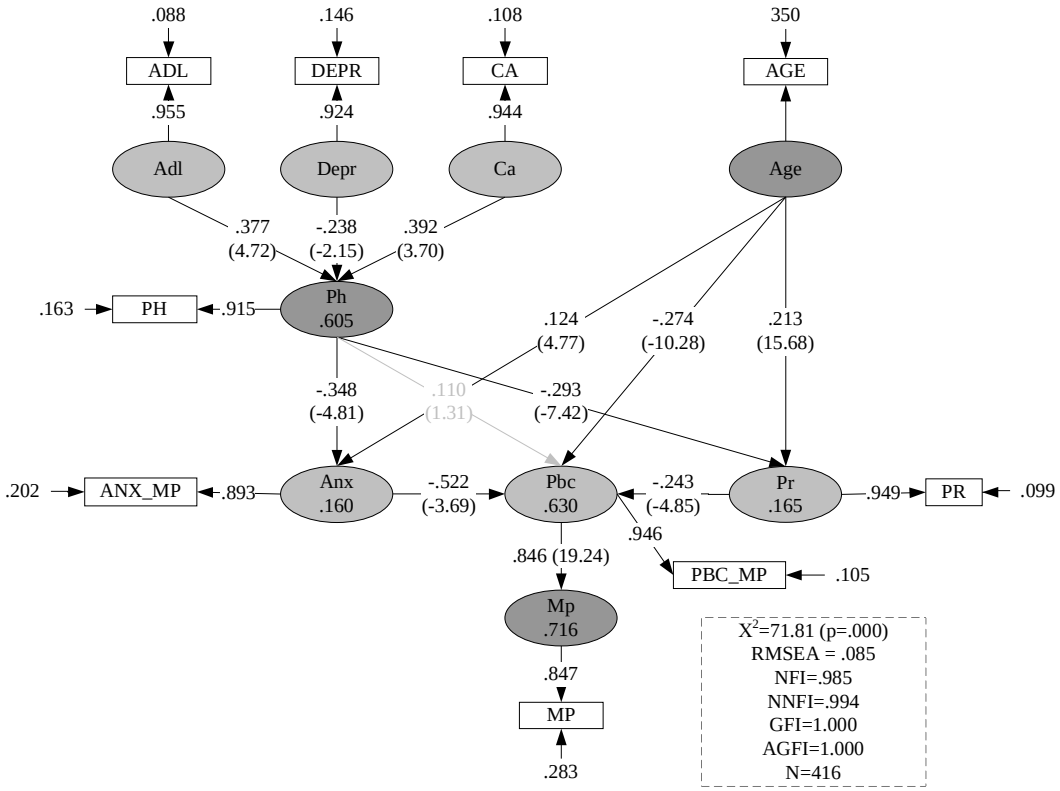

Figure 34 Result of the structural model 5, path coefficients (t-values), R^2 below the latent variable

Age instead appeared to influence perception of control, i.e. older users perceive less control than their younger counterparts. In the case of mobile phones, perceived health was significantly influenced by all the three determinants, functional ability, cognitive ability and depression. Restrictions in the normal activities in daily living may lead to restrictions using mobile phone due to the small size of the appliance. Cognitive ability and depression also had indirect effects on technology perception through perceived health.

7.2.4 Modelling behavioural intention to use hypothetical health services with ICT applications

Two hypothesized models concerned behavioural intention to use home computers or cell phones to health services. In the first model, technology anxiety and perceived behavioural control of existing technologies were attached to the hypothetical ICT based health care service context.

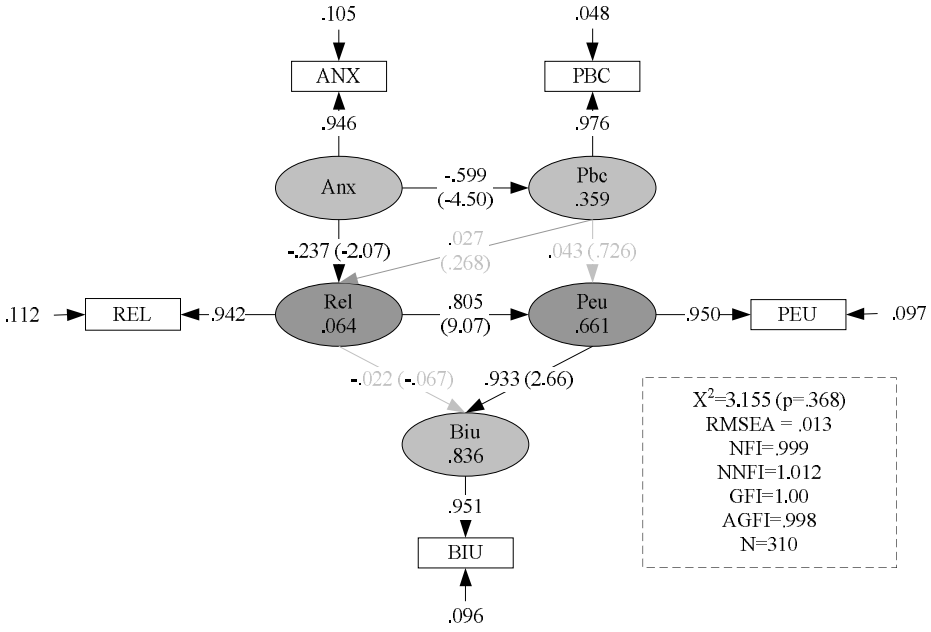

Figure 35 Results of the structural model 6, path coefficients (t-values), R^2 in below the latent variable

Figure 35 assembles to result of structural model 6. Anxiety succeeded in explaining perceived behavioural control inline with the previously tested models, H23 was thus supported. In contrast, the results indicate that perceived behavioural control had no role in to model, thus no effect on perceived reliability and perceived usefulness of the new service, that leads to the rejection of hypotheses H21 and H22. It might be possible that the scaling on response patterns in the questionnaire was biased for only those individuals that have higher perceptions of control, and thus considered them eligible for answering the questions dealing with the hypothesized health service. Technology anxiety on the other had a significant path coefficient toward perceived reliability (H20 is accepted), although the R square is really

small. Perceived usefulness was significantly affected by perceived reliability supporting hypothesis H19. Perceived reliability succeeded to explain more the 60 percent of the usefulness. The main target of the model was the behavioural intention to use. Both perceived reliability and usefulness were suggested to influence intention, but only perceived usefulness succeeded, thus H18 is accepted and H17 is rejected. The model had excellent match for the data based on the fit indices and the R square of the intention was extremely high.

The final model encloses the health characteristics and age to technology perceptions. The model 7 was adjusted based on the results received from the previous model. Perceived behavioural control had no meaning for adoption intention, thus it was left out from the last model. This means that hypothesis H25 remains unsolved. Also inline with previous models, the non significant relationship were removed from estimation. Figure 36 illustrates the results. The estimated model supported hypothesis H24, perceived health and age also had significant influence on anxiety, but with a low R square. Perceived health, however had no influence on future service perceptions, and hypotheses H26 and H27 had to be rejected. Age instead had low but significant path coefficients to both perceived reliability and perceived usefulness. Interestingly, older respondents perceived health communication reliability with ICT appliances higher than their younger counterpart, but they also perceived new services less useful.

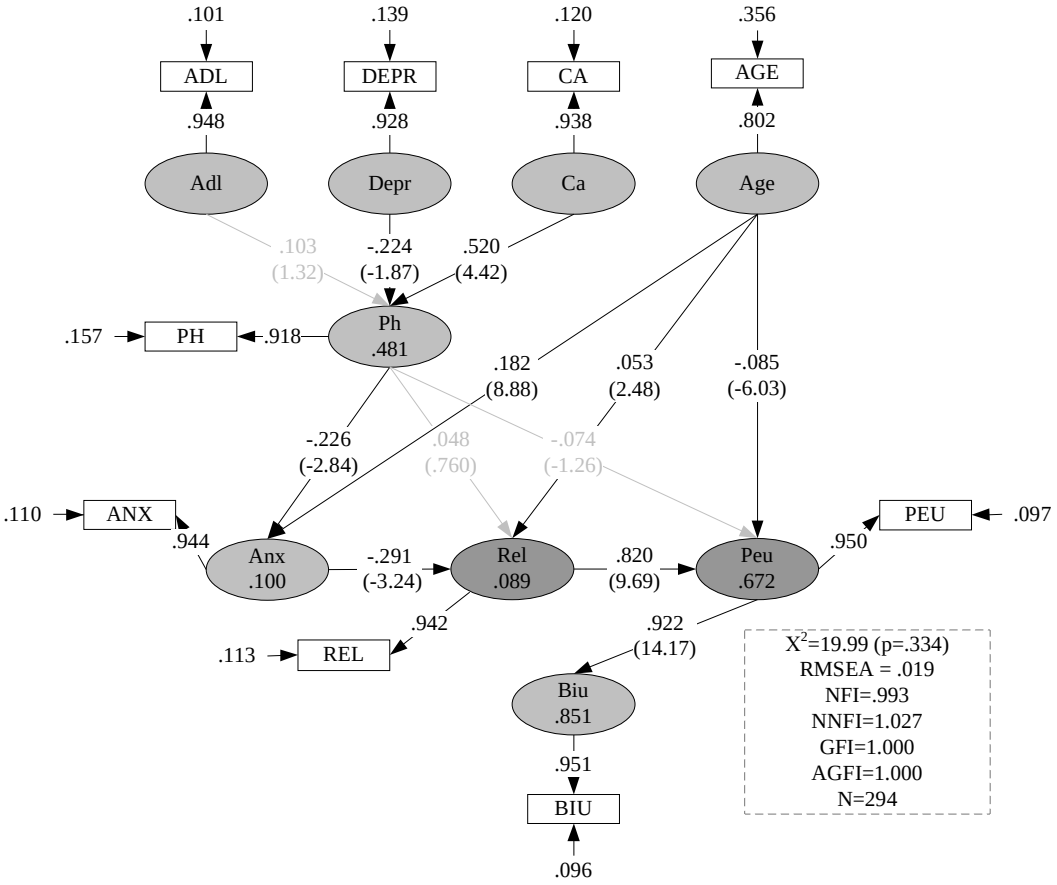

Figure 36 Results of the structural model 7, path coefficients (t-values), R^2 below the latent variable

Another interesting issue is related to the perceived reliability. As can be noticed, technology anxiety and age explained only a bit over eight percent of perceived reliability. This should be under a closer investigation in the future, thus it could be proposed that people that have already experience with services like online banking, are more prone to rely on information transmission in the electronic environment.

7.2.5 Analysis of selection bias in structural models

Due to the scaling of responses in the questionnaires, the representativeness of the structural models was verified using Heckman selection model in regression analysis. As the

questionnaire had scaling opportunity for skipping questions, this procedure is necessary in order to evaluate that the respondents with the poorest health weren't significantly missing from the structural analysis. The same datasets used as input in structural models were analysed with Heckman selection model regression. For each model the dependent variable was the same as in the structural model (PC, mobile phone and behavioural intention). The model specific technology perceptions were used as independent variables, and the health related variables were used as explanatory variables for selection bias except perceived health that is proven to be dependent of functional ability, cognitive ability and depression.

The results are presented in Table 21. The regression model for mobile phones indicates that the only explanatory variable for missing cases was the existence of depressive symptoms. This supports the assumption that the structural models weren't totally biased according to health related factors. The regression results suggest that less depressed persons were included in the analysis. This partly supports the finding that depression wasn't significant part of the self-rated health in the mobile phone model.

The regression for PC adoption, however, indicates that there is no bias in the structural models that were tested. All the three variables were insignificant explainers for selection bias. This is a good result, thus more selection bias caused by health indicators would have been expected for computers than for mobile phones.

The final regression concerned behavioural intention. For this model the selection was explained only by cognitive ability. This is inline with the assumption that new types of service application require cognitive effort in learning to use them. Activities of daily living and depression were insignificant determinants for self-rated health in the structural model and it is possible that there is some bias based on health status, although the Heckman selection model doesn't support it.

Altogether, the results of the selection models do not indicate severe bias that would have been possible due to the scaling of the questionnaire. The results also support the original idea in the development stage of the questionnaire that it was meaningful to leave those persons out of analysis that didn't have a slightest interest or experience with mobile phones or PCs.

Table 21 Regression results with Heckman selection model

		Dependent: mobile phone		
Independent	**β**	**s.e.**	**z**	**p**
Pbc_mp	.189	.024	7.94	.000
Anx_mp	-.119	.034	-3.48	.000
Pr	-.023	.016	-1.43	.153
Constant	1.688	.150	11.24	.000
Selection	**β**	**s.e.**	**z**	**p**
Adl	.101	.174	.58	.560
Ca	-.013	.074	-.18	.859
Depr	*-.283*	*.086*	*-3.27*	*.001*
Constant	1.593	.537	2.96	.003
		Dependent: PC		
Independent	**β**	**s.e.**	**z**	**p**
Pbc_pc	.291	.103	2.81	.005
Anx_Pc	.006	.157	.04	.970
Constant	1.319	.622	2.12	.034
Selection	**β**	**s.e.**	**z**	**p**
Adl	.255	.424	.60	.549
Ca	-.061	.164	-.37	.709
Depr	-.215	.183	-1.18	.239
Constant	1.875	1.357	1.38	.167
		Dependent: behavioural intention to use		
Independent	**β**	**s.e.**	**z**	**p**
Peu	.877	.058	15.18	.000
Rel	.142	.054	2.61	.009
Constant	-.089	.249	-.36	.721
Selection	**β**	**s.e.**	**z**	**p**
Adl	.197	.119	1.65	.099
Ca	*.130*	*.051*	*2.52*	*.012*
Depr	-.059	.065	-.90	.367
Constant	-.619	.379	-1.63	.102

7.3 Summary of findings

The first conclusion from the empirical study is the notion that structural equation modelling provided a useful way to analyse entities that are discussed in the current study. Besides being useful, the method succeeded in estimating the proposed models. Table 22 summarizes the set hypotheses and the deductions based on the estimated structural models.

Table 22 Summary of the hypothesis and deduction

H1	Good functional ability has a positive effect on perceived health status.	A
H2	Existence of depressive symptoms has a negative effect on perceived health status.	A
H3	Good cognitive ability has a positive effect on perceived health status.	A
H4	Perceived behavioural control has a positive effect on PC usage behaviour.	A
H5	*Computer anxiety has a negative effect on PC usage behaviour.*	*R*
H6	Computer anxiety has a negative effect on perceived behavioural control.	A
H7	Good perceived health has a negative effect on computer anxiety.	A
H8	*Good perceived health has a positive effect on perceived behavioural control.*	*R*
H9	*Physical restrictions have a negative effect on MP usage behaviour.*	*R*
H10	Perceived behavioural control has a positive effect on MP usage behaviour.	A
H11	*Mobile anxiety has a negative effect on MP usage behaviour.*	*R*
H12	Mobile anxiety has a negative effect on perceived behavioural control.	A
H13	Physical restrictions have a negative effect on perceived behavioural control.	A
H14	Good perceived health has a negative effect on mobile anxiety.	A
H15	*Good perceived health has a positive effect on perceived behavioural control.*	*R*
H16	Good perceived health has a negative effect on physical restrictions.	A
H17	*Reliability on the electronic information transmission has a positive influence on behavioural intention.*	*R*
H18	Perceived usefulness has a positive influence on behavioural intention.	A
H19	Reliability on the electronic information transmission has a positive influence on perceived usefulness.	A
H20	Technology anxiety has a negative influence on perceptions of reliability.	A
H21	*Perceived behavioural control has a positive influence on perceptions of reliability.*	*R*
H22	*Perceived behavioural control has a positive influence on perceived usefulness.*	*R*
H23	Technology anxiety has a negative effect on perceived behavioural control.	A
H24	Good perceived health has a negative influence health on technology anxiety.	A
H25	Good perceived health has a positive influence on perceived behavioural control.	A

Starting from the top of each model, constructs related to health and coping formed a unified concept of perceived health. When analysing the PC adoption and behavioural intention, functional ability wasn't a significant predictor of perceived health. This might be partly due to the selection bias for the PC adoption, but on the other hand, this makes logically sense, because the measurement of cognitive ability was based on a comparative measure (current vs. previous cognitive functioning), and on the other hand learning to use technology requires cognitive effort that as discussed before tends to decrease due to aging. Further on, it could be proposed that depressive symptoms and cognition are hand-in-hand constructs. Figure 37 illustrates a summary of the results for current technology adoption. Perceived health proved to be a determinant of computer and mobile anxiety and a determinant for mobile phone's physical restrictions. When the technology perceptions are discussed, most of the variance in perceived behavioural control was captured with anxiety, perceived health thus influenced only indirectly through anxiety. Physical restrictions related to the size of mobile phones was an additional explanatory construct for cell phones behavioural control. In both cell phone and computer cases, perceived behavioural control appeared to be the only construct that directly influenced the current stage of technology adoption.

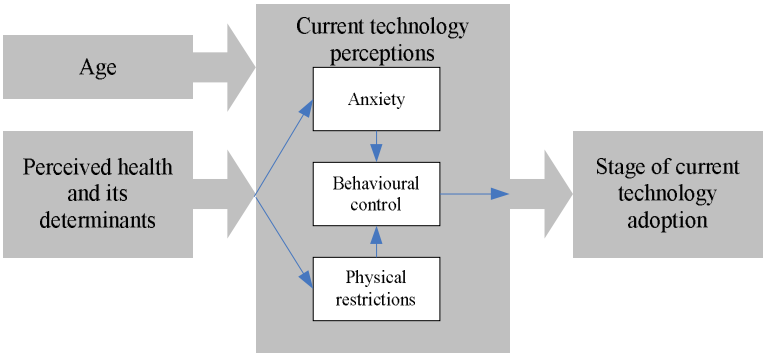

Figure 37 Summary of current technology adoption

Age should not be forgotten. Together with perceived health, age influenced all the technology perceptions analysed in the structural model for current technology. Supporting the importance of health characteristics, it has to be stressed that age had a minor effect on the perceptions compared to perceived health. The R squares of the dependent variables were mainly on excellent level, but for anxiety constructs, it wasn't assumed that health would have

a very large influence on the perception, and the main thing is, that it appeared to be significant, even though it left a lot of variance in anxiety unexplained.

When turning the focus on future service adoption intentions (Figure 38), the results are partly inline with the current technology usage. Cognitive ability and depression altered the technology perceptions through perceived health, which had a significant path coefficient toward technology anxiety. Perceived behavioural control, however, had no role in the future adoption intentions model. From the current technology perceptions, anxiety had the only significant link for reliability perception of the hypothetical service. Reliability then affected the perceived usefulness, which eventually explained very well the adoption intention.

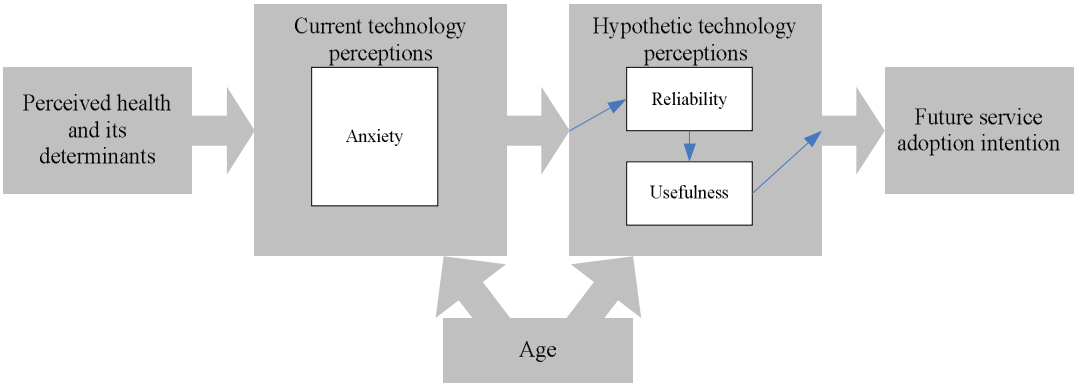

Figure 38 Summary of future adoption intention

All the empirical evidence support the assumption that health is important in consumer behaviour when people age. In addition, age has proven to be an excellent predictor of technology perceptions, but it isn't enough by itself. On the other hand, age usually differentiates young versus older consumers, but it also appears that age makes differences among the elderly.

8 DISCUSSION AND CONCLUSIONS

First, the results of the present dissertation are discussed, and thereafter the main contributions of the dissertation are discussed along with the three main areas that the research intersects (Figure 39). The theoretical contributions are discussed first before turning to managerial contributions. Limitations are evaluated after the contribution and finally, some suggestions for further research are discussed.

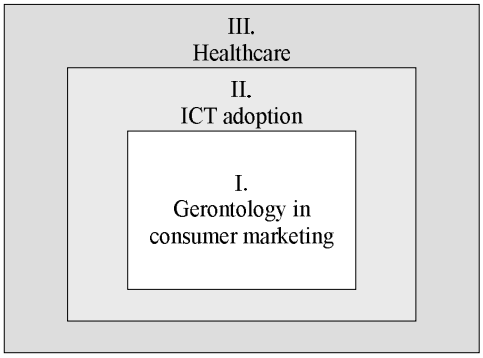

Figure 39 Areas of contribution

8.1 Discussion of the results

The results of the study in light of the research questions are the following:

1) Which factors affect ICT adoption among older consumers?

The hypothesized models for PC and mobile phone adoption indicate that the major contributor for technology adoption is perceived behavioural control, which had a strong direct effect on the adoption behaviour. On the other hand, technology anxiety had a mediating effect on current technology adoption through control.

2) What are the relationships between traditional factors affecting innovation adoption and aging related characteristics?

Perceived health and its determinants appeared to have an important background effect on adoption through technology perceptions, thus health had a positive effect on technology adoption. In this context, the cognitive ability was found to be the strongest determinant of self-rated health over depression and functional ability. Age as a control variable had a negative effect on technology perceptions, thus indicating that the willingness to adopt new technologies decreases with aging.

3) What is the readiness to apply existing technologies into new services and which are the main determinants behind it?

Aging people are not that tending to avoid technology as it could be proposed beforehand. The stage of adoption of PCs and mobile phones suggest a rather good basis for developing new services. The actual willingness to apply existing technologies for health communications in a new way was reflected with intention to do that. The determinants behind the intention strongly emphasized the perceptions of innovations usefulness; i.e. perceived usefulness was the only direct and significant influencer on intentions. Perceived reliability, however, had a mediating influence on intention through perceived usefulness. Surprisingly, the perception related to current technology had a role in the model only due to anxiety. Self-rated health had again a positive influence on the intention through technology perceptions.

Considering the results in relation to previous research, perceived health and additionally age operated rather well in structural models. As was concluded from the literature review, Davis's (1985) technology acceptance model has been complemented with numerous external variables varying from demographics to situational characteristics, thus for the purposes of the present study the selection of these so called external variables was successful.

The adoption models were formed on the basis of the literature review and the three ground theories (technology acceptance model, theory of planned behaviour, and diffusion of innovations). Successful focusing on technology anxiety and perceived behavioural control was able to explain the adoption of computers and mobile phones among aging consumers. Perceived behavioural control was the major facilitator of adoption as could be proposed based on previous research (e.g. Bhattacherjee, 2000; Morris and Venkatesh, 2000; Hung, Ku

and Chang, 2003). It has to be noticed, that in the question of mobile phone and PC adoption, the target variable wasn't pure intention, instead it included actual behaviour, thus supporting the original theory of Ajzen (1985) proposing that perceived behavioural control influences both the intention and the actual behaviour. In addition, perceived behavioural control has been proven to have stronger impact on older people's behaviour in situation of innovation adoption compared to their younger counterparts (Morris and Venkatesh, 2000).

Standing out from the theoretical models, the present dissertation introduced technology anxiety as part of adoption model instead of pure attitudinal beliefs. For the adoption research, anxiety isn't completely a new concept (e.g. Igbaria and Iivari, 1995; Oyedele and Simpson, 2007), but it can be considered rather novel element and the present study confirmed that the perceptions of anxiety have an important role when ICT innovations are discussed.

Turning the discussion toward the future intention related to new service ideas, the effect of perceived usefulness follows clearly the same line as suggested in the literature (e.g. Gefen et al., 2003b; Chan and Lu, 2004; Kulviwat, Bruner, Kumar, Nasco and Clark, 2007). The finding that perceived behavioural control had no role in the intention modelling is quite exceptional compared to previous research and ground theory. One possible explanation might be that there exist some kind of selection bias due to the structure of the questionnaire, or that the control is high enough to consider new service trial or adoption.

8.2 Theoretical contribution

The dissertation contributes to the three core areas as follows:

I. In the field of consumer marketing the interest of research and practice are turning to older consumers. The current dissertation gives an important link from gerontology to consumer psychographics. As discussed earlier, age doesn't explain the behaviour of the aging people. In turn, it is suggested that health and coping are more important issues that control the elderly lives and affect their beliefs and attitude formation. The concept of perceived health was proven to be formed by functional ability, cognitive ability and depression. Interestingly, in the context of technology adoption, the effect of cognitive ability was much stronger compared

to the other determinants of self-rated health. In contrast, as the effect of cognitive ability became stronger, the effect of functioning became weaker. This thus suggests that the technological innovations do require more cognitive capabilities compared to physical functioning as they are novel and their usage requires learning efforts. Age is important explanatory factor, but its effect was found to be minor than that of perceived health.

II. For the previous research in the field of technology adoption among consumers, the present study makes some revisions. The wide variety of theories provides useful insights for the consumer adoption behaviour, but here it is suggested that picking the best parts of the models is useful. For current adoption behaviour, perceived behavioural control is the key, but technology anxiety succeeded to explain more than half of control and thus definitely has an important role in ICT adoption particularly in the target population. The role of technology anxiety is important when determining the perceived behavioural control that is necessary for ICT adoption. As denoted already by Cohen and Waugh (1989) the negative relationship between experience and computer anxiety indicates that mere exposure seems to alleviate some of the fear subjects have about using computers. As the level of anxiety decreases, the perception of control increases thus leading to positive outcomes in the adoption and usage processes. Using psychographics drawn from health research and gerontology as external variables affecting technology beliefs and attitudes is a totally new aspect of analysing ICT markets for older consumers; nevertheless the explanatory power is rather low it is still significant. Concerning the cognitive ability, its effect was emphasized in all the models that explained adoption, thus providing an approach that indicates differences among aging consumers' behaviour. In addition, contribution was made for measurement issues with the development of short and reliable scales, especially technology anxiety, which was drawn from computer anxiety scales and successfully reflected to cover anxiety related to mobile phones.

III. The present study succeeded rather well in predicting the behavioural intention that relates to new health service adoption. The present dissertation takes a look at the characteristics of individual end-user, not the health service provider. Research has indicated cost and quality benefits for health information technology for

institutional systems, thus the present study attempted to evaluate the potential for health information systems from the other end of the value chain. Successfully, results indicate that there exists willingness for new services and provides also key antecedents for new service adoption, namely perceived reliability and usefulness. Measurement items drawn from pure consumer and intra-organizational adoption were proven to be applicable in the context of health services. The role of health related indicators in this entity is important, and they can be used for predicting the service adoption intentions.

8.3 Managerial implications

The managerial implications for the three core areas are the following:

I. Using aging related characteristics for analysing consumers markets allows marketers to allocate their products or services correctly along with the marketing efforts. Perceived health along with functioning, depressive symptoms and cognitive ability are essential parts of elderly lives and thus shouldn't be neglected when the aging markets are discovered. These issues cover the deepest centre of elderly lives and provide information for marketers, and emphasize their differences from younger market as well as the differences inside the aging market.

II. Technology perceptions are important determinants of ICT adoption. The perception of health emphasized with cognitive ability has clear implications for ICT marketers. The ability to learn to use new devices is preferred as either a facilitating or inhibiting factor for adoption. The cognitive state affects this, but on the other hand it can be considered to have minor effect in the future as both computers and cell phones become part of consumers' daily lives when they are still young. The usage gets versatile, but the aging market today hasn't completely experienced this kind of information society. Computer anxiety was a significant part of every model tested in the empirical part of the present study. As noted in previous research (Igbaria and Iivari, 1995; Chua et al., 1999), computer anxiety isn't a permanent characteristic of the individual. The level on anxiety can be

altered by proper training targeted correctly for the individual's level of knowledge and abilities. In order to make the coping with computer easier, individuals should be informed that the initial anxiety they experience is a natural reaction which diminishes over time (Cohen and Waugh, 1989). The changing nature of technology anxiety can thus be altered. The training for computer usage and thereby increasing perceived behavioural control makes adoption more probable. Physical restrictions proved to be an additional determinant for perceived behavioural control with mobile phones. The design of the device thus hasn't been able to pay enough attention for the aging cohort. Cognitive capacities related to hearing and vision are important together with the motor functions for the usage of mobile phones. As the aging market grows, this should not be ignored.

III. Individual users of health care services have a wide variety of benefits rising from ICT applicability in the field. As was seen, the perceived usefulness was a powerful predictor of intention, and reliability altered intention through perceived usefulness. This indicates that perhaps, the end-users have more mature way of considering new service types, than do the service providers. Technology development has been done by the public sector being in charge. The end-user readiness is rather clear and predictable, but the service development should start from the end-users' point of view. In the future, the legislation should allow the patients to take part of their own treatment merely due to ICT services, thus releasing resources for more critical parts of the health care processes. For the communication between service provider and consumer, a significant order takes place for automation for information and requests that are currently sent via postal mail or telephone conversations. On the other hand, the present dissertation provides clear suggestions for the targeting of electronic health care, all patients are neither ready nor capable for applying home computer or cell phone for services that discus their own health, and the benefits for that type of services are not clear enough. Therefore, the part of aging market that has lower health status can be targeted with other types of telecare applications. The main point for the public sector cost structure is that the longer the older people can remain in their own homes, the higher the financial benefits are. This is where the telecare can help to maintain the standards of living as high as possible for the aging. In

addition, the services developed for aging people are also applicable for other segments thus increasing the market potential for application and service providers.

8.4 Limitations

The present study, as all research, has limitations. These are mainly related to the sampling, measurement, model construction and background theories. The empirical research was only conducted in one city, thus replications are needed in order to verify the research results and the measurement constructs. It could be suggested that a nation wide random sample stratified with age or a selection of few cities from different geographical location and different sizes would fix this. The measurement thus needs replications, because many of the measurement scales were shortened versions of the originals. The model compositions where only based on the latent instruments and the basic background information i.e. socio-economic status were left out of the analysis, thus leaving one area out of discussion. As only self-reported measures were used, there is a risk for common method bias (see Podsakoff, MacKenzie, Lee and Podsakoff, 2003). On the other hand several concepts are purely subjective and there would not have been any other way to conduct the measurement. For some constructs such as functional ability, cognitive functioning or technology usage it would have been possible to collect information by observing. As the study is cross-sectional, it is unable to clarify how sensitive the technology perceptions are for the changes occurring in health conditions or how they could have been changed.

The theoretical background of the present thesis is limited to adoption models, although studying behavioural intention though has been found to be a good predictor of actual usage (e.g. Taylor and Todd, 1995; Hung et al., 2003; Turel, Serenko and Bontis, 2007). Essential part of diffusion of innovations theory, the time dimension, was left out of the research focus that might have been able to provide additional information of the innovativeness of aging consumers. Additionally, the concepts of personal innovativeness and domain specific innovativeness could have complemented the background and maybe also had some explanatory power on the current state of ICT adoption and on behavioural intentions. Leaning only on behavioural intentions is limited also because of the fact that usage doesn’t

always occur even though a strong intention exists, and there might be multiple reasons for this such as situational factors.

8.5 Suggestions for further research

Suggestions for further research for each core area are the following:

I. The applicability of the psychographics drawn from gerontology should be applied in other contexts, and their usability for consumer behaviour should be validated. The present dissertation found that the effect of cognitive ability was emphasized in the context of ICT innovation adoption, but for the adoption of totally different types of product or services (for instance food or cleaning services) the effect of functional abilities might be highlighted. In addition, to using these variables in consumer marketing, a gerontology based approach to functional ability, depressive symptoms and cognitive functioning needs more clarification. By this it is referred to the reciprocal relationships of the variables. The circled effect suggested by the researchers in the field should be clarified because the elderly life content is affected by these health related aspects. Structural equation modelling provides useful tools for this phenomenon; however longitudinal data would provide support for this research field. To conclude, more theory development and verification is needed. Including socio-economic factors in the analysis would provide useful information for marketers and help them form proper market segments for targeting actions.

II. For the innovation adoption and acceptance research, an extension of the present empirical research is needed in the form of external variables behind the technology perceptions. As was proved here, perceived health covered only part of the variance in anxiety, thus there are some other background variables behind. What comes to the behavioural intention, the effect of previous web service applications might occur to be important predictors for new service adoption and they might also be the basis for the reliability perception in addition to the psychographics.

III. As the current trend is to develop services that restrain the cost growth in health care, a true development process would be useful for the development and testing theories in consumer behaviour with no age based targeting of research population. By this it is meant that the same type of pre development research should be done as here, thereafter a research should be done pre adoption and thereafter post adoption. This is how the development of theories and models to predict adoption could be verified, and eventually be able to recognize the true indicators of behaviour.

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APPENDIX 1

Reviewed articles

APPENDIX 1: Reviewed articles

Abbreviations used in the review list for background theories:

DOI = diffusion of innovation theory

ECM-IT = expectation-confirmation model in IT domain (see Bhattacherjee, 2001)

EDT = Expectation disconfirmation theory (see Oliver, 1980)

PAD = pleasure, arousal and dominance paradigm (see Mehrabian and Russell, 1974)

SCT = social cognition theory (see Bandura, 1986)

TAM = technology acceptance model

TPB = theory of planned behaviour

TRA = theory of reasoned action

DTPB = decomposed theory of planned behaviour

Abbreviation used in the review list for statistical methods

SEM = structural equation modelling (LISREL, AMOS, EQS)

PLS = partial least squares analysis

Author	Innovation	Theories	*Dependent* / Independents	Sample/Method	Conclusions
Igbaria and Iivari (1995)	computer use	TAM, SCT, TRA, TPB	*usage* computer experiences, organizational support, self-efficacy, computer anxiety, perceived ease of use, perceived usefulness	employees of 81 companies, N=450 (55.8%), PLS	computer experience, organizational support → self-efficacy computer experience, self-efficacy → computer anxiety computer experience, organizational support, self-efficacy, computer anxiety → perceived ease of use computer experience, organizational support, perceived ease of use → perceived usefulness perceived usefulness → usage
Taylor and Todd (1995)	computing resource centre	TAM, TPB, DTPB	*intention / usage* attitude, Perceived usefulness, perceived ease of use, subjective norm, perceived behavioural control, compatibility, peer influence, superior's influence, self-efficacy, resource facilitating conditions, technology facilitating conditions	university students, N=786, SEM	TAM: perceived ease of use → perceived usefulness perceived ease of use, perceived usefulness → attitude perceived usefulness, attitude → behavioural intention behavioural intention → usage behaviour TPB: attitude, subjective norm, perceived behavioural control → behavioural intention behavioural intention, perceived behavioural control → usage behaviour DTPB: perceived usefulness → attitude → behavioural intention peer influence, superior's influence → subjective norm → behavioural intention self-efficacy, resource facilitating conditions → perceived behavioural control → behavioural intention behavioural intention, perceived behavioural control → usage
Agarwal and Prasad (1997)	www service	DOI, TAM	*current use / future use intentions* relative advantage, ease of use, compatibility, trialability, visibility, result demonstrability, image, voluntariness	class in the MBA program, N=73, regression	voluntariness, visibility, compatibility, trialability → current use relative advantage, result demonstrability → future use intentions

Author	Innovation	Theories	*Dependent* / Independents	Sample/Method	Conclusions
Gefen and Straub (1997)	e-mail	TAM	*usage* gender, social presence, perceived ease of use, perceived usefulness	knowledge workers of three organizations, N=392, PLS	gender [0=female, 1=male](-) → social presence gender (-), social presence → perceived usefulness gender → perceived ease of use perceived usefulness, perceived ease of use → usage
Agarwal and Prasad (1998)	internet	DOI, TAM	*intention* usefulness, ease of use, compatibility, personal innovativeness in IT	business professional enrolled in a part-time MBA program, N=175, regression	usefulness, compatibility * personal innovativeness in IT → intention
Compeau, Higgins and Huff (1999)	computer use	SCT	*usage* anxiety, affect, outcome expectations, computer self/efficacy	subscribers to Canadian business periodical, longitudinal study, N=394, PLS	computer self-efficacy, performance outcome expectations → affect computer self-efficacy → personal outcome expectations computer self-efficacy → anxiety affect, computer self-efficacy, performance outcome expectations, personal outcome expectations → usage
Järvenpää and Tractinsky (1999)	internet bookstore	TRA, TPB;	*willingness to buy* attitude, risk perception, trust in store, perceived size, perceived reputation, culture	N(Australia)=184, N(Israel)=198, N(Finland)=119, SEM & regression	perceived size, perceived reputation → trust in store trust in store → risk perception trust in store, risk perception → attitude attitude, risk perception → willingness to buy no cultural differences found
Karahanna and Straub (1999)	email	TAM	*use* perceived usefulness, perceived ease of use, social presence, social influence, perceived accessibility, availability of user training and support	Employees of a transportation company, N=180	perceived accessibility → perceived ease of use social influence, social presence, perceived ease of use → perceived usefulness perceived usefulness → use

Author	Innovation	Theories	*Dependent* / Independents	Sample/Method	Conclusions
Liao, Shao, Wang and Chen (1999)	virtual banking	TBP	*intention* attitude toward the use, relative advantage, ease of use, compatibility, result demostrability, perceived risk, subjective norms, image, visibility, critical mass, perceived behavioural control, voluntariness, trialability, support, learning	convenience sampling, N=118 (59%), linear regression	relative advantage, ease of use, compatibility, result demostrability → attitude image, critical mass → subjective norm attitude, perceived behavioural control → intention
Swaminathan, Lepkowska-White and Rao (1999)	electronic exchange		*likelihood of electronic exchange* perceived reliability of web vendors, perceived convenience of using web vendors, perceived price competitiveness of web vendors, perceived usefulness of information of web vendors, perceived security of transactions, concern for privacy, customer characteristics	email survey, N=438, linear regression, logistic regression	vendor characteristics (reliability, convenience, price competitiveness, usefulness of information), perceived security, social interaction, convenience → frequency of online purchases information privacy, privacy laws, social interaction, convenience → amount of money spent of online purchasing
Bhattacherjee (2000)	electronic brokerage	TAM, TPB	*intention* attitude, subjective norm, behavioural control, usefulness, ease of use, interpersonal influence, external influence, self-efficacy, facilitating conditions	web survey, N=172, SEM	usefulness, ease of use → attitude interpersonal influence, external influence → subjective norm self-efficacy, facilitating condition → behavioural control attitude, subjective norm, behavioural control → intention
Jiang, Hsu, Klein and Lin (2000)	internet	TAM	*utilization of the internet* experience with the internet, facilitating conditions, near-term consequences, long-term consequences	N=335 college students, SEM/regression	facilitating conditions, experience with the internet → near-term consequences, long-term consequences facilitating conditions, experience with the internet, near-term consequences, long-term consequences → utilization of the internet

Author	**Innovation**	**Theories**	***Dependent* / Independents**	**Sample/Method**	**Conclusions**
Järvenpää, Tractinsky and Vitale (2000)	internet bookstore, internet travel activities	TRA, TPB, exchange theory, balance theory	*willingness to buy* attitude, risk perception, trust in store, perceived size, perceived reputation	Australian undergraduate and MBA students, N=184, SEM	perceived size (only with travel sites), perceived reputation → trust in store trust in store → risk perception trust in store, risk perception → attitude risk perception, attitude → willingness to buy
Morris and Venkatesh (2000)	accounting software	TPB	*actual usage behaviour* age, attitude, subjective norm, perceived behavioural control	intrafirm survey, N=118 hierarchical regression	age (-)→ usage attitude → usage subjective norm → usage perceived behavioural control → usage age * attitude (-) → usage age * subjective norm → usage age * perceived behavioural control → usage
Childers, Carr, Peck and Carson (2001)	online shopping	TAM	*attitude* navigation flexibility, convenience, sub-substitutability of personal examination, usefulness, ease of use, enjoyment	N(students)=274, N(home shopping)=366 (37%), SEM	convenience, substitutability of personal examination → usefulness navigation, convenience → ease of use navigation, convenience, substitutability of personal examination → enjoyment usefulness, ease of use, enjoyment → attitude
de Ruyter, Wetzels and Kleijnen (2001)	hypothetical e-service of a travel organization	signalling theory, DOI	*trust, perceived quality, intention to use* relative advantage, performance risk, organizational reputation	N=202, role playing scenarios and survey, MANOVA	organizational reputation → trust, perceived quality, intention to use relative advantage → perceived quality, intention to use perceived risk → trust, perceived quality, intention to use
Goldsmith (2001)	online shopping	DOI	*future online buying intention, internet use, previous online buying* domain specific innovativeness	undergraduate students, N=117, ANOVA	domain specific innovativeness → future online buying intention, internet use, previous online buying

Author	**Innovation**	**Theories**	***Dependent* / Independents**	**Sample/Method**	**Conclusions**
Venkatesh and Brown (2001)	PC	TPB	*intention (0/1), purchase (0/1)* attitude (utilitarian outcomes, hedonic outcomes, social outcomes), subjective norm (social influences), perceived behavioural control (barriers)	longitudinal study, N=733, detailed cross-sectional analysis	attitudinal beliefs were major determinants of purchase behaviour among current users, also social influence had a significant effect utilitarian outcomes were major drivers of intention, barriers were determinants for no intention
Eastin (2002)	online shopping, banking, investing, services	DOI, SCT	*adoption of e-commerce activities* previous experience (telephone shopping etc), perceived level of risk, self-efficacy, amount of internet use, perceived conveniences, perceived economic advantages	selected members USENET newsgroups, N=274, multiple regression	prior use of telephone for shopping, self-efficacy, perceived convenience, perceived financial benefits → adoption of online shopping perceived risk, internet use, perceived convenience → online banking prior use of telephone to investing, perceived risk, perceived convenience, perceived financial benefits → adoption of online investing internet use, perceived convenience → adoption of online services perceived risk, self-efficacy, internet use, perceived convenience → overall adoption of e-commerce activities
Goldsmith (2002)	online shopping	DOI	*future intention to buy* amount of online buying, internet use, internet innovativeness, global innovativeness, internet involvement	undergraduate students, N=107, SEM	global innovativeness, internet involvement → internet innovativeness internet innovativeness → amount of online buying internet involvement, internet innovativeness, amount of online buying → future intentions to buy

Author	Innovation	Theories	*Dependent* / Independents	Sample/Method	Conclusions
Gefen, Karahanna and Straub (2003a)	shopping via amazon.com	TAM	*purchase intention* perceived ease of use, perceived usefulness, familiarity, disposition to trust, trust	MBA & senior undergraduate students, N=317, PLS	*potential customers:* familiarity → perceived ease of use familiarity, disposition → trust perceived ease of use → perceived usefulness familiarity, trust → intention *repeat customers:* familiarity → perceived ease of use familiarity, disposition → trust perceived ease of use → perceived usefulness familiarity, trust, perceived usefulness → intention
Gefen, Karahanna and Straub (2003b)	online shopping	TAM	*intention to use* trust, perceived ease of use, perceived usefulness, calculative-based beliefs, institution-based structural assurances, institution-based situational normality, knowledge-based familiarity	field study, experienced online shoppers, undergraduate/graduate business students, N=213, SEM	calculative-based beliefs, institution-based structural assurances, institution-based situational normality, perceived ease of use → trust institution-based situational normality, knowledge-based familiarity → perceived ease of use trust, perceived ease of use → perceived usefulness trust, perceived ease of use, perceived usefulness → intended use
Hung, Ku and Chang, 2003	WAP	DOI, TPB, TAM	*intention / use* perceived behavioural control, subjective norm, attitude, facilitating condition, self-efficacy, external influence, peer influence, usefulness, ease of use, personal innovativeness, user satisfaction, service cost, connection speed	systematic sampling, N=267 (53.4%), SEM	connection speed, user satisfaction, personal innovativeness, ease of use, usefulness → attitude peer influence → subjective norm self-efficacy → perceived behavioural control attitude, subjective norm → intention perceived behavioural control → use
Lee, Lee and Eastwood (2003)	electronic banking, computer & ATM	DOI	*adoption (binary)* access to electronic banking technologies, income, education, age, perceived usefulness, reliability, security, complexity, observability, trialability	telephone survey, N=1000, probit analysis	age, education, income → access perceived benefits, reliability, security, complexity, access → adoption of computer banking perceived benefits, reliability, security, complexity, trialability, age, income, education → adoption of ATM banking

Author	Innovation	Theories	*Dependent* / Independents	Sample/Method	Conclusions
O'Cass and Fenech (2003)	web retailing	TAM	*behaviour (adoption vs. non-adoption)* attitude, perceived usefulness, perceived ease of use, personality, web experiences, shopping orientation	web survey, N=392, PLS	personality, web experiences → perceived usefulness personality, web experiences → perceived ease of use perceived ease of use, perceived usefulness → attitude attitude → behaviour
Oh, Ahn and Kim (2003)	broadband	TPB, TAM, DOI	*attitude* perceived usefulness, perceived ease of use, perceived resources, compatibility, trialability, visibility, result demonstrability	mail and electronic survey, random sample from universities, firms and households, N=157, regression	compatibility, perceived ease of use → perceived usefulness compatibility, visibility, perceived resources → perceived ease of use compatibility, result demonstrability → perceived resources perceived usefulness, perceived ease of use → attitude
Vishwanath and Goldhaber (2003)	cellular phones	TAM, DOI	*behavioural intention* attitude, relative disadvantages, perceived complexity, lack of observability, perceived incompatibility, change agent contact, media ownership, media use, age, income, education, occupation, gender	telephone survey, nonadopters of cellular phones, N=225, SEM	age, income, occupation → media ownership change agent → complexity media ownership, complexity → relative disadvantage media ownership, complexity → incompatibility media ownership, media use, complexity → observability incompatibility, observability → attitude attitude (-) → intention
Yoh, Damhorst, Sapp and Laczniak (2003)	apparel shopping through internet	TRA, DOI	*buying intention* attitude toward internet apparel shopping(IAS), social acceptance of IAS, social support for IAS, beliefs about IAS, prior experience with the internet, beliefs about in-home apparel shopping	mail survey, directory based random sample, N=355, SEM	beliefs about in-home apparel shopping, prior experience with the internet → beliefs about IAS → attitude toward IAS → IAS intention prior experience with the internet → IAS intention social support for IAS → social acceptance of IAS → IAS intention

Author	**Innovation**	**Theories**	***Dependent* / Independents**	**Sample/Method**	**Conclusions**
Chan and Lu (2004)	internet banking	TPB, TAM, TAM2, SCT	*intention to adopt / intention to continue use* perceived usefulness, perceived ease of use, computer self-efficacy, subjective norm, image, result demonstrability, perceived risk	under graduate and graduate students, N=499, SEM	*Intention to continue use:* computer self-efficacy → perceived ease of use image, result demonstrability, perceived ease of use → perceived usefulness subjective norm, perceived usefulness → intention to continue use *Intention to adopt:* computer self-efficacy → perceived ease of use subjective norm, image, perceived risk, perceived ease of use → perceived usefulness subjective norm, perceived usefulness → intention to adopt
Hansen, Jensen and Solgaard (2004)	online grocery shopping	TRA, TPB	*intention* attitude, subjective norm, perceived behavioural control	online survey, Danish/Swedish sample, N=2260, SEM	subjective norm → attitude subjective norm, attitude, perceived behavioural control → intention
Shih (2004)	e-shopping	TAM, TRA	*user acceptance* web security, access costs, perceived ease of use, perceived usefulness, user satisfaction, perceived information quality, perceived system quality, perceived service quality	employees of 8 SMEs in Taiwan, N=212 (66.2%), regression	web security, perceived ease of use of trading, perceived usefulness, user satisfaction, access cost → attitude web security, perceived ease of use of trading → perceived usefulness perceived ease of use of web, user satisfaction → perceived ease of use of trading security, user satisfaction → perceived ease of use of web attitude, perceived information quality, perceived service quality, perceived system quality, web security, user satisfaction → user acceptance

Author	**Innovation**	**Theories**	***Dependent* / Independents**	**Sample/Method**	**Conclusions**
Shih and Venkatesh (2004)	computer	DOI	*usage* household communication, competition for limited resources, prior experience with technology in the family, technological sophistication, complementary technologies, use innovativeness, frustration with technology, external communication, external technology access, family exposure to target media	random digit dialling method for sampling, N=910, two staged least squares regression	intensity of communication with others, competition of technology, product experience, use of more advanced technology, use of other complementary technologies, use innovativeness, frustration with technology, external communication technology, access to innovation outside the home environment, exposure to target media → variety and rate of use
Vijayasarathy (2004)	online shopping	TAM, TRA, TPB	*intention* attitude, usefulness, ease of use, compatibility, privacy, security, normative beliefs, self-efficacy	proportional random sampling, N=281 (35,1%), multiple regression	usefulness, ease of use, compatibility, security → attitude attitude, normative beliefs, self-efficacy → intention
Bruner and Kumar (2005)	a handheld internet device	TAM	*behavioural intention to use* attitude toward the act, usefulness ease of use, fun, consumer visual orientation, type of device	Undergraduate students, N=212, SEM	consumer visual orientation, internet device → ease of use internet device , ease of use → fun ease of use → usefulness fun, usefulness → attitude attitude → behavioural intention
Lassar, Manolis and Lassar (2005)	internet banking use	DOI, TAM, SCT	*internet banking adoption (yes/no)* innate or general marketplace innovation characteristics, opinion leadership on internet processes and issues, opinion seeking behaviour in internet processes, web experience, intensity of internet use, comfort with internet technology, utilitarian internet use, hedonistic internet use, income, education level, age	internet survey, professionals participating university courses aged 19-48, N=349, logistic regression	marketplace innovation characteristics (-), opinion leadership (+), opinion seeking behaviour (-), intensity of internet use (+), income (+), utilitarian internet use (+), hedonistic internet use (-) → internet banking adoption

Author	Innovation	Theories	*Dependent* / Independents	Sample/Method	Conclusions
Martínez-López, Luna and Martínez (2005)	online shopping		*online shopping adoption (yes/no)* web design aspects, interaction speed/time of response, social benefits, invasion of privacy, attitude towards the internet, perceived usefulness of in-home shopping, trust in internet shopping	non-probability sampling, American and Spanish university students, N=700, SEM	web design aspects, interaction speed/time of response, social benefits, invasion of privacy (-), perceived usefulness of in-home shopping → attitude towards the internet perceived usefulness of in-home shopping, attitude towards the internet → trust in internet shopping trust in internet shopping → online shopping
Hong and Tam (2006)	multipurpose information appliances		*intention to adopt* perceived usefulness, perceived ease of use, perceived service availability, perceived monetary value, perceived enjoyment, need for uniqueness, social influence, gender, age	online survey, N=1328, SEM	perceived usefulness (weak direct), perceived ease of use (strong direct), perceived service availability (strong indirect), perceived monetary value (strong direct), perceived enjoyment (strong direct and indirect), need for uniqueness (strong direct), social influence (strong direct), gender (weak direct)
Hong, Thong and Tam (2006)	mobile internet/ e-government services	TAM, ECM-IT	*continued usage intention* satisfaction, confirmation, perceived ease of use, perceived usefulness	members of government e-service website, N=1826, SEM	TAM (best fit): perceived ease of use → perceived usefulness perceived ease of use, perceived usefulness → continued usage intention ECM-IT: confirmation → perceived usefulness confirmation, perceived usefulness → satisfaction perceived usefulness, satisfaction → continued usage intention EECM-IT: confirmation → perceived ease of use confirmation, perceived ease of use → perceived usefulness confirmation, perceived ease of use → satisfaction perceived usefulness, confirmation, perceived ease of use → continued usage intention

Author	Innovation	Theories	*Dependent* / Independents	Sample/Method	Conclusions
Iyer and Eastman (2006)	internet use, online purchasing, comparison shopping		*internet use, online shopping, comparison shopping* attitude, computer experience, comfort level of computer skills, confidence of computer skills	mail survey, random national sample, aged 65-85, N=190, independent t-test, correlation	attitude → internet use attitude → online shopping attitude, comfort level of computer skills, confidence of computer skills, computer experience → comparison shopping
Lee, Fiore and Kim (2006)	online shopping	TAM	*intention* attitude, perceived usefulness, perceived ease of use, perceived enjoyment, utilitarian shopping orientation, hedonic shopping orientation, level of image interactivity technology	undergraduate student N=206, SEM	utilitarian shopping orientation, level of image interactivity technology → perceived usefulness utilitarian shopping orientation, level of image interactivity technology → perceived ease of use hedonic shopping orientation, level of image interactivity technology → perceived enjoyment perceived usefulness, perceived ease of use, perceived enjoyment → attitude perceived usefulness, perceived ease of use, attitude → intention
Lin and Hsieh (2006)	self-service technologies		*intention* SST satisfaction, SST service quality, technology readiness	N=436, SEM	technology readiness → SST service quality technology readiness, SST service quality → SST satisfaction technology readiness, SST service quality, SST satisfaction → intention
McKechnie, Winklhofer and Ennew (2006)	internet usage as a distribution channel for financial services	TAM	*extent of internet usage as a distribution channel for financial services* product category involvement, internet access from home, purchasing experience, perceived usefulness, perceived ease of use, attitudes towards using (positive and insecurity emotions), gender, age, income	telephone interview, N=300, age > 18, SEM	product category involvement, purchasing experience, internet access from home → ease of use ease of use, purchasing experience → perceived usefulness perceived usefulness, ease of use, purchasing experience → positive emotions perceived usefulness, ease of use, purchasing experience → insecurity emotions positive emotions, purchasing experience → extent of use

Author	**Innovation**	**Theories**	***Dependent* / Independents**	**Sample/Method**	**Conclusions**
Phang, Sutanto, Kankanhalli, Li, Tan and Teo (2006)	e-government service	TAM	*intention* perceived usefulness, perceived ease of use, internet safety perception, preference for human contact, self-actualization, resource savings, computer anxiety, computing support, declining physiological conditions	50-90 year old participants of activity centres, N=179, PLS	self-actualization, resource savings, perceived ease of use → perceived usefulness computer anxiety, computing support → perceived ease of use perceived usefulness, perceived ease of use, internet safety perceptions → intention
Walker and Johnson (2006)	internet banking, telephone bill paying, internet shopping		*usage* personal capacity to use technology enabled services, perceived risk, relative advantage, desire for personal back up, desire for personal contact, willingness to try new things	interview survey, N=360, SEM	*internet banking:* capacity → willingness perceived risk → personal back up perceived risk, relative advantage (-),personal back up → personal contact capacity, personal contact (-), willingness → usage *telephone bill paying:* capacity → willingness perceived risk → personal back up perceived risk, relative advantage (-),personal back up → personal contact capacity, personal contact (-), personal back up → usage *internet shopping:* capacity → willingness perceived risk → personal back up perceived risk, relative advantage (-),personal back up → personal contact capacity, willingness, personal back up (-) → usage

Author	Innovation	Theories	*Dependent* / Independents	Sample/Method	Conclusions
Yi, Fiedler and Park (2006)	online buying, PDA	TAM, DOI	*intention* individual innovativeness, personal innovativeness in information technology, usefulness, ease of use, compatible	workers of two organizations & undergraduate and MBA students, N(buying)=412 (77.4%) faculty and resident physicians at a family medicine practice residence program, N(PDA)=222 (74.4%), multiple regression	buying: a) individual innovativeness → usefulness, ease of use, compatibility individual innovativeness, usefulness, compatibility → intention b) personal innovativeness in IT → usefulness, ease of use, compatibility personal innovativeness in IT, usefulness → intention PDA: a) individual innovativeness → usefulness, ease of use, compatibility individual innovativeness, usefulness, compatibility → intention b) personal innovativeness in IT → usefulness, ease of use, compatibility personal innovativeness in IT, usefulness, compatibility → intention
Kim, Chan and Gupta (2007)	mobile internet	TAM, consumer choice and decision theories	*intention* usefulness, enjoyment, technicality, perceived fee, perceived value	internet survey, attenders in public forums, undergraduate and graduate student, N=161	usefulness, enjoyment, technicality, perceived fee → perceived value → intention
Kulviwat, Bruner, Kumar, Nasco and Clark (2007)	PDA[1]	TAM, PAD	*adoption intention* attitude, relative advantage, perceived usefulness, perceived ease of use, pleasure, arousal, dominance	undergraduate students, N=260, SEM	perceived ease of use → perceived usefulness perceived usefulness, pleasure, arousal → attitude perceived usefulness, attitude → adoption intention

[1] personal digital assistant

Author	Innovation	Theories	*Dependent* / Independents	Sample/Method	Conclusions
Lanseng and Anreassen (2007)	SST technology in electronic healthcare	TAM	*intention* attitude, expected usefulness, expected ease of use, trust in service provider	N=470	trust in service provider → expected ease of use trust in service provider, expected ease of use → expected usefulness expected ease of use, expected usefulness → attitude attitude → intention
Niemelä-Nyrhinen (2007)	internet, SMS[2]		*technology anxiety* internet and SMS experience	random sample of babyboomers aged 50-60, N=620, two-way ANOVA	internet experience strongly connected to technology anxiety
Oyedele and Simpson (2007)	self service technologies: shopping, library, hotel	SCT	*usage of self service technology in shopping, library and hotel situation* locus of control (internal control, chance, powerful others), autonomy (sensitivity to others control, goal attainment), time pressure, technology anxiety, self-efficacy	under graduate students, N=186, logistic regression	technology anxiety had a significant effect on the use of self service technologies in all target contexts external locus of control had a significant effect in the shopping context chance, goal attainment and self-efficacy had a significant effect in the hotel context
Ratten and Ratten (2007)	WAP banking	SCT	*behavioural intention* media, modelling, outcome expectancy, self-efficacy, outcome values	university students, aged 18-29, N=203, three way ANOVA	media → intention outcome values → intention
Reisenwitz and Iyer (2007)	internet use		*purchase on the internet, level of experience using the internet, satisfaction with current internet skills, innovativeness of using the internet, satisfaction with the internet* two age groups (younger and older babyboomers)	regional sample of babyboomers aged 40-58, N=295, t-test	no significant differences between age groups in none of the dependent variables

[2] short messaging services

Author	**Innovation**	**Theories**	***Dependent* / Independents**	**Sample/Method**	**Conclusions**
Turel, Serenko and Bontis (2007)	SMS	TAM, TRA, TPB	*behavioural intention, actual use* perceived value, performance/quality value, emotional value, value-for-money, social value	undergraduate university students, N=222, PLS	performance/quality value, emotional value, value-for-money → perceived value → intention → actual use
Premkumar and Bhattacherjee (2008)	computer based tutorial	TAM, EDT	*intention* perceived usefulness, perceived ease of use, initial expectation, performance, disconfirmation, satisfaction, intention	longitudinal study, junior and senior level undergraduate students, N=175, PLS	Simplified TAM: perceived usefulness → intention Expectation-Disconfirmation model: initial expectation, performance → disconfirmation initial expectation, performance, disconfirmation → satisfaction satisfaction → intention Integrated model (best explains intention): perceived ease of use → perceived usefulness performance → disconfirmation performance, disconfirmation → satisfaction perceived ease of use, perceived usefulness, satisfaction → intention

APPENDIX 2

Questionnaire cover letter

Questionnaire in Finnish

Questionnaire in English

Hyvä imatralainen!

Haluamme kehittää terveydenhoito- ja hoivapalveluita juuri teidän ikäluokkanne kohdalla yhteistyössä Imatran kaupungin ja Lappeenrannan teknillisen yliopiston kanssa. Kehittämistä varten haluaisimme tietää mitä odotatte ja tarvitsette nykyisessä elämäntilanteessanne terveydenhoito- ja hoivapalveluihin liittyen. Toivoisimmekin teidän täyttävän oheisen kyselylomakkeen ja auttavan meitä siten kehittämään oikeantyyppisiä palveluita kaupunkilaisille.

Tutkijaryhmämme puolesta haluan korostaa, että kaikki vastaukset ovat luottamuksellisia ja niitä käsittelee ainoastaan tutkijaryhmä. Vastauksia tarkastellaan tilastollisesti, eikä yksittäisiä vastauksia voida jälkeenpäin tunnistaa.

Toivon nyt teiltä hieman vaivannäköä kyselylomakkeen täyttämiseen. Haluan korostaa, että lomaketta on pyritty porrastamaan niin, ettei teidän tarvitse vastata aivan kaikkiin kysymyksiin vaan niihin, jotka teitä koskettavat. Kysymyksissä on harmaalla pohjalla ohjeita, joiden mukaan pystytte ohittamaan sellaiset kysymykset, jotka eivät teitä kosketa.

Vastattuanne teillä on mahdollisuus osallistua arvontaan, jossa on palkintona kylpyläpäivä kahdelle hengelle Imatran kylpylässä sekä kaksi kappaletta lahjakortteja Instrumentariumiin. Olkaa hyvä ja täyttäkää lomakkeen viimeisellä sivulla oleva arvontalipuke ja lähettäkää se meille kyselylomakkeen mukana, niin olette mukana arvonnassa.

Olkaa hyvä ja postittakaa kyselylomake oheisessa vastauslähetyskuoressa viimeistään **3.12.2004**. Postimaksu on maksettu puolestanne.

Jos haluatte apua lomakkeen täyttämisessä, voitte pyytää sitä läheisiltänne tai minulta. Halutessanne tulen haastattelemaan teitä.

Tutkijaryhmän puolesta,

Sanna Sintonen, projektipäällikkö
Puhelin: 040 591 1771
Sähköposti: sanna.sintonen@lut.fi

I. TAUSTATIEDOT JA ELINYMPÄRISTÖ

1. Sukupuoli? * Nainen * Mies

2. Minä vuonna olette syntyneet? Vuonna _____

3. Sivilisäätynne?
* Naimaton * Avoliitossa * Eronnut
* Naimisissa * Leski

6. Millaisen peruskoulutuksen olette saanut? Valitkaa korkein saamanne koulutusaste.
* kansakoulu / keskikoulu * ylioppilas

7. Millaisen ammatillisen koulutuksen olette saanut? Valitkaa korkein saamanne koulutusaste.
* ei ammattikoulutusta
* ammattikurssi
* ammattikoulu
* opistotasoinen ammattikoulutus
* korkeakoulu- tai yliopistokoulutus

11. Kuinka suuret ovat kuukausittaiset nettotulonne?
* Alle 500 €
* 501 – 1 000 €
* 1 001 – 1 500 €
* 1 501 – 2 000 €
* 2 001 – 2 500 €
* 2 501 – 3 000 €
* Yli 3 000 €

19. Miten suoriudutte asunnossanne pienistä korjaustöistä (esimerkiksi lampunvaihto)?
* Täysin itsenäisesti, ilman vaikeuksia *(Siirtykää kysymykseen 21.)*
* Itsenäisesti, mutta vaikeuksia on *(Siirtykää kysymykseen 21.)*
* Toisen henkilön avustamana
* En pysty itse suoriutumaan

27. Miten suoriudutte kauppakäynneistä ja muista asiointimatkoista ?
* Täysin itsenäisesti, ilman vaikeuksia *(Siirtykää kysymykseen 31.)*
* Itsenäisesti, mutta vaikeuksia on *(Siirtykää kysymykseen 30.)*
* Itsenäisesti apuvälineiden avulla *(Siirtykää kysymykseen 30.)*
* Toisen henkilön avustamana
* En pysty itse suoriutumaan

II. TERVEYDEN TILA, ARKIASKAREET JA HYVINVOINTI PALVELUT

34. Millainen on tämänhetkinen terveydentilanne omasta mielestänne?

* Erittäin hyvä
* Melko hyvä
* Keskinkertainen
* Melko huono
* Huono

35. Seuraavassa on väittämiä terveyden tilaan liittyen. Valitkaa omaa terveyttänne ajatellen sopivin vaihtoehto sen mukaan, miten samaa tai eri mieltä olette.

	Täysin eri mieltä	*Osittain eri mieltä*	*Ei samaa eikä eri mieltä*	*Osittain samaa mieltä*	*Täysin samaa mieltä*
Väsyn ilman erityistä syytä.	*	*	*	*	*
Koen itseni täysin terveeksi.	*	*	*	*	*
Olen huolissani terveydentilastani.	*	*	*	*	*
Pelkään, etten pysty huolehtimaan itsestäni tulevaisuudessa.	*	*	*	*	*
Olen muihin ikätovereihini verrattuna hyvässä kunnossa.	*	*	*	*	*
Asiat sujuvat minulta yhtä helposti kuin ennenkin.	*	*	*	*	*
Pystyn ajattelemaan yhtä selvästi kuin ennenkin.	*	*	*	*	*

Seuraavaksi on erilaisiin päivittäisiin ja arkisiin toimintoihin liittyviä kysymyksiä. Kysymykset on pyritty opastamaan niin, että teidän ei tarvitsisi vastata niihin kysymyksiin, jotka eivät teitä kosketa. Seuratkaa vastausvaihtoehtojen perässä olevia ohjeistuksia.

45. Miten suoriudutte ulkoilusta?

* Täysin itsenäisesti, ilman vaikeuksia *(Siirtykää kysymykseen 47.)*
* Itsenäisesti, mutta vaikeuksia on *(Siirtykää kysymykseen 47.)*
* Toisen henkilön avustamana
* En pysty itse suoriutumaan

47. Miten suoriudutte siivouksesta?

* Täysin itsenäisesti, ilman vaikeuksia *(Siirtykää kysymykseen 49.)*
* Itsenäisesti, mutta vaikeuksia on *(Siirtykää kysymykseen 49.)*
* Toisen henkilön avustamana
* En pysty itse suoriutumaan

49. Miten suoriudutte ruuanlaitosta?

* Täysin itsenäisesti, ilman vaikeuksia *(Siirtykää kysymykseen 52.)*
* Itsenäisesti, mutta vaikeuksia on *(Siirtykää kysymykseen 52.)*
* Toisen henkilön avustamana
* En pysty itse suoriutumaan

52. Miten suoriudutte syömisestä ?

* Täysin itsenäisesti, ilman vaikeuksia
* Itsenäisesti, mutta vaikeuksia on
* Toisen henkilön avustamana
* En pysty itse suoriutumaan

53. Miten suoriudutte pyykinpesusta ja vaatteiden korjauksesta?

* Täysin itsenäisesti, ilman vaikeuksia *(Siirtykää kysymykseen 55.)*
* Itsenäisesti, mutta vaikeuksia on *(Siirtykää kysymykseen 55.)*
* Toisen henkilön avustamana
* En pysty itse suoriutumaan

55. Miten suoriudutte peseytymisestä ?

* Täysin itsenäisesti, ilman vaikeuksia *(Siirtykää kysymykseen 57.)*
* Itsenäisesti, mutta vaikeuksia on *(Siirtykää kysymykseen 57.)*
* Toisen henkilön avustamana
* En pysty itse suoriutumaan

57. Miten suoriudutte pukeutumisesta?

* Täysin itsenäisesti, ilman vaikeuksia *(Siirtykää kysymykseen 59.)*
* Itsenäisesti, mutta vaikeuksia on *(Siirtykää kysymykseen 59.)*
* Toisen henkilön avustamana
* En pysty itse suoriutumaan

59. Miten suoriudutte WC:ssä käynnistä?

* Täysin itsenäisesti, ilman vaikeuksia
* Itsenäisesti, mutta vaikeuksia on
* Toisen henkilön avustamana
* En pysty itse suoriutumaan

60. Miten suoriudutte sänkyyn menosta tai sängystä nousemisesta?

* Täysin itsenäisesti, ilman vaikeuksia
* Itsenäisesti, mutta vaikeuksia on
* Toisen henkilön avustamana
* En pysty itse suoriutumaan

III. TIETOKONEEN JA KÄNNYKÄN KÄYTTÖ

68. Onko kotonanne tietokone?

* Kyllä * On ollut, muttei ole enää * Ei vielä, mutta suunnittelen hankkimista * Ei

69. Millaiseksi kuvailisitte tietokoneen käyttötaitojanne?

* Osaan mielestäni käyttää tietokonetta hyvin.
* Minulla on vain hieman kokemusta tietokoneesta, mutta opettelen tietokoneen käyttöä.
* En hallitse tietokoneen käyttöä, mutta haluaisin oppia.
* En hallitse tietokoneen käyttöä enkä halua oppia. *(Siirtykää kysymykseen 73.)*
* En ole koskaan käyttänyt tietokonetta. *(Siirtykää kysymykseen 73.)*

72. Seuraavassa on väittämiä liittyen tietokoneen käyttöön. Olkaa hyvä ja valitkaa sopivin vaihtoehto sen mukaan, miten samaa tai eri mieltä olette.

	Täysin eri mieltä	*Osittain eri mieltä*	*Ei samaa eikä eri mieltä*	*Osittain samaa mieltä*	*Täysin samaa mieltä*
Tietokonetta on mielestäni helppo käyttää.	*	*	*	*	*
Haluaisin lisää opastusta tietokoneen käytössä.	*	*	*	*	*
Minusta on mukava käyttää tietokonetta.	*	*	*	*	*
Minulla on tarpeeksi tietoa, jotta voin käyttää tietokonetta.	*	*	*	*	*
Hallitsen tietokoneen käytön.	*	*	*	*	*
Tietokoneen käyttäminen hermostuttaa minua.	*	*	*	*	*

73. Seuraavat väittämät pyrkivät kuvaamaan yleistä suhtautumistanne tietokoneisiin. Olkaa hyvä ja valitkaa sopivin vaihtoehto sen mukaan, miten samaa tai eri mieltä olette.

	Täysin eri mieltä	*Osittain eri mieltä*	*Ei samaa eikä eri mieltä*	*Osittain samaa mieltä*	*Täysin samaa mieltä*
Tietokoneet eivät pelota minua.	*	*	*	*	*
En tunne itseäni ulkopuoliseksi, kun muut puhuvat tietokoneista.	*	*	*	*	*
Tietokoneet saavat minut tuntemaan oloni vaivautuneeksi.	*	*	*	*	*

74. Onko teillä oma kännykkä?

* Kyllä * On ollut, muttei ole enää * Ei vielä, mutta suunnittelen hankkimista * Ei

75. Millaiseksi kuvailisitte kännykän käyttötaitojanne?

* Osaan mielestäni käyttää kännykkää hyvin.
* Minulla on vain hieman kokemusta kännykästä, mutta opettelen sen käyttöä.
* En hallitse kännykän käyttöä, mutta haluaisin oppia.
* En hallitse kännykän käyttöä enkä halua oppia. *(Siirtykää kysymykseen 79.)*
* En ole koskaan käyttänyt kännykkää. *(Siirtykää kysymykseen 79.)*

76. Mihin käytätte kännykkää?

☐ Puhumiseen ☐ Lähetän ja vastaanotan tekstiviestejä ☐ Lähetän ja vastaanotan kuvaviestejä

78. Seuraavassa on vielä väittämiä liittyen kännykän käyttöön. Olkaa hyvä ja valitkaa sopivin vaihtoehto sen mukaan, miten samaa tai eri mieltä olette.

	Täysin eri mieltä	*Osittain eri mieltä*	*Ei samaa eikä eri mieltä*	*Osittain samaa mieltä*	*Täysin samaa mieltä*
Kännykkää on mielestäni helppo käyttää.	*	*	*	*	*
Haluaisin lisää opastusta kännykän käytöstä.	*	*	*	*	*
Minusta on mukava käyttää kännykkää.	*	*	*	*	*
Minulla on tarpeeksi tietoa, jotta voin käyttää kännykkää.	*	*	*	*	*
Hallitsen kännykän käytön.	*	*	*	*	*
Kännykän käyttäminen hermostuttaa minua.	*	*	*	*	*
Pieni näyttö vaikeuttaa kännykän käyttöä kohdallani.	*	*	*	*	*
Pienet näppäimet vaikeuttavat kännykän käyttöä kohdallani.	*	*	*	*	*

79. Seuraavat väittämät pyrkivät kuvaamaan yleistä suhtautumistanne kännyköihin. Olkaa hyvä ja valitkaa sopivin vaihtoehto sen mukaan, miten samaa tai eri mieltä olette.

	Täysin eri mieltä	*Osittain eri mieltä*	*Ei samaa eikä eri mieltä*	*Osittain samaa mieltä*	*Täysin samaa mieltä*
Kännykät eivät pelota minua.	*	*	*	*	*
En tunne itseäni ulkopuoliseksi, kun muut puhuvat kännyköistä.	*	*	*	*	*
Kännykät saavat minut tuntemaan oloni vaivautuneeksi.	*	*	*	*	*

Seuraavaksi on kysymyksiä ja väittämiä kännykän ja kotitietokoneen hyödyntämisestä terveydenhoito- ja hoivapalveluissa. Esimerkkejä tällaisista palveluista voisivat olla ajanvaraus tai vaikkapa omien laboratoriotulosten saaminen. Kännykän käytöllä ei tässä yhteydessä tarkoiteta puheluita vaan esimerkiksi tekstiviestejä.

80. Mitä seuraavista käyttäisitte mieluiten apuna hyvinvointiin ja terveydenhoitoon liittyvässä asioinnissa?

- * Kotitietokonetta
- * Kännykkää
- * Molempia
- * En kumpaakaan *(Siirtykää kysymykseen 82.)*

81. Alla on väittämiä liittyen kännykän ja kotitietokoneen käyttöön ja sen soveltamiseen terveydenhoito- ja hoivapalveluissa. Olkaa hyvä ja valitkaa sopivin vaihtoehto sen mukaan, miten samaa tai eri mieltä olette väittämien kanssa.

	Täysin eri mieltä	*Osittain eri mieltä*	*Ei samaa eikä eri mieltä*	*Osittain samaa mieltä*	*Täysin samaa mieltä*
Kotitietokoneen tai kännykän käyttö olisi hyödyllistä terveydenhoidossa.	*	*	*	*	*
Minulle olisi hyötyä, jos voisin katsoa terveystietojani kotitietokoneen tai kännykän välityksellä.	*	*	*	*	*
Uskon, että kotitietokoneen tai kännykän hyödyntäminen terveyspalveluissa on luotettavaa.	*	*	*	*	*
Kotitietokoneella tai kännykällä saatavat tiedot ovat yhtä luotettavia kuin vastaavat tiedot paperilla.	*	*	*	*	*
Minusta henkilötietojen antaminen kotitietokoneella tai kännykällä on yhtä turvallista kuin tavallisessa puheyhteydessä.	*	*	*	*	*
Uskon tietojeni olevan turvassa, vaikka kotitietokoneita ja kännykkää hyödynnettäisiin enemmän terveyspalveluissa.	*	*	*	*	*
Kotitietokoneen tai kännykän käyttämisestä voisi olla selkeitä hyötyjä oman terveyteni seurannassa ja hoidossa.	*	*	*	*	*
Jos minulla olisi kotitietokone tai kännykkä, haluaisin hyödyntää sitä terveyspalveluissa.	*	*	*	*	*
Kotitietokoneen tai kännykän avulla saavutettavat hyödyt voisivat helpottaa hoitohenkilökunnan työtä.	*	*	*	*	*
Jos kotitietokonetta tai kännykkää voisi hyödyntää terveyspalveluissa, käyttäisin mielelläni tällaisia palveluita.	*	*	*	*	*

IV. ELÄMÄNHALLINTA JA VAPAA-AIKA

96. Miten hyvin seuraavat väittämät kuvaavat teitä? Valitkaa sopivin vaihtoehto sen mukaan miten samaa tai eri mieltä olette.

	Täysin eri mieltä	*Osittain eri mieltä*	*Ei samaa eikä eri mieltä*	*Osittain samaa mieltä*	*Täysin samaa mieltä*
Olen usein masentunut.	*	*	*	*	*
Mielialani vaihtelee lähes jatkuvasti.	*	*	*	*	*
Tunnen itseni usein surulliseksi.	*	*	*	*	*
Minulla on usein tarvetta itkeä.	*	*	*	*	*

SUURET KIITOKSET VASTAUKSESTANNE!

Olkaa hyvä ja taitakaa vastauslomake mukana tulleeseen vastauskuoreen ja postittakaa se meille. Postimaksu on maksettu puolestanne.
Mikäli haluatte osallistua arvontaa, täyttäkää arpalipuke ja laittakaa se lomakkeen kanssa samaan kuoreen.

I. BACKGROUND INFORMATION AND SURROUNDINGS

1. Gender? * Female * Male

2. On what year where you born? In _____

3. Marital status?
* Single * Cohabitation without marriage * Divorced
* Married * Widowed

6.What kind of basic education do you have? Choose the highest degree.
* elementary / middle school * high school

7. What kind of occupational education do you have? Choose the highest degree.
* no occupational education
* occupational course
* vocational school
* college-level training
* university degree

11. How high are your monthly net income?
* 500 € or less
* 501 – 1 000 €
* 1 001 – 1 500 €
* 1 501 – 2 000 €
* 2 001 – 2 500 €
* 2 501 – 3 000 €
* Over 3 000 €

19. How do you cope with small reparation tasks in your department (e.g. changing the light bulb)?
* Totally independent, no difficulties *(Move along to question 21.)*
* Independent, but difficulties exist *(Move along to question 21.)*
* With help of someone else
* Cannot cope at all

27. Howdo you cope with going shopping and other such things?
* Totally independent, no difficulties *(Move along to question 31.)*
* Independent, but difficulties exist *(Move along to question 30.)*
* Independent with aiding devices *(Move along to question 30.)*
* With help of someone else
* Cannot cope at all

II. HEALTH STATUS, DAILY ACTIVITIES AND HEALTH SERVICES

34. How do you consider your current stae of health?

* Ecxellent
* Fairly good
* Mediocre
* Fairly poor
* Poor

35. In the following there are statements that concern your current health status. Please select the proper alternative that best describes your health right now according to how much you agree or disagree with the statement.

	Completely disagree	*Partly disagree*	*Neither disagree nor agree*	*Partly agree*	*Completely agree*
I get tired without any specific reason.	*	*	*	*	*
I feel myself completely healthy.	*	*	*	*	*
I'm concerned about my health status.	*	*	*	*	*
I'm afraid that I can't take care of myself in the future.	*	*	*	*	*
I'm in a good shape compared to my age/mates.	*	*	*	*	*
I can handle different things as easily as ever before.	*	*	*	*	*
I can think as clearly as ever before.	*	*	*	*	*

Next, there are some questions concerning daily activities. Effort is made to guide responding so that you do not have to answer questions that don't really concern you. Please follow the guidance at the end of the response alternatives.

45. How do cope with outdoor recreation?

* Totally independent, no difficulties *(Move along to question 47.)*
* Independent, but difficulties exist *(Move along to question 47.)*
* With help of someone else
* Cannot cope at all

47. How do you cope with house-cleaning?

* Totally independent, no difficulties *(Move along to question 49.)*
* Independent, but difficulties exist *(Move along to question 49.)*
* With help of someone else
* Cannot cope at all

49. How do you cope with cooking

* Totally independent, no difficulties *(Move along to question 52.)*
* Independent, but difficulties exist *(Move along to question 52.)*
* With help of someone else
* Cannot cope at all

52. How do you cope with eating?

* Totally independent, no difficulties
* Independent, but difficulties exist
* With help of someone else
* Cannot cope at all

53. How do you cope with laundry and repairing clothes?

* Totally independent, no difficulties *(Move along to question 55.)*
* Independent, but difficulties exist *(Move along to question 55.)*
* With help of someone else
* Cannot cope at all

55. How do you cope withwashing yourself?

* Totally independent, no difficulties *(Move along to question 57.)*
* Independent, but difficulties exist *(Move along to question 57.)*
* With help of someone else
* Cannot cope at all

57. How do you cope with dressing?

* Totally independent, no difficulties *(Move along to question 59.)*
* Independent, but difficulties exist *(Move along to question 59.)*
* With help of someone else
* Cannot cope at all

59. How do you cope with toilet matters?

* Totally independent, no difficulties
* Independent, but difficulties exist
* With help of someone else
* Cannot cope at all

60. How do you cope with getting in and out of bed?

* Totally independent, no difficulties
* Independent, but difficulties exist
* With help of someone else
* Cannot cope at all

III. COMPUTER AND MOBILE PHONE USAGE

68. Do you have a computer at your home?

* Yes * I've had, but not anymore * Not yet, I'm planning to buy * No

69. How would you describe your computing skills?

* I think I can use a computer very well.
* I have only a little experience of computers, but I'm continuously learning.
* I do not control computer usage, but I would like to learn.
* I do not control computer usage and I don't want to learn *(Move along to question 73.)*
* I have never ever used a computer. *(Move along to question 73.)*

72. Following there is statement that relate to computer usage. Please pick the closest alternatives considering how much you agree or disagree with the statements.

	Completely disagree	*Partly disagree*	*Neither disagree nor agree*	*Partly agree*	*Completely agree*
Computers are easy to use.	*	*	*	*	*
I need further guidance for PC usage.	*	*	*	*	*
I feel comfortable when using a PC.	*	*	*	*	*
I have the knowledge necessary to use a PC.	*	*	*	*	*
I have control over using a PC.	*	*	*	*	*
Using a PC makes me feel nervous.	*	*	*	*	*

73. Following statement aim to describe your general opinions about computers. Please pick the closest alternatives considering how much you agree or disagree with the statements.

	Completely disagree	*Partly disagree*	*Neither disagree nor agree*	*Partly agree*	*Completely agree*
Computers do not frighten me.	*	*	*	*	*
I don't feel like an outsider when others talk about computers.	*	*	*	*	*
Computers make me feel ill at ease.	*	*	*	*	*

74. Do you have an own mobile phone?

* Yes * I've had, but not anymore * Not yet, but I'm planning to buy * No

75. How would you describe your mobile phone usage skills?

* I think I can use a mobile phone very well.
* I have only a little experience of mobile phones, but I'm continuously learning.
* I do not control mobile phone usage, but I would like to learn.
* I do not control mobile phone usage and I don't want to learn *(Move along to question 79.)*
* I have never ever used a mobile phone. *(Move along to question 79.)*

76. What for do you use your mobile phone?

☐ Calling ☐ Sending and receiving text messages ☐ Sending and receiving multimedia messages

78. Following there is statement concerning mobile phone usage. Please pick the closest alternatives considering how much you agree or disagree with the statements.

	Completely disagree	*Partly disagree*	*Neither disagree nor agree*	*Partly agree*	*Completely agree*
Mobile phones are easy to use.	*	*	*	*	*
I need further guidance for MP usage.	*	*	*	*	*
I feel comfortable when using a MP.	*	*	*	*	*
I have the knowledge necessary to use a MP.	*	*	*	*	*
I have control over using a MP.	*	*	*	*	*
Using a MP makes me feel nervous.	*	*	*	*	*
Small screen makes it difficult for me to use MP.	*	*	*	*	*
Small buttons make it difficult for me to use MP.	*	*	*	*	*

79. Following statement aim to describe your general opinions about mobile phones. Please pick the closest alternatives considering how much you agree or disagree with the statements.

	Completely disagree	*Partly disagree*	*Neither disagree nor agree*	*Partly agree*	*Completely agree*
Mobile phones do not frighten me.	*	*	*	*	*
I don't feel like an outsider when others talk about mobile phones.	*	*	*	*	*
Mobile phones make me feel ill at ease.	*	*	*	*	*

Next, there are questions and statement about using mobile phones or PC in health care services. Examples of these kinds of services could be reserving appointments or receiving own laboratory results. Instead of normal phone calls, using mobile phones is referred here using for example text messages.

80. What would you prefer to apply for helping you to communicate with health services and health related other issues?

- Home computer
- Mobile phone
- Both
- Neither of them *(Move along to question 82.)*

81. Below there are statements that concern using and applying mobile phones or home computers to health care services. Please pick the closest alternatives considering how much you agree or disagree with the statements.

	Completely disagree	*Partly disagree*	*Neither disagree nor agree*	*Partly agree*	*Completely agree*
Using home computer or cell phone would be beneficial for healthcare.	*	*	*	*	*
It would be useful for me, if I could see my health records with home computer or cell phone.	*	*	*	*	*
I believe that using home computer or cell phones in health services is reliable.	*	*	*	*	*
Information received through home computer or cell phone is as reliable as they would be on paper.	*	*	*	*	*
I see that transferring my personal information through home computer or cell phone would be as safe as during traditional phone call contact.	*	*	*	*	*
I believe that my medical records are safe, although home computers of cell phones would be taken into advantage merely in health services.	*	*	*	*	*
Using home computer or cell phone might result clear benefits for following up my own health and treatment.	*	*	*	*	*
If I had a home computer of cell phone, I would like to apply it for healthcare services.	*	*	*	*	*
Benefits acquired with home computer or cell phone could ease up the work of nursing staff.	*	*	*	*	*
If it would be possible to use home computer or cell phone in healthcare services, I would be delighted to use that kind of services.	*	*	*	*	*

IV. LIFE CONTROL AND FREETIME

96. How well do the following statements depict you? Please pick the closest alternatives considering how much you agree or disagree with the statements.

	Completely disagree	*Partly disagree*	*Neither disagree nor agree*	*Partly agree*	*Completely agree*
I often feel myself depressed.	*	*	*	*	*
My moods fluctuate almost continuously.	*	*	*	*	*
I often feel myself sad.	*	*	*	*	*
I often feel a need to cry.	*	*	*	*	*

GREAT THANK YOU FOR YOUR ANSWERS!

Please put the questionnaire into the response envelope and mail it to us. The mail fee is already paid for your behalf.

If you like to take part into the raffle, fill out the ticket and put it into the envelope along with the questionnaire.

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