Various Studies on Policy Implications of Demographic Changes in National and Community Policies

LOT7

The Demographic Change – Impacts of New Technologies and Information Society

Final report

August 2005

European Commission
EMPLOYMENT AND SOCIAL AFFAIRS DG
Social protection and social integration
Social and demography analysis

Disclaimer

The views expressed in this report are those of the authors and do not necessarily reflect those of the European Commission. Neither the European Commission nor any person acting on behalf of the Commission is responsible for the information provided in this document.

Contact

For further information about this study, please contact:

empirica
Lutz Kubitschke
Gesellschaft für Kommunikations- und Technologieforschung mbH
Oxfordstr. 2, D-53111 Bonn
Germany

Tel.: +49 (0)228 98 539 0
Fax: +49-(0) 228 98530-12
info@empirica.com

Work Research Centre
Kevin Cullen
1 Greenlea Drive,
Terenure, Dublin 6W,
Ireland

Tel.: +353 1 492 7042
Fax: +353 1 492 7046
wrc@wrc-research.ie

Rights Restrictions

Bonn, August 2005

European Commission
EMPLOYMENT AND SOCIAL AFFAIRS DG
Social protection and social integration
Social and demography analysis

Table of Contents

Part A

Key Conclusions and Recommendations

Key conclusions and policy recommendations

This section of the overall report presents the key conclusions and policy recommendations from a study of the interactions between two major forces of change in Europe – demographic ageing and the increasing pervasiveness of Information and Communication Technologies (ICTs).

In 2005 we are at a stage where ageing of the European population is already underway and will soon start to accelerate. In the meantime the deployment of computers, the Internet and mobile communications in all aspects of the economy, services and everyday life continues apace. These two trends can hardly pass each other by without interacting in a multitude of ways. The challenge for Europe is to identify the key developments and points of intersection, the opportunities and risks that these present and the levers of influence whereby policy can help to shape developments in desired directions.

The study aimed to provide support to this policy challenge by focusing on three core themes:

- An age-friendly Information Society
- ICTs, employment and work
- ICTs to support independent living, social care and health care.

On the basis of the evidence and analysis presented in the report it can be concluded that ICTs and the emergence of the Information Society present both challenges and opportunities in the context of the demographic ageing of the European population. Market forces alone will not ensure that the outcomes from the intersections between demographic ageing and ICT developments will be optimal for older people and for European society as a whole. Public policy will be required that helps to shape developments in the ways that are needed to exploit the positive potential and reduce the likelihood of negative impacts.

Towards an Age-friendly Information Society

What the evidence shows

Despite the fact that Internet usage among older age groups has gradually increased during recent years, only a minority of older people are actively engaging in the Information Society today and this age-divide should be a matter of real concern to policy. It means that older people are not gaining the benefits of online services and applications that have high potential utility for them and are also facing new risks because important services are increasingly *only* available online. The available evidence indicates that these age-divides will not go away without policy intervention - the majority of the current cohorts of older people aged 65 years and older are unlikely to go online on their own initiative within their lifetimes and, as technology continues to evolve, new age-divides will emerge for future cohorts of older people.

For these reasons it is important that reinforced policy attention is given to reducing the age-divides in engagement in the Information Society but also that much more attention is given to counteracting the potential negative impacts of such divides. It is neither appropriate nor realistic to try to push all older people online, so substantial efforts will be needed to ensure that those who are not online are not left behind in access to services and to wider civic participation.

Priority actions

The EU and Member States must give a lot more attention to the age-divide in the Information Society. Two priority actions are proposed.

1. Establish an EU Task Force to tackle the age-divide in the Information Society

A specific EU Task Force should be established to address this issue, which could be one of the flagship initiatives under the eInclusion strategies to be developed and implemented through the i2010 programme. Its brief could be to establish targets for a substantial reduction of age-divides in the Information Society in Europe and of the impacts of such age-divides in everyday life. Both near-term (2010 horizon) and longer-term targets could be established. The brief could also include the identification of the actions needed to achieve the established targets and the monitoring mechanisms needed to assess progress towards their achievement. The Task Force could include representatives from national and local government, older people's organisations, the relevant branches of the ICT industry and others active in the promotion of eInclusion in Europe.

2. Address older people's needs in all European eGovernment initiatives

There is considerable EU level activity and co-operation between Member States in the development and deployment of eGovernment services. This provides an ideal opportunity to initiate a Europe-wide effort to address older people's needs in relation to a wide array of services of key public interest. It should become a matter of policy that all eGovernment programmes give a high priority to meeting the needs of older people. This will require attention both to the needs of (the minority) of older people who are online and of the (majority of) older people who are not online. The objectives should be to ensure that older people also get the benefits of new approaches to public service provision and that eGovernment developments are associated with an enhancement rather than a reduction in the levels of service that older people have received up to now.

ICTs, Employment and Work

What the evidence shows

The available evidence suggests that ICTs present both risks and opportunities for the achievement of the European goals of higher employment rates and good quality of work for people in the later stages (50-64 years) of the working age range. An increasing proportion of jobs require use of ICTs and these are often better quality jobs. More opportunities for older workers and potential workers to access jobs involving ICTs could therefore make a substantial contribution to the achievement of the EU targets. Without policy intervention, however, access to such jobs will remain restricted mainly to older workers who are already in advantaged positions - those who are better educated and who have good quality and well-remunerated jobs already. The policy response must therefore give particular attention to equality of opportunity and to ways of creating the conditions whereby older workers (and

potential workers) facing less advantageous circumstances can be enabled to benefit from ICTs in the workplace.

Equality considerations are also central in relation to the design of mainstream ICTs that are used in the workplace and to the provision of technologies in the workplace that are specifically developed to support older workers with disabilities (assistive technology). ICTs currently available in the workplace can be difficult to use for many older workers and exploitation of the opportunities presented by assistive technologies is very uneven across Europe.

Priority actions

The EU, Member States and other relevant stakeholders must give a lot more attention to the contribution of ICT skills, age-friendly ICT design and assistive technologies to the employment opportunities and work capacities of older workers. Two priority actions are proposed.

3. Give all older Europeans (50-64 years) a suitable opportunity to acquire ICT skills

A target to give all older Europeans (50-64 years) a suitable opportunity to acquire ICT skills should be included in the EU Employment Guidelines in order to support the achievement of the Stockholm and Barcelona Council employment targets. This would also make a major contribution towards the reduction of Information Society age-divides for those aged 65+ in the future. Employers, public and private training providers and other relevant actors should be mobilised to ensure that suitable training opportunities are made available within and outside the workplace. Public subsidies should be provided, where necessary, to ensure equality of opportunity for those who would otherwise be unlikely to be reached.

4. Exploit the provisions in the EU Equality and Public Procurement Directives

The *European Council Directive Establishing a General Framework for Equal Treatment in Employment and Occupation* has provisions under the age and disability grounds that, in principle, require the availability of accessible and usable ICTs and / or assistive technologies for older workers (and potential workers) that need them. The ICT-related implications of the age and disability grounds need to be spelled out (perhaps in a Communication from the Commission) and robustly implemented. Because the public sector plays a major role as employer, this should also draw out the links between the Equality Directive and the provisions under the European *Public Procurement Directives.* An EU-driven initiative could follow, to engage the relevant stakeholders (government equality agencies, employers, procurers, trades unions, user organisations, and the ICT and assistive technology industries), establish targets and put in place an EU-wide programme of action (e.g. within an Open Method of Coordination framework) to achieve the targets.

Independent living, social care and health care

What the evidence shows

The evidence shows that ICTs offer a very large but unrealised potential to address the care challenges posed by demographic ageing. Solutions are becoming available that can support independent living, including assistive technologies for everyday life and ICT-supported delivery of social care and health care services in the home and community. Both financial and non-financial benefits can be gained from wider utilisation of such solutions. However, the innovation processes that are needed to bring these technological developments through from RTD to widespread take-up and deployment (by health and social care services and by older consumers themselves) are not functioning effectively at present. There is also very uneven provision of basic infrastructures for delivering services to the home, such as social alarm centres, across Europe - in some countries social alarm infrastructures have been established as a key element of social care for older people but in others are hardly available at all. The current EU-wide market potential for state-of-the-art social alarm services is estimated to comprise 21 million potential users, but only a comparatively small proportion of these are actually served today. Similar demand potentials exist in relation to emerging ICT-supported care solutions that have been implemented only in small scale pilots as of yet. Many of these show considerable promise but we still have very limited understanding of their wider cost-benefit, social and ethical dimensions.

Priority actions

EU-driven actions are needed to encourage the necessary developments in this field. Two priority actions are proposed.

5. Use the Structural Funds to co-finance ICT-supported social care infrastructure

Telephone-based social alarm services should now be considered a standard component of the social care infrastructure for older people in Europe and a quality service should be available to all older Europeans who need one. The development or improvement of social alarm infrastructure should therefore be specifically identified as an eligible measure for co-financing under the EU structural funds. Depending on the circumstances, the development of such infrastructures might include capital funding for the technological and facilities components (call centres, networks and user alarm equipment) and human resources funding for training, organisational development and so on. Apart from providing basic but essential day-to-day support for older people, the availability of such an infrastructure is a prerequisite for many of the service innovations that are now becoming possible through emerging technologies such as those in the ambient assisted living field.

6. Substantially increase support for RTD and trials of emerging technologies

The EU and Member States should provide substantially increased support for RTD and trials of emerging technologies to support independent living, social care and health care in the home and community. Funding for RTD, including related socio-economic research, in this field should be significantly increased under FP7. Other instruments, such as eTEN,

should also be maximally leveraged to support the large-scale, real-world trials that are now needed to prove promising emerging technologies and to assess cost-benefit, social and ethical aspects.

Part B

Summary Report

Summary Report

This part of the overall report summarises the outcomes of a detailed analysis of the interactions between two major forces of change in Europe – demographic ageing and the increasing pervasiveness of Information and Communication Technologies (ICTs).

In 2005 we are at a stage where ageing of the European population is already underway and will soon start to accelerate. In the meantime the deployment of computers, the Internet and mobile communications in all aspects of the economy, services and everyday life continues apace. These two trends can hardly pass each other by without interacting in a multitude of ways. The challenge for Europe is to identify the key developments and points of intersection, the opportunities and risks that these present and the levers of influence whereby policy can help to shape developments in desired directions.

The study aimed to provide support to this policy challenge by focusing on three core themes:

- An age-friendly Information Society
- ICTs, employment and work
- ICTs to support independent living and care.

This document presents a summary of the report structured according to the these three themes. It summarises the main findings and conclusions and presents the recommendations for policy that have been formulated on the basis of these.

Theme I - An age-friendly Information Society

The first theme concerns the intersection of demographic ageing with the emergence of an Information Society. The focus is on ICTs in everyday life and how these are impacting on the ways that everyday things are done and the everyday things that are done. Some central questions are addressed. Are older people getting involved or being left behind in the Information Society? Does this really matter for them or for society overall? How might things evolve without any policy intervention? Do market and business interests coincide with consumer and social concerns? What policy interventions might be warranted to achieve desired outcomes?

Challenges and opportunities

The analysis of the available evidence identifies a number of challenges and opportunities in relation to this theme.

Challenges and opportunities

- A prevailing age-divide as regards engagement in the Information Society.
- Various barriers and constraints that affect older people's engagement.
- Real potential benefits for older people, but the majority are missing out.
- Emergence of new risks for older people.

Prevailing age divides

Although ICT uptake among older citizens in the EU25 has steadily increased during recent years, they are still much less likely to have access to and use ICTs and online services than younger people and an age-divide will continue for the foreseeable future.

Age divides

- Just over one-in-four of those aged 55-64 and just under one-in-nine of those aged 65-74 use the Internet, compared to almost two-thirds of those aged 25-34 and almost half of those aged 35-54.
- Those older people who are online are a lot less likely to have broadband access.
- Available evidence suggests that the current age-divide will not disappear in the foreseeable future without significant supply-side and demand-side initiatives.
- In addition, continuing changes in technology and in the ways that technology is used may open up new divides in the future.

Barriers and constraints

The older people who do utilise ICTs and the Internet tend to be the younger and better-educated, to have more active lifestyles and to be better-off financially. There are also a number of specific factors that pose barriers to and constraints on the engagement of older people with ICTs and the Information Society.

Barriers and constraints

Lack of interest

- Many studies have confirmed that lack of interest and low motivation are key factors limiting engagement in the Information Society by older people.
- Computer anxiety and intimidation by technology also appear to be barriers, compounded by the fast pace of hardware and software development.

Lack of skills

- Another factor is lack of skills in how to access and use the Internet and associated access devices such as PCs.
- In addition, many older adults who are actually online report a lack of confidence in their online skills and this can limit what they do online and the benefits that they get.
- Not having had the opportunity to acquire ICT skills in working life is a major factor behind these age-divides in skills.

Costs

- Costs can also be an important barrier for older people on low incomes, a factor that is especially relevant in the new Member States.
- More generally, the tendency towards greater cost-sensitivity amongst older people is also a factor.

Age-related functional restrictions

- A large proportion of older adults (perhaps 60%) have functional restrictions (e.g. visual, hearing and dexterity) that prevent or hinder their usage of ICTs as currently designed.

Real potential benefits (being missed by older people)

The age-divide would hardly matter very much if the Information Society had little or no practical relevance for the lives of older people. However, as the Information Society matures it is clear that there are many real benefits that are being missed by those who are not online.

Real potential benefits (but being missed by most older people)

Doing things from home

- The opportunity to do things online from home has particular utility potential for older people who experience mobility restrictions, for example, because of physical disability, increased frailty or fears about crime in the neighbourhood or beyond.
- Very practical benefits can be achieved in everyday life through online shopping, online banking and online interaction with public administrations.

Access to health information

- Online health information has now become a central feature in the health management activities of very many European citizens.
- The age-divide is resulting in new (e)health divides, with those who stand to benefit most (the older age groups with high prevalence of chronic and other health conditions) making much less use of the online opportunities.

Consumer empowerment

- More generally, information of practical usefulness in everyday life is increasingly becoming available over the Internet.
- One of the most common uses is searching for and comparing (consumer) information about products and services; older people are a lot less likely to do this and miss out on the consumer empowering benefits of being able to source cheaper and better products.

New risks

Apart from missing out on the potential benefits presented by the Information Society, some new and more direct risks for older people can also be identified.

New risks

Discrimination (through inaccessible products and services)

- Many older people are prevented from using ICTs because lack of attention to their accessibility and usability requirements; this may increasingly be considered to be a manifestation of discrimination, given that there are readily available design solutions for many of the problems.

Increasing number of services only available online

- An increasing number and range of both commercial and public services are now only available online, or are available off-line only at a lower quality or higher price, putting older people at a serious disadvantage.

Loneliness

- Increasing virtualisation of social contacts and other everyday interactions brings the risk of social isolation and loneliness for older people; however, the research evidence available on the social impacts of this nature is quite limited to date.

Market failure and the need for remedial public policy

The age-divide in engagement in the Information Society and the accessibility and other barriers faced by older people indicate significant market failures. This applies both to the ICT industry and to commercial and public online service providers. There is a need for intervention through remedial public policy.

Current European and Member State policies and measures

The main current EU-level and Member State policies and activities relating to the Information Society age-divide can be found under the *eInclusion* and *eAccessibility* themes. These are addressing, in various ways, three main themes: awareness, motivation and skill; access and affordability; and accessibility and design for all.

Current European and Member State approaches

Awareness, motivation and skills

- There is a lot of activity across Europe focusing on raising Internet and Information Society awareness, motivation and skills amongst older people; measures at a variety of different levels of action (government, local, and NGO) can be identified.
- There is considerable variety of initiatives and approaches, in part reflecting tailoring to local needs and circumstances but in part reflecting widely varying levels of attention and resource allocation to the issue across countries, regions and localities.

Access and affordability

- Issues of access and affordability of the Internet for older people are also being addressed, although to a considerably lesser degree.
- Driven in part by the eEurope initiative, most Member States (particularly the New Member States) have implemented significant initiatives to install *Public Internet Access Points (PIAPs)*, although there are relatively few examples of initiatives targeted specifically towards older people.
- The available evidence suggests that older people are a lot less likely to use PIAPs than younger people so other types of interventions are also needed; more generally, although public access points can play an important role, the real convenience benefits of the Internet especially derive from personal access at home, particularly for those who do not have workplace access.
- Some Member States, sectoral interests and ICT suppliers have implemented *specific financial measures* to help overcome cost barriers to access to ICTs and the Internet, including discounted prices, direct subsidies, financial incentives to taxpayers and financial incentives to employers.
- Many of these measures are, by their nature, not very relevant for older people who are not in employment or for whom tax relief may not be relevant. Therefore, although these types of measures should be examined for their potential contribution to reducing cost barriers for older people, the most effective lines of action may be within the wider reach of more universal provisions.
- So far there has been little examination of how more universal mechanisms, such as the *Universal Service Obligation* imposed in the EU's telecommunications market and *social protection* systems, could be used to reduce costs barriers to Internet access for older people.

Current European and Member State approaches (continued)

Accessibility and Design for All

- The eAccessibility policy situation in Europe and internationally represents something of a patchwork at the moment, with different issues being addressed in different countries as well as different policy approaches being employed to address similar issues across countries.
- This is an area where the international dimension is important, not least because of the global marketplace for ICTs and the global implications of accessibility requirements in public procurements whether in Europe, the US or elsewhere. In this regard, eAccessibility is a topic in the EU-US dialogue processes.
- Various EU instruments and policies directly or indirectly address eAccessibility, including the Communication on eAccessibility in 2005; Council Resolutions on accessibility of public websites and on eAccessibility more generally; the Public Procurement Directives; the Copyright Directive; the Universal Service Directives; the Terminals Directive and the Framework Directive on Employment Equality.
- So far, however, the extent to which the potential offered by these instruments in relation to eAccessibility is not very much exploited in the Member States - accessibility of public (and private) web sites is still poor, very few ICT procurements include accessibility requirements, and eAccessibility does not seem to have emerged as a theme in response to the Employment Equality legislation.
- The broader Design for All approach has been supported at the EU-level through help with the establishment of the European Design for All Network (EDeAN); however, research suggests that a lot of awareness raising will be required if Design for All is to become mainstreamed amongst ICT designers.

Policy and research priorities

Given the current market failures and the challenges that are posed by the age-divide and other age-relevant developments in the Information Society, a number of policy and research priorities can be identified.

Policy and research priorities

Awareness, motivation and training

- An EU driven effort to collate and exchange good practice, benchmark developments and set common targets for numbers of older people reached; this could be initiated within the framework of the EQUAL programme.
- Research on learning preferences and needs of older people in relation to ICT skills.

Access and affordability

- A review and re-examination of the possibility of extending the scope of universal service provisions to include mobile and Internet access.
- Socio-economic research on the importance of the Internet for accessing essential services and of cost barriers for older people in this regard.

Policy and research priorities (continued)

Accessibility and Design for All

- Development of a comprehensive, multi-pronged EU level approach, with prominent attention to the needs of older people.
- An EU initiative to encourage and give guidance for strong implementation by the Member States of the accessibility provisions of the various EU Directives; to include encouragement of specific attention to age-friendly design of ICTs.
- Continued EU emphasis and encouragement of the Design for All approach to address the diversity of user needs, with special attention to changing needs as people get older; EDeAN work on curriculum development to give prominent attention to the needs of older people.
- Increased research attention to understanding age-related changes in perception, dexterity and cognition and the implications of this for ICT design; specific targeting of this issue in the RTD Framework Programmes.

Counteracting second-order digital divides

- An increased EU emphasis on second-order skills to make the best use of the Internet in areas of key public interest, with prominent attention to older people
- Socio-economic research on the benefits of the Internet (and dis-benefits of not using it) for older people, the skills needed, and monitoring of skills gaps.

Avoiding new risks from virtualisation

- Promotion amongst the Member States of the importance of access for all (especially for older people), including those not online, to services of public interest.
- Establishment of common benchmarks on the quality of social interactions as a key indicator of social cohesion and social capital in the Information Society.
- Socio-economic research to monitor the impacts of increasing virtualisation on access to services of public interest and on social interaction / isolation.

Supporting the development of older people's interest groups

- Encouragement of attention to ICT and Information Society issues for older people, both by older people's interest groups and by more general consumer organisations.
- Socio-economic research on the role and potential influence of consumer and other interest groups in this area.

Theme II - ICT, employment and work

The second theme focuses on the intersection of demographic ageing with the increasing utilisation of ICTs in the workplace. Key features of current and future demographic change in this area include ageing of the workforce and a policy to encourage increased employment rates for older workers and to discourage early retirement. In 2004, the employment rate amongst the 55-64 years age group in the EU25 was 40.7%, well below the target of at least 50% that was set at the Stockholm European Council in 2001. Achievement of these targets will require the mobilisation of all possible sources of encouragement for older workers as well as removal of causes of discouragement.

The analysis on this theme of ICTs and "work-related active ageing" focuses on some critical issues for European employment policy. What are the opportunities and risks posed by ICTs for the achievement of high employment rates? Do they support better or worse quality of work and work-related health and wellbeing for older workers? What are the implications for work-life balance and informal work such as family care? What impacts do they have on age equality in the workplace and in the labour market? What can policy do to shape developments in a way that maximises the potential benefits and minimises the potential negatives?

Older workers' exposure to ICTs and technological change

Ageing of the workforce (and potential workforce) is occurring against a backdrop of continual technological change, the most dramatic of which in recent times has been the wide-scale introduction of ICTs into working life. Available evidence indicates the increasing exposure of older workers to technological change as well as some differences between older men and older women and between younger and older age groups in this regard.

Exposure to ICTs

- Older workers are proportionately represented amongst occupations where ICTs have a high relevance, although they are significantly under-represented in the specialist ICT areas.
- Workers in the youngest and oldest age ranges are somewhat less likely to use ICTs at work than prime age workers; for the older workers, a fall off in usage can be detected amongst those aged 55 years and above, especially amongst those aged 60 and above.
- Nevertheless, substantial numbers of older workers work with ICTs to some degree; more than half of workers aged 50 to 54 years use computers in their work, as do more than one-third of workers aged 55 to 59, and about one in five workers aged 60 years and older.
- Amongst older workers, men are more likely than women to use computers in their work and, overall, men comprise about two-thirds of the older workers using computers.
- Looking forward to 2010, it can be expected that, if nothing else changes and computer users show the same pattern of remaining in or exiting from the workforce as other workers, then older workers will have the same level of computer usage as prime age workers have now.

Challenges and opportunities presented by ICTs

The possible interactions between ICTs and demographic ageing are complex and multi-dimensional and simple direct effects of ICTs on employment rates and employment-related outcomes for older workers and potential workers are hard to isolate. An added difficulty in this is that there has been relatively little focused research on ICTs and work-related active ageing.

Quality of work and work-life balance

Overall, the available evidence suggests that jobs involving computer usage are more likely to be of good quality (and thus to be "age-friendly") than are jobs that do not, although ICTs can bring intensification to some jobs in a manner that is unlikely to suit the capacities and preferences of many older workers.

Quality of work and work-life balance

Work quality

- Jobs involving computer usage are more likely to be of good quality (and thus to be "age-friendly") than are jobs that do not.
- One reason for this is that computers tend to be used in jobs that were of better quality in the first place; in addition, however, there is evidence that when care is taken to prepare properly for the introduction of ICTs they are more often associated with improvements than with dis-improvements in the quality of work.
- Amongst computer users, older workers have a higher likelihood of being in better quality jobs than younger workers, although a significant minority are in low quality jobs that may either be under-stimulating or involve excessive demands.
- More generally, there has been an intensification of work associated with increasing usage of ICTs over the last 10 to 15 years, with a growth in the number of workers being required to work at high speeds and meet tight deadlines; some workers may view this as a positive quality of their jobs but others (especially older workers) may not.
- In fact, it seems that older workers working with computers are overall more likely to have to work at high speeds and meet tight deadlines than older workers in other jobs, although there is substantial variability within both groups.

Work-life balance

- Teleworking and other applications of ICTs open up opportunities for more flexibility that could be used to facilitate work-life balance; however, we still know relatively little about how attractive or practically useful teleworking from home might be for older workers in particular circumstances, for example, those with care responsibilities.

Workability and productivity

The available evidence indicates that older workers are quite capable of learning to use ICTs if given the opportunity and a large majority of those who work with computers feel that they have sufficient skills for this work. Jobs involving ICTs are more often of a quality that supports the maintenance of workability and productivity of older workers, although this may not always be the case when ICTs are associated with intensification of work. Accessibility and usability of ICTs, and the availability of assistive technology, are important for the maintenance of workability and productivity of many older workers but these aspects have not been given sufficient attention to date.

Workability and productivity

Skills

- Overall, only about one-half of the EU15 workforce working with computers has ever received computer training at the workplace; computer users aged 60 and over and those aged under 30 are less likely to have received computer training at the workplace than other age groups.
- Nevertheless, most older workers working with computers say that they have sufficient skills to meet the demands of their work; about 10% say that their skills are too low.
- Research indicates that older workers are well able to learn and apply new technologies but are generally slower than younger adults to acquire new skills and require more help and hands-on practice.

Workability and productivity (continued)

Age-friendly design of ICT-based work

- The issue of age-friendly design of work, whether ICT-based or otherwise, has received insufficient attention to date, both in research and in practice.
- Given that the majority of jobs involving ICTs seem to be of relatively good quality, ICTs may often be conducive to the maintenance of workability and productivity of older workers; however, trends such as intensification may have negative implications for workability of older workers.
- An issue that warrants more attention is the prevalence of repetitive strain injuries amongst those working with ICTs; there is a lack of good quality data on this topic for the European workforce and research is needed on whether the risks and requirements (for ergonomic adjustments) are especially pronounced for older workers.

Accessibility and usability ICTs

- Although generally the overall work quality in jobs involving ICTs tends to be relatively high, the specific physical and cognitive demands of working with ICTs such as computers can pose substantial challenges for many older workers.
- There are significant age-related changes in physical and cognitive function that can affect the accessibility and usability of ICTs for older workers; European and US research suggests that up to 60% of those in the 50-64 years age range may face challenges in this area.
- Although about one-in-five computer users at work in the EU are aged 50 and above, very little attention has so far been given to this issue in Europe, whether by employers (in their purchasing of ICTs) or by the ICT industry (in the design and marketing of ICTs).

Assistive technology

- Assistive technologies, ranging from low- to high-tech devices and systems, can help both to make ICTs more accessible and to provide supports for workers with physical or cognitive challenges in the wider aspects of their jobs.
- Available evidence indicates that there are wide variations across Europe in the extent of provision of assistive technologies and that this is generally a very underdeveloped area.

Employability

Employability concerns the factors that affect an older (potential) worker's likelihood of getting a job in the labour market and the type of job they get (for those trying to enter the workforce), as well as opportunities to change jobs (for those already in the workforce). Technological change may have implications for employability, for example, through changes in skills and in the cost-productivity ratios of workers of different ages, skill profiles and so on. It may also have impacts through differential usage of new ICT-based supports for skill development (e.g. eLearning) and job seeking (e.g. online job search).

Employability

ICT skills for general employability

- Although ICT skills are increasingly required by employers for a wide range of jobs, there is little direct evidence on how ICT skills (or lack of same) affect the employability of older workers.
- ICT skill levels are dramatically lower amongst those aged 50-64 who are outside the labour market in comparison to their peers who are in the workforce and also in comparison to younger people, whether inside or outside the workforce; this will increasingly put older potential workers at a disadvantage in seeking (to return to) work.

Employability in IT occupations

- The IT workforce is younger than that of other occupations comprising workers of comparable educational attainment.
- US research indicates that older IT workers (aged 40 and over) are more likely to lose their jobs than younger workers whereas the reverse is the case in the rest of the economy.

Use of ICTs to support skill acquisition

- European research shows that those aged 50-64 are much less likely than other age groups to make use of the Internet for purposeful learning activities.

Online job search

- Evidence from the US and the UK suggests that older workers and potential workers are a lot less likely to use the Internet for job seeking than are those in the younger age groups.

Disengagement from the labour market

Concern about early disengagement from the labour market is by far the most visible theme on the work-related active ageing policy agenda at the moment, prompted by low employment rates and early retirement trends amongst the older age groups of the working age population in most European countries. Some are "retired" in various ways, sometimes through choice and sometimes through necessity, some are unemployed, and many are on sickness or disability benefits.

The profile of this population varies widely across Europe, depending on pension, benefit structures and other factors. Work quality, workability and employability can also influence engagement or disengagement. Technological change can influence engagement and disengagement decisions through its impacts on these other three dimensions, as well as through more direct impacts on the decisions of older workers (and potential workers) and employers, for example, whether to invest in training in new skills.

The results of studies in this field have been somewhat contradictory. Overall, however, it seems that the introduction of ICTs has so far had only a relatively small direct impact on retirement decisions of older workers but that it may play a role in some cases, even if this is not always a determining one.

Disengagement from the labour market

- There is not much evidence of any substantial direct impacts of ICTs, *per se*, on the engagement or disengagement decisions of older workers and potential workers.
- Nevertheless, lack of encouragement (by employers) of ICT skill development amongst older workers or lack of interest (on the part of older employees) may influence early retirement decisions of some older workers.
- In addition, it seems likely that a perception of low employability due to lack of ICT skills may be a deterrent to return-to-work for at least some of the older (potential) workers outside the labour market.
- On the other hand, there is emerging evidence that job quality can be very important in the retention or attraction of older people into the labour market; if jobs involving ICTs are good quality jobs then they are likely to be conducive to older worker retention.

Caring and other informal / unpaid work

People in the older worker (50-64 years) age range, especially women, are major providers of informal care for children and for dependant (elderly or disabled) adults in Europe. As individually and collectively there are only a finite number of hours available to be shared between paid work and this informal work, full employment (in the sense of everyone of working age being in full-time employment) is unlikely to be achievable nor is it desirable. Technological change opens up new opportunities and some new potential risks for older workers and potential workers in these aspects of work-life balance.

Caring and other informal / unpaid work

- ICTs can help to increase the flexibility of formal working arrangements and thus have the potential to support a better balance between work and care; ICTs that provide help in the caring process have also a potentially very useful role to play.
- On the other hand, where ICTs result in intensification and extensification of work, then the time and space for care may be diminished.
- There has been very little research on these issues; there is a need for more information on the opportunities and risks posed by teleworking for carers and on the possibilities for technology to help working carers to provide care from the workplace (e.g. by remote monitoring of the wellbeing of the person being cared for).

"Market" failure and the need for policy intervention

Although technology on its own may not be a "killer application" as regards the achievement of high employment rates and later exit ages for older workers, exploitation of the age-friendliness potential of technological change will be an important element of the overall set of supports that are needed to achieve European targets in this area. It can be estimated that age-friendly approaches to ICTs could have direct relevance in relation to retention in employment or attraction (back) to employment for up to 10% or more of the 55-64 years age group. In addition, this can make an important contribution to the achievement of improved quality of work and health and wellbeing of older workers, and of a better balance between paid work and informal work.

The degree to which there is equality of opportunity in access to the potential benefits of ICTs, across the active and inactive older working age group, will be a key factor determining whether such potential gains are realised in practice. This includes wider access to good quality (and age appropriate) jobs and to the skills to compete for such jobs on the labour market.

The development of age-friendly ICTs also has a central economic significance for Europe, both for the productivity of the sectors of the economy where older workers use ICTs in their daily work and for the competitiveness of the European ICT industry itself. Accessibility and age-friendliness of ICT products and services will become a competitive factor, driven initially by public procurement developments, and this is something that has already been taken note of by US industry.

Three main groups of "market" stakeholders - employers, other labour market actors and the ICT industry - have key roles to play in addressing these issues. Overall it must be concluded that, in the EU at least, none have so far given sufficient attention to the role of ICTs in work-related active ageing.

Lack of adequate stakeholder response to date

Employers and the other social partners

- Although age management is becoming an increasingly visible theme in human resource circles, so far neither employers, employer organisations nor the other social partners in the EU seem to have given much direct attention to the specific theme of ICTs and work-related active ageing.
- Part of the explanation for this is a lack of awareness of the issues for older workers around ICTs and how these can be addressed; ambivalence of employers towards older workers may also be a significant factor.

Other labour market actors

- Public agencies play a significant role in the labour market in most European countries, providing incentives towards labour market participation, encouragement and support for job-seekers and wider skills-oriented activities.
- There is little evidence of direct attention to ICTs and work-related active ageing in these contexts as of yet; again, both lack of awareness and a continuing ambivalence towards activation of older (potential) workers are likely to be factors in this.

ICT industry

- In the US, there is visible attention by the ICT industry to accessibility, driven by public procurement legislation, direct legislative requirements on the telecoms industry and wider anti-discrimination legislation; we have yet to see the emergence of a similar level of visibility of attention to accessibility in the ICT industry's activities in Europe.
- Neither in the US or the EU has there yet been sufficient attention given to the specific accessibility and usability challenges associated with age-related changes.

Policy and research priorities

In view of the limited stakeholder response to date, there is a need for specific and reinforced policy attention at the EU and Member State levels in this area.

Policy and research priorities

ICT design

- Strong implementation of the accessibility provisions in the EU Procurement Directives by the Member States; an EU-driven follow-up and guidance initiative may be needed to ensure that the needs of an ageing workforce are given sufficient attention and priority.
- Prominent attention to accessibility of ICTs for the older workforce in the implementation of the Employment Equality Directive by the Member States; again, an EU-driven follow-up and guidance initiative may be needed to progress this.
- Increased EU support for relevant RTD under the Framework Programmes.

Quality and organisation of ICT-related work

- Prominent attention to this theme in the new EU programme of work on Health and Safety at Work (2007-2012).
- A specific focus on this theme in the work programmes of the European Foundation and EWON, and in the EQUAL programme and its successors.

Equality of opportunities in access to age-friendly work

- An EU-wide initiative to provide all of those in the 50-64 years age range with a suitable opportunity to acquire at least basic ICT skills.
- Development of opportunities for occupational mobility, over the working lifetime and amongst older workers and potential workers, to widen access to good quality, age-friendly jobs, including those involving ICTs.

Assistive technologies

- An EU-driven initiative to encourage more attention to this at Member State and employer levels, including awareness raising, benchmarking of good practice and establishment of common targets across the Member States.

Work-life balance

- Implementation of a focused programme of research on this theme, covering the advantages and disadvantages of teleworking for older workers who have caring responsibilities and how ICTs can support caring whilst carers are out at work.

ICT-related skills and competencies

- Research on how older people prefer to learn ICT skills and the best ways to provide ICT learning and training opportunities that the meet the needs of older people.

Theme III - ICT and independent living

This theme focuses on the intersection of demographic ageing with the opportunities offered by ICTs to support independent living and care for older people. There are many ways that ICTs can be used in this domain and there is a growing RTD effort aiming to develop new ICT-based services and supports. The analysis focuses on some critical issues for European policies in this area. What are the currently available ICT-based services and

supports? To what extent are these being deployed and used? What evidence is there of their effectiveness and acceptability? How can policy support appropriate exploitation of the potential in this field?

Challenges and opportunities

The analysis considers a number of key issues in relation to the challenges and opportunities that technological change poses in this area.

Increasing demand for social and medical care

Despite the trend towards improved health in later life, demographic ageing will result in increasing demand for care and support.

Increasing demand for care and support

- The substantial increases in the numbers of older old (80+) is a major factor; the prevalence of limitations in mobility and other aspects of physical functioning as well as cognitive impairments rises sharply amongst this age group.
- Already today, many of those who suffer from such limitations do not receive adequate help and support; socio-economic developments connected with the demographic change and the increasing demand for long-term medical and social care bear the risk of a further widening of this "care gap".
- Counteracting these developments is one of the core challenges when it comes to harnessing the potential provided by technological innovation in relation to the demographic change.

Technologies with potential for supporting older people

Independent Living Technologies (ILTs) in four fields of application present a lot of potential in the context of the emerging care challenge.

Four key Independent Living Technology (ILT) fields

Assistive Technology (AT)

- Assistive Technologies (ATs) are products that are designed to compensate for motor, sensory and cognitive difficulties frequently experienced by older adults.
- The range of ICT-related Assistive Technologies and potential applications is very wide; just a few examples are speech technology (speech recognition, synthesis, coding and analysis), portable devices to help find lost objects and the emerging development of more powerful devices such as robots designed to support dependent people in carrying out a variety of tasks.

Smart homes

- Opportunities to support the independence of older people are being provided by adding "intelligence" to the immediate home environment through the networking of ICTs.
- Here, ICTs are utilized to integrate various appliances, devices, and services within the home, to ultimately enable a resident to control and monitor his entire living space from any location within the home; technology can range from relatively simple home automation functions such as turning lights on/off, smoke alarms or access control to fully automated home systems and networks.

Four key Independent Living Technology (ILT) fields (continued)

Remote social and medical support

- ICTs can also enable remote provision of medical and social care.
- In principle there are a very wide range of applications including, for example, alarm systems addressing security related needs, remote monitoring of vital data for medical purposes and provision of social support and reassurance by videotelephony.

Ambient intelligence

- This is an emerging RTD domain that can be expected to deliver independent living solutions addressing the wider living environment (e.g. the street, public transport, public buildings, shops and so on).
- Examples include intelligent self-service terminals, information kiosks and transport systems as well as mobile communication devices providing tracking/alarm services or other location-based services, all flexibly adapting to the specific communicational, functional and cognitive needs of older people.

Improving the quality of life of care recipients

The ILT domain offers a lot of potential for improving the quality of life of older people with functional limitations or ill health.

Potential for improved quality of life

- Evaluations suggest that ILTs have significant potential to improve the quality of life of older people who need support in their everyday lives; case studies suggest that ILTs can support significant gains in Quality Adjusted Life Years (QUALYs) although there has yet to be enough research of this nature to allow wide-scale generalisations.
- Examples of benefits include more independence and possibilities to live an active life, greater confidence felt by ILT users and immediate availability of help in emergency situations, and faster discharge of older people from hospital and delayed admission to institutional care.

Empowering older people, including those who are carers

ILTs also have the potential to contribute in various ways to the empowerment of older people.

Empowering older people, including those who are carers

- ILTs offer the potential to empower older people to participate in social and economic life in a wider sense; this applies not only to those with functional imitations or ill health, but also to the many older people who themselves provide informal care to others.
- ILTs enabling older carers to provide care from the workplace (e.g. by remote monitoring of the well being of the person cared for) may help older family carers to more fully participate in economic and social life, although a lot more research is needed on the risks and opportunities that may be presented.
- The issue of how ILTs could be harnessed to enable older people to take a more active role in making care and treatment choices and to participate in the management of the care process has also been highlighted by some analysts; however, we currently do not have a very good understanding of these processes and there is a need for research on the particular role that ILTs could play.

Cost-effectiveness of care service provision

Consideration also needs to be given to the relative merits of investing in ICT-based solutions as opposed to paying for other forms of support, including more labour-intensive service models.

Cost effectiveness of ILTs in care service provision

- For relatively simple solutions, such as item locators and medication dispensers, costs do not seem to be a major issue when compared with benefits experienced by older people and by their carers.
- For more complex (and expensive) ILT systems it is difficult to make generalised cost benefit assessments; depending on structural peculiarities of national welfare and health systems, costs as well as benefits may accrue a various levels and to a various actors (e.g. care recipients and their families, municipalities, charity organisations, public and private funding organisations, and commercial service and technology providers).
- Apart from cost-benefits in "front office" aspects of care services, consideration also needs to be given to the "back office"; here, productivity gains may become possible through ICT, for example, through more efficient coordination of the various actors involved throughout the entire service chain.
- Overall, many case studies suggest that there is clear potential for cost-benefits to be achieved from many ILTs; however, a lot more research is needed if we are to fully understand where these benefits are most likely to be found and how they can best be achieved within complex social/medical care supply systems.

Ethical considerations

There are various ethical issues that also need to be considered, including the possibility that the cost-saving potential of ICT may become the main driving force to the neglect of service quality and the possible emergence of a creeping de-humanisation of care and the everyday lives of those needing care. We must avoid the emergence of inequitable scenarios in this regard. One such scenario would be where ILTs were provided as an "extra" in addition to good quality human care for some (those who can afford it) but as a substitute for quality human care for others (those who cannot afford it). Another would be where, irrespective of the human care aspect, helpful ILTs were only available to those who could afford to pay for them themselves.

Ethical considerations

- One important issue concerns the respective merits of human care and of ILTs; the theoretical discourse in this regard has reflected a continuum of opinion, ranging from views that technology-based care is inevitably de-humanising to uncritical ("technology-push") championing of technology for care.
- In fact, the levels of utilisation of ICTs in care are not yet sufficient to draw any robust conclusions on what the overall social implications might be, positive or negative; a possible exception to this are the now quite widespread social alarm systems for older people in many countries – in this regard, the benefits for all seem well proven and it is instructive that there has been little if any voicing of concerns about negative social impacts by older people's organisations.

Ethical considerations (continued)

- Use of ICTs to support people with dementia and their carers is one area where considerable attention has been given to ethical issues, prompted by the difficulties of informed consent from people with dementia and the possibility of conflicts of interest between those receiving and providing care; in this field expert guidelines have been developed to support ethically and socially appropriate usage of ICTs.
- More macro-ethical issues also arise in relation to ILTs, particularly as regards equality of access to quality and preferred forms of care; this will be an important issue on the future, as existing disparities in access to care between rich and poor older people may well widen in many countries.

Insufficient market response and a need for public policy intervention

Diverse market structures and maturity levels

The ILT domain has not yet matured in terms of well-established products that are widely available. Only social alarms and a variety of AT devices are widely available today. Many ILT implementations exist only in experimental settings and levels of awareness what is possible tend to be low among potential target groups.

Market structure and maturity

Assistive Technology (AT)

- It has been estimated that there are currently more than 20,000 Assistive Technology (AT) products available in Europe; however, although there is no reliable estimate of the numbers of people actually using AT, it is widely accepted that there are significant market and supply failures in Europe in this domain.
- In most countries the public sector plays an important intermediary role, sourcing AT and supplying it to those who need it who meet define eligibility criteria; rules about what AT is provided and who can avail of public support vary widely across Europe.
- The market strongly lacks transparency due to the complexity of current delivery systems and processes, and lack of awareness of what's available restricts the expression of demand.
- On the production side, most AT products are produced in small series, resulting in high price levels; in addition, complex distribution channels and the large number of very small manufacturers tend to hamper technology transfer from the research domain to the market.

Market structure and maturity (continued)

Smart homes

- Despite considerable research effort to exploit smart home technology for the benefit of older people and people with disabilities, actual implementation is still largely confined to experimental settings and demonstrators; technologies and standards seem to have failed to create the right conditions for a mass market for smart home applications.
- The first Code of Practice expected to be available by the end of 2005 as part of the eEurope 2005 initiative may give the smart home domain a critical push towards the development of marketable products; also, more recent activities of large players from the consumer electronics industry may contribute to the emergence of a commercial value chain along which home networking products and services may soon flow to the consumer.
- Without public intervention, however, it seems unlikely that older people and people with disabilities will be targeted by these commercial developments for the foreseeable future.

Telecare / telemedicine

- Social alarms are the most widely available ILT application today, although actual take-up varies considerably across countries; overall some 4% of the 50+ population in the EU15 use such alarms, with the highest levels in the UK (16%).
- Despite extensive piloting in Europe and beyond, more advanced ILT implementations such as dwelling-based health monitoring have yet to become mainstreamed within health care services; both technical challenges and lack of appropriate business models present barriers.
- Nevertheless, there have been some successful examples of integration of well established ILT components into day-to-day community care practices and this shows that ICT-mediated provision of social and medical care can be viable and sustainable.

Ambient intelligence

- This is an emerging RTD domain that has yet to develop into a coherent market; public encouragement of RTD and deployment would help to accelerate its development and to leverage the undoubted potential to support independent living for older people.

Huge (unmet) potential demand for ILTs

Although assessment of demand is difficult because markets and supply are not yet well developed it is nevertheless clear that there is huge potential demand given the number of older people for which the various ILT domains are ostensibly of relevance.

Huge (unmet) potential demand

- Even at the current relatively early stage of demographic ageing, each of the ILT domains already has relevance for tens of millions of older people in Europe.
- This potential market will double or even triple by 2050, in line with the large projected increase in the numbers aged 80 years and older.

Policy and research priorities

Given the current market failures in the ILT domain, a number of policy and research priorities can be identified.

Policy and research priorities

Improving uptake of useful technologies that already exist

- EU-driven support for large-scale real-world trials (e.g. under the eTEN and RTD programmes or Articles 169/171 of the European Treaty), with an emphasis on needs-driven integration of ICT-mediated health/care processes.
- Increased attention to the potential offered by ICTs in relevant policy coordination processes (e.g. the OMC process in the fields of health care and social inclusion)
- Promotion of technical standardisation and interoperability in key areas, including health care, smart homes and assistive technology.
- ICT-related awareness raising in the care and independent living domain; identification and exchange of good practice, promotion of both “high-tech” and “low-tech” solutions.
- Continued and reinforced efforts to overcome market fragmentation in the assistive technology domain.
- Socio-economic research enabling policy and public/private market actors to better understand market dynamics and potentials.
- Continued applied RTD in relation to the care and independent living domain under the Framework Programmes.

Avoiding undesirable impacts of ILT uptake

- Establishment of an EU network to address ethical issues.
- Promotion of quality standards or codes of good practice in relation to social and medical telecare.
- Socio-economic research to enable a better understanding of micro-ethical (e.g. potential threats to privacy and dignity of the dependent individual) and macro-ethical impacts (e.g. possibility of widening income-related divides in access to quality of care and quality of life).
- Socio-economic research to enable a comprehensive understanding of costs and benefits that may come with increasing technology application in the care and independent living domain.

Harnessing the potential offered by emerging technologies

- Increased emphasis on the importance of attention to this field in all of the main fields of technological innovation (including basic research, technology watch and technology transfer to support this field).
- Continued RTD efforts to exploit emerging technologies for care and independent living purposes under the framework of relevant RTD programmes (e.g. the IST programme) or under articles 168/171 of the European treaty.
- Socio economic research to better understand in which way needs that come with the ageing process threaten independence and the benefits ICTs may hold in this regard.·
- Continued emphasis on the involvement of key actors groupings (e.g. ICT industry, formal/informal carers, financing/reimbursement bodies, older end users) in the RTD process.

Part C

Main Report

1 Introduction

This report focuses on the policy issues that arise for Europe as a result of the interactions between two major forces of change – demographic ageing and the increasing pervasiveness of Information and Communication Technologies (ICTs). In 2005 we are at a stage where demographic ageing is already beginning and will soon start to accelerate. In the meantime the deployment of computers, the Internet and mobile communications in all aspects of the economy, services and everyday life continues apace.

These two trends can hardly pass each other by without interacting in a multitude of ways. The challenge for Europe is to identify the key developments and points of intersection, the opportunities and risks that these present and the levers of influence whereby policy can help to shape developments in desired directions.

1.1 Three core themes

In its recent Green Paper, the European Commission has identified the demographic shift as one of the great policy challenges in the 21st century (CEC 2005a). This study aims to provide support to this policy challenge by focusing on three core themes.

An age-friendly Information Society

The first theme concerns the intersection of demographic ageing with the emergence of an Information Society. Although the term “Information Society” now tends to be used in a rather generalised manner to encompass everything to do with developments in ICTs, the focus of the analysis of this theme is on ICTs in everyday life and how these are impacting on the ways everyday things are done. Some central questions are addressed. Are older people getting involved or being left behind in the Information Society? Does this really matter for them or for society overall? How might things evolve without any policy intervention? Do market and business interests coincide with consumer and social concerns? What policy interventions might be warranted to achieve desired outcomes?

ICTs, work and employment

The second theme focuses on the intersection of demographic ageing with the increasing utilisation of ICTs in the workplace. Demographic ageing is leading to an older workforce and to a need for higher employment rates, especially amongst those at the later stages of the traditional working life. The analysis on this theme focuses on some critical issues for European employment policy. What are the opportunities and risks posed by ICTs for the achievement of high employment rates? Do they support better or worse quality of work and work-related health and well-being for older workers? What impacts do they have on age equality in the workplace and in the labour market? What can policy do to shape developments in a way that maximises the potential benefits and minimises the potential negatives?

ICTs for independent living and care

The third theme focuses on the intersection of demographic ageing with the opportunities offered by ICTs to support independent living and care for older people who need support in their everyday lives because of functional difficulties associated with increasing age. Demographic ageing will result in a substantial increase in the numbers of older people facing such difficulties and in the levels of care and support that will be needed from family and from public and private care services. There are many ways that ICTs can be used in

this domain and there is a growing RTD effort aiming to develop new ICT-based services and supports. The analysis on this theme focuses on some critical issues for European policies that relate to the care area. What are the currently available ICT-based services and supports? To what extent are these being deployed and used? What evidence is there of their effectiveness and acceptability? How can policy support appropriate exploitation of the potential in this field?

1.2 Key features of demographic ageing

In the following, some key demographic trends are sketched to shed light on the scale of the policy challenges faced by the European Union due to the ageing of its population. This starts with a presentation of current demographic projections for the European Union as a whole and for the individual member states (1.2.1). Further to this, some evidence on the relationship between population ageing, health and disability is presented (1.2.2).

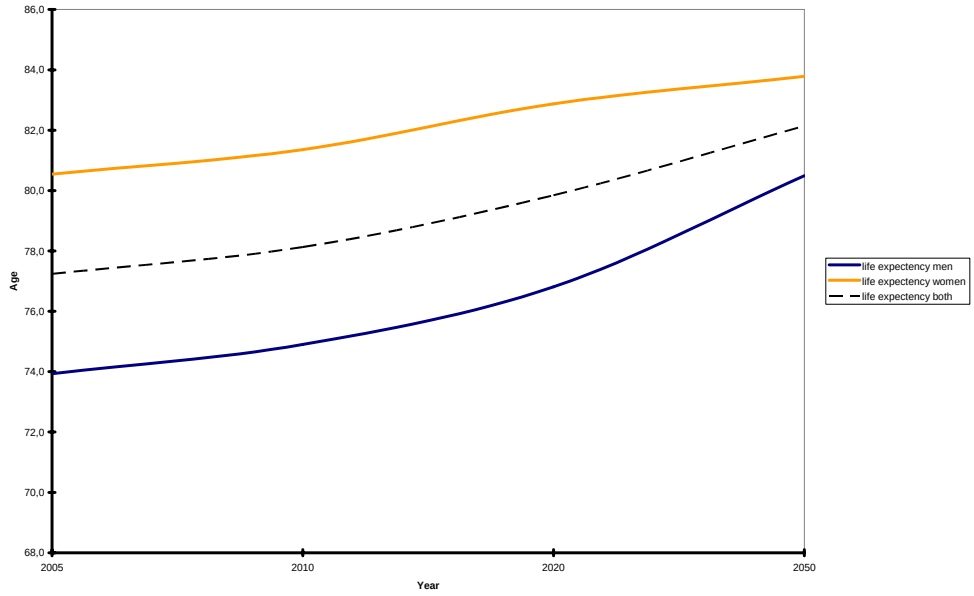
1.2.1 Demographic projections

The process of population ageing is driven by two key developments, namely increasing life expectancy and low fertility rates. On the one hand, while the population of the 25 countries that today form the European Union has grown from 378 million in 1960 to over 453 million in 2002, population growth has in recent decades slowed down to a rate of a mere 0.3% in 2003 (EUROSTAT 2004: 40). Neither in the EU15 nor in the enlarged Union do fertility rates currently reach the so-called replacement level (that is a reproduction rate high enough to replace an area's population) of 2.1 children per woman. On the other hand, life expectancy has continuously increased. In the last decade alone, life expectancy at birth has risen by almost three years in the 25 EU countries, reaching 75 years for men and 81 years for women in 2002 (EUROSTAT 2004: 58; compare also CEC 2002a: 8-9). In 1991 a 65 year old man and a 65 year old woman could statistically expect to live for another 14.8 and 18.5 years respectively. By 2002 this figures have risen to 16.0 years for males and 19.9 years for females (EUROSTAT website[1], accessed August 2005).

These figures illustrate the unprecedented demographic shift the European Union is facing today. When assessing future demographic trends one needs however to be bear in mind that typically different “futures”, i.e. different possible scenarios, exist depending on certain assumptions on can make in relation factors that ultimately influence demographic developments. Also, once projections are known they can have an impact on policy and can thereby change reality, resulting in a different outcome than projected. It is thus clear that demographic forecasts are inevitably affiliated with a certain degree of uncertainty. Nevertheless, the demographic developments sketched above are most likely to continue during the coming decades.

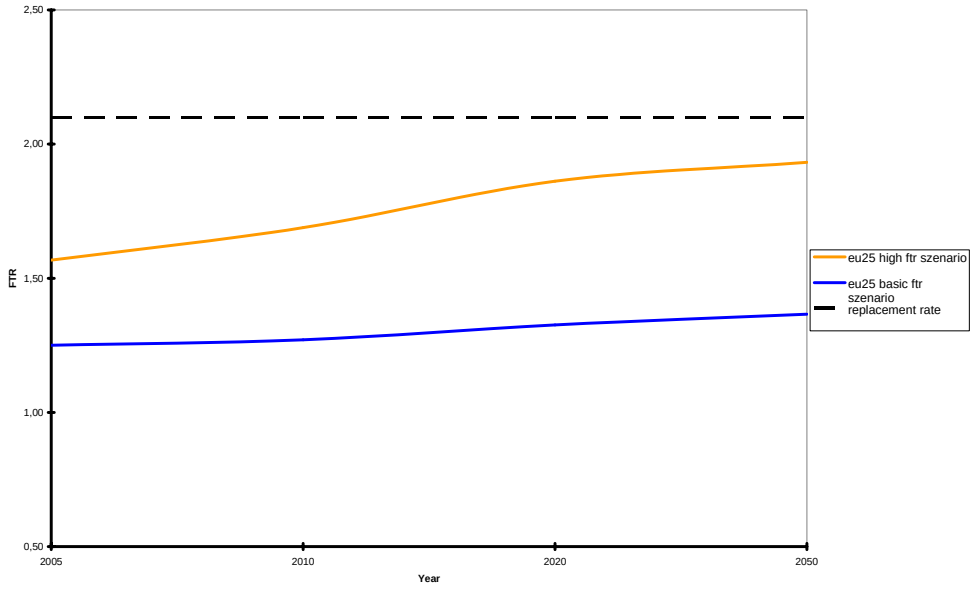
[1] http://epp.eurostat.cec.eu.int/portal/page?_pageid=1996,39140985&_dad=portal&_schema=PORTAL&screen=detailref&language=de&product=sdi_as&root=sdi_as/sdi_as/sdi_as_dem/sdi_as1200

Exhibit 1-1: Projection of EU25 population life expectancy (Eurostat baseline variant)



Source: EUROSTAT[2] ,accessed August 2005

Exhibit 1-2: Projection of EU25 fertility rate (Eurostat baseline variant and high fertility variant)



Data source: EUROSTAT[3], accessed August 2005

[2] This graph has been generated by the authors on the basis of data available from the Eurostat online portal featuring a dedicated population projection facility:

http://epp.eurostat.cec.eu.int/portal/page?_pageid=1996,45323734&_dad=portal&_schema=PORTAL&screen=welcomeref&open=/Popula/proj/trend/TBP&language=en&product=EU_MASTER_population&root=EU_MASTER_population&scrollto=0

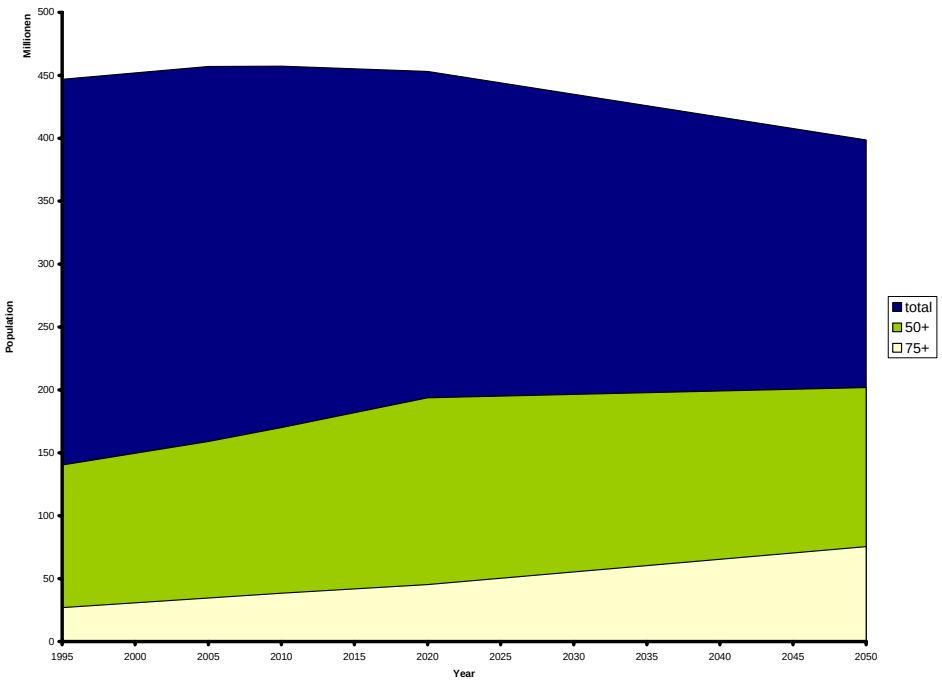
Queen tree path used: Population – Pop. projections – Trend scenario – Baseline variant – Assumptions – Demographic indicators: MLEXPEC (Life expectancy at birth – males) and FLEXPEC (Life expectancy at birth – females) [Last Eurostat update: 08.04.2005]

Demographers predict that life expectancy will continue to rise for both sexes. According to EUROSTAT (2004), in 2050 the average life expectancy for the European Union's male population may have reached 80.5 years, nearly 8 years more than in 1995 (Exhibit 1-1). For women the increase is however likely to be less pronounced; their average life expectancy is predicted to amount to 83.8 years in 2050, a plus of nearly 4 years from the 1995 figure.

Although fertility rates are projected to slightly increase in the near future, they are likely to remain below the replacement level for the whole period up to 2050 (Exhibit 1-2). In an optimistic scenario, the EU25 fertility rate may increase from 1.48 in 2000 to 1.93 in 2050, with France and Sweden reaching the 2.10 mark but not surpassing it. A less optimistic scenario envisions only an increase to 1.62, with no European country even near the replacement mark.

Due to these trends, the share of older people in the overall population will continue to rise (Exhibit 1-3). Leaving aside possible migration developments the share of the 50+ population is likely to rise from 35% (i.e. from some 159 Mio) in 2005 up to some 48.5% (to some 202 Mio) in 2050. At the same time, the share of the people older than 75 years is predicted to rise from 7.6% (some 34 Mio) to 19% (some 75 Mio) by 2050. Thanks to immigration the European Union's overall population is assumed to increase slightly until 2025 – i.e. by 2% when compared with 2005 - before starting to drop thenceforward (CEC 2005a).

Exhibit 1-3: Projection of EU25 population according to age (no migration variant)



[3] This graph has been generated by the authors on the basis of data available from the Eurostat online portal featuring a dedicated population projection facility:

http://epp.eurostat.cec.eu.int/portal/page?_pageid=1996,45323734&_dad=portal&_schema=PORTAL&screen=welcomeref&open=/Popula/proj/trend/THF&language=en&product=EU_MASTER_population&root=EU_MASTER_population&scrollto=0

Queen tree path used: Population – Pop. projections – Trend scenario – Baseline variant – Assumptions – Demographic indicators: TOTFERRT (Total fertility rate) [Last Eurostat update: 08.04.2005]

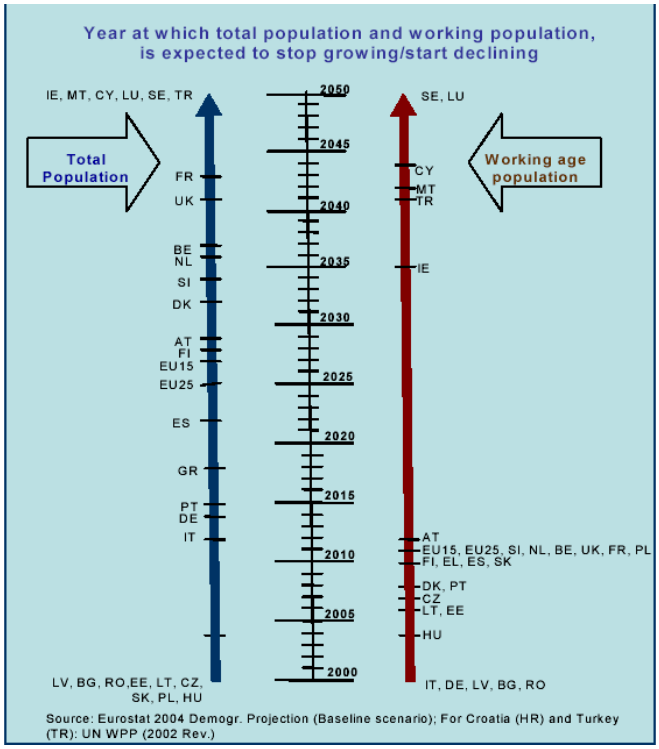
And: Population – Pop. projections – Trend scenario – High fertility variant – Assumptions – Demographic indicators: TOTFERRT (Total fertility rate) [Last Eurostat update: 06.06.2005]

Data source: EUROSTAT[4], accessed August 2005

It is clear that member states will not be affected by these developments to the same degree and at the same time. Exhibit 1-4 provides a graphical representation at what point in time the demographic shift is supposed to make an impact on the individual Member States in terms of a declining population. While some countries are affected already today others are some way removed from this point and may thus not experience the same urgency in implementing measures to alleviate the resulting problems.

However, towards the end of this decade the majority of countries will have to face up to a declining workforce, even if it may take one or more decades before the demographic development starts to take effect in terms of a shrinking overall population. For most countries the effect of the demographic shift on their working populations will come considerably earlier than the effect on the size of their overall population.

Exhibit 1-4: First calendar year of total population and working age population decline in the EU and the Member-States (Eurostat baseline demographic scenario)



Source: CEC 2005a: 22

Finally, it is worth to be noted that the demographic developments outlined above are not restricted to the European Union but have turned into a global phenomenon. This is for instance reflected by an increasing old age dependency ratio – i.e. the ratio relating the population aged over 64 and the population in the age range between 15 and 64 – in almost

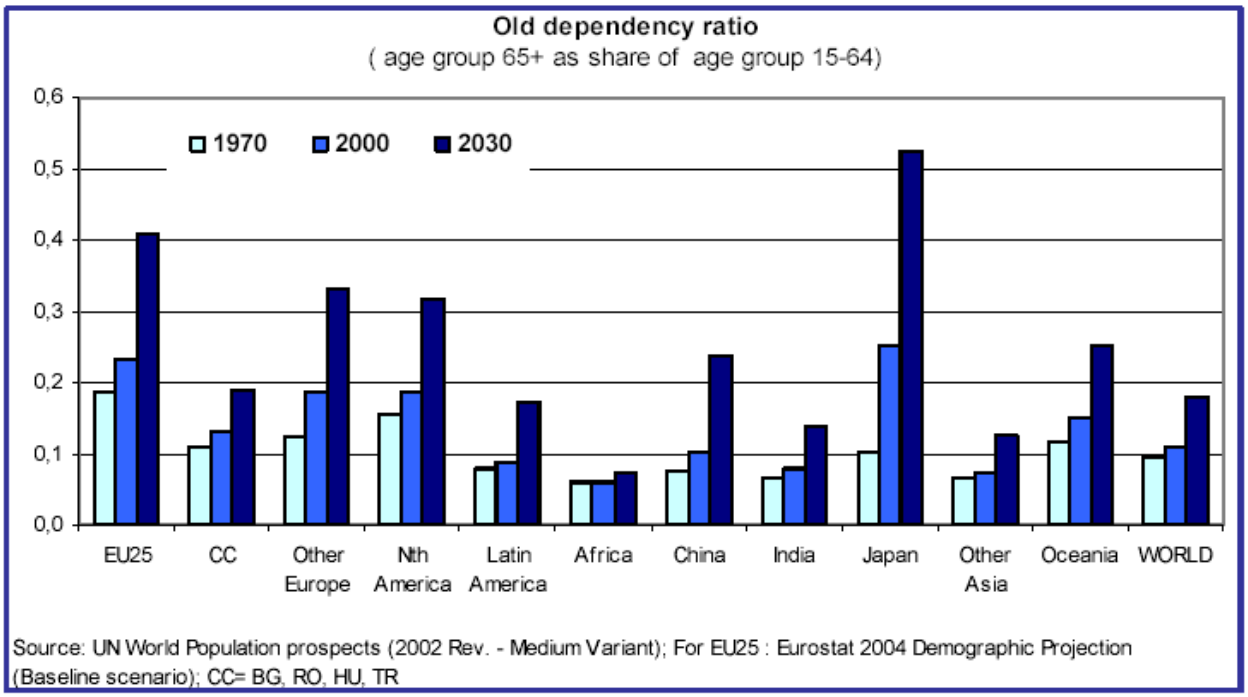
[4] This graph has been generated by the authors on the basis of data available from the Eurostat online portal featuring a dedicated population projection facility:

http://epp.eurostat.cec.eu.int/portal/page?_pageid=1996,45323734&_dad=portal&_schema=PORTAL&screen=welcomeref&open=/Popula/proj/trend/TBP&language=en&product=EU_MASTER_population&root=EU_MASTER_population&scrollto=0

Queen tree path used: Population – Pop. projections – Trend scenario – No migration variant [Last Eurostat update: 08.04.2005]

all world regions. Here, Japan is predicted to face the highest pressure by 2030 followed by Europe and North America (Exhibit 1-5).

Exhibit 1-5: Old age dependency ratio in different world regions



Source: CEC 2005a: 16

While developing countries are comparatively young today, they are however projected to experience rapid population ageing in the future, due to a drop in fertility rates and an increase in longevity. By 2050 the number of older people in less developed countries is estimated to quadruple (CEC 2002a). Globally, there may be some 2 billion older people in 2050 (21% of the world population), a tripling of this age group from the present day (600 million or 10% of the world population) (SENIORWATCH 2002a; see also UNITED NATIONS POPULATION DIVISION 2001).

1.2.2 Population ageing, health and disability

In the past, advances in health have promoted population aging in almost all industrialised countries (BUTLER 1997). “In the last quarter of this century, older people have made substantive health gains. Explanations for this vary and may be interactive including improvements in health education, health services, medicine, public health and standard of living” (MESTHENEOS et. al. 1999: 155). However, whether the age-specific health status will remain constant or change in future - and in which direction - remains to be seen. Progress in medical technology cuts both ways in terms of the average health status of older people: “While it is reasonable to assume that some elderly will be healthier and have a health status equivalent to that of younger individuals in the previous generation, others may survive into the older age cohorts because of improved medical technology, but their health status may still be relatively poor for their age” (SHOVEN et. al. 1994: 1337). Thus, simplistic conceptions about the interrelationship of population ageing and health seem to be misplaced.

Nevertheless, analysts have predicted that “health trends in the next 25 years will be determined mainly by the ageing of the world’s population” (MURRAY and LOPEZ 1997: 1498). Typically, ageing is conceptualised as a progressive loss of functions with advancing biological age, and it will not come as a surprise that there is manifold evidence that the

prevalence of activity limitations and health problems among older people tends to be relatively high (Exhibit 1-6). According to the SENIORWATCH survey conducted in 2001, some 60% of the 50+ population in the EU15 Member States were for instance treated for a chronic disease or any long term condition. The more recent SHARE survey of the 50+ population in 10 Member States revealed, that 40% of the respondents reported to have some activity limitation due to health problems, and almost 50% reported to have some long term health problems (MACKENBACH et al. 2005: 83). The authors conclude that "almost all physical health problems are strongly related to age: their prevalence usually rises steeply with age, in a linear, sometimes even exponential fashion." (MACKENBACH et al.: 84). This result is in line with data available from Eurostat. As shown by Exhibit 1-7 the proportion of those stating that they are hampered in daily activities by any physical or mental health problem, illness or disability is twice as high in the 65+ age range when compared with the age range between 16 and 64 years.

Exhibit 1-6: Prevalence of frequent diseases among older people

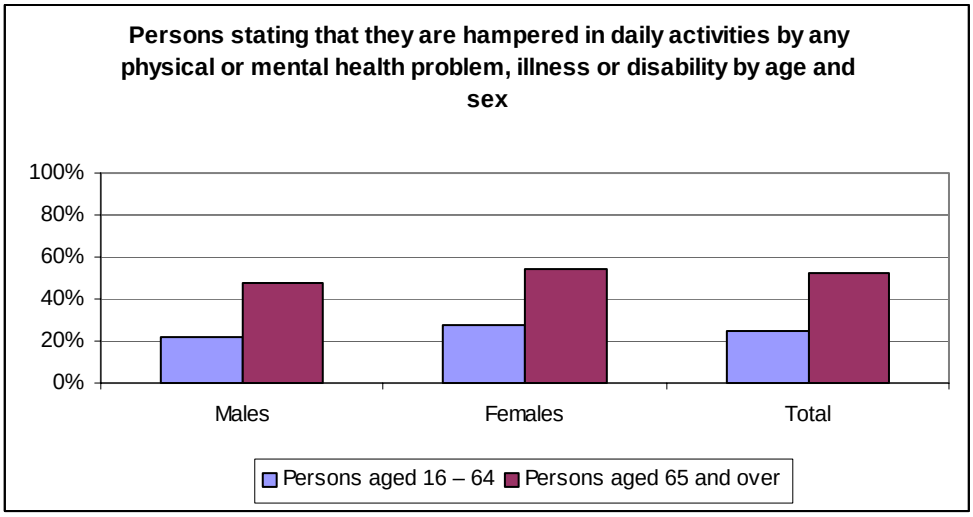
Currently treated for	Age				
	50 - 59	60 - 69	70 - 79	80+	Total
High blood pressure	23.1	34.8	44.9	41.7	33.7
Joint/bone/muscle diseases	18.9	27.0	30.3	35.2	25.6
Heart disease	7.4	14.5	27.4	35.7	16.8
Diabetes	6.8	9.4	12.2	10.1	9.2
Chronic respiratory disease	5.4	8.8	11.5	11.4	8.5
Any of these (at least one answer yes)	41.7	58.5	68.6	69.9	56.0
Other long term condition (n.o.s.)	16.7	18.5	20.9	22.2	18.7
Any of these (incl. other long term condition)	49.0	64.2	73.5	74.0	61.9

Base: All respondents (N=9661)

Source: SENIORWATCH, 2001a: 53

There is however great diversity in relation to the extent to which adults develop health problems during later stages of life. For instance, while about more than two thirds of the respondents of the SHARE survey reported to have at least one chronic disease diagnosed during their life time (40% even two or more) around one third reported no chronic disease at all, or no symptoms at all (MACKENBACH et al.: 2005: 83). Clearly, socio-economic and cultural factors as well as cohort effects seem to have a bearing on the extent to which the biological ageing process comes along with health problems and disabilities. There is strong evidence that "individuals with lower socio-economic status have more health problems, face more disability problems and live shorter than those with a more privileged socio-economic position" (AVENDANO et al.: 2005: 89).

Exhibit 1-7: Illness & disability by age



Base: respective age group

Source: CEC 2004a: 185

As shown above, health and disability are closely related. According to an OECD study the relative proportion of people with disabilities in the overall elderly population seem to have declined during the early 1990 in many industrialised countries (CAMBOIS et al. 1998). The study found that sever disabilities had declined in nine of the OECD member countries between 1990 and 1994. However, the gains were mainly found in the younger age groups (65-80), and they were greater for men than for women. The study also found that the decline was pronounced in private households. However, rising disability rates in the institutionalised population were observed – possibly due to a general trend towards increased home care provision. Four countries had significant gains including France, Germany, Japan and the USA. There were mixed results in Canada and Sweden while Australia, the Netherlands and the UK had very moderate or no gains.

While disability rates seem to decline the total number of frail and disabled persons is likely to rise in the future because of the demographic shift in the coming decades. According to CAMBOIS et al. (1998) the OECD found for instance that Japan would see a 74% increase in the number of older people living in institutions by 2020. Canada would see a 61% increase while the growth would be 33% in the U.S.. Other European nations were forecast to have lower growth rates: Germany, 26%; France, 29%; the U.K., 18%; Sweden, 27% (ibid.). According to another study the number of disabled living at home is set to grow even faster. For example, a 74% rise of disabled elderly in Japan between 2000 to 2020 has been forecasted; in Canada a 62% jump and in the U.S. a 41% increase. The corresponding figure for Germany is 38%, for France 54% and for Sweden 29% (ENGLAND 2001: 73).

1.3 Key technological developments

There are many different ICT-based and other new technologies, applications and services that have relevance for older people (Exhibit 1-8).

To begin with there are a myriad of mainstream, everyday products, services and applications that are of just as much relevance for older people as they are for other age groups and in some cases can be even more relevant. Information Society services and content can open up many new opportunities for participation for people who have restricted mobility, for example. Smart home and consumer electronic developments can make

management of the home and everyday living a lot easier for older people. Workplace technologies and tools can help to prolong working life. Healthcare technologies can help in prevention, early detection and cure, as well as in facilitating management of chronic conditions.

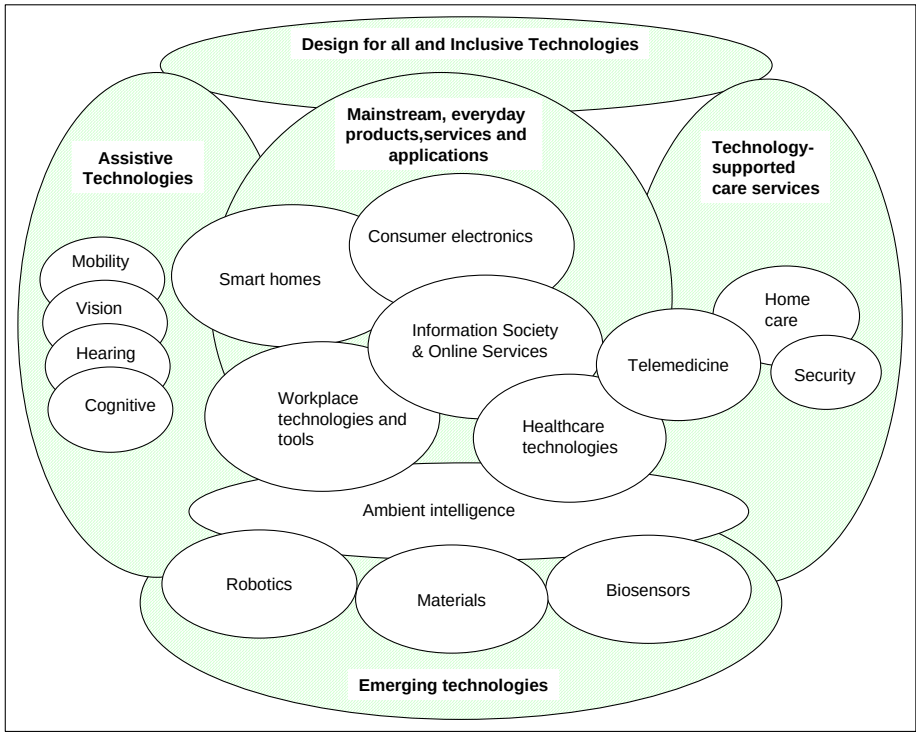
Because older people are increasingly at risk of having functional difficulties in areas such as mobility, vision, hearing and in some aspects of cognitive performance, specifically designed ICT-based assistive technologies can also be of great benefit.

As well as assistive technologies, many of the challenges of old age require support from the health and social care services. Telemedicine opens up new opportunities for providing medical care to the home and there are many new developments in the field ICT-based home care, including ways of monitoring well being and providing a secure home environment.

Underpinning future developments in many of these areas are some key emerging technologies. These include robotics, new materials and biosensors. In addition, the emerging concept of ambient intelligence offers great potential, with the possibility for the whole environment (at home, on the move, in the street, whilst driving or during transportation, in public buildings and so on) to have embedded intelligence that helps with everyday life.

Finally, as well as the many opportunities there are also some potential barriers posed by technological development if these are not foreseen and addressed in their design and deployment. In particular, the design and development of mainstream technologies needs to be based on Design for All principles in order for them to be usable by older people with functional changes and decline. In addition, technologies need to be designed and deployed in ways that ensure that they are inclusive and do not lead to new forms of exclusion through social isolation or other processes.

Exhibit 1-8: Overview of key technological developments



Source: The authors

1.4 Time horizons and projections

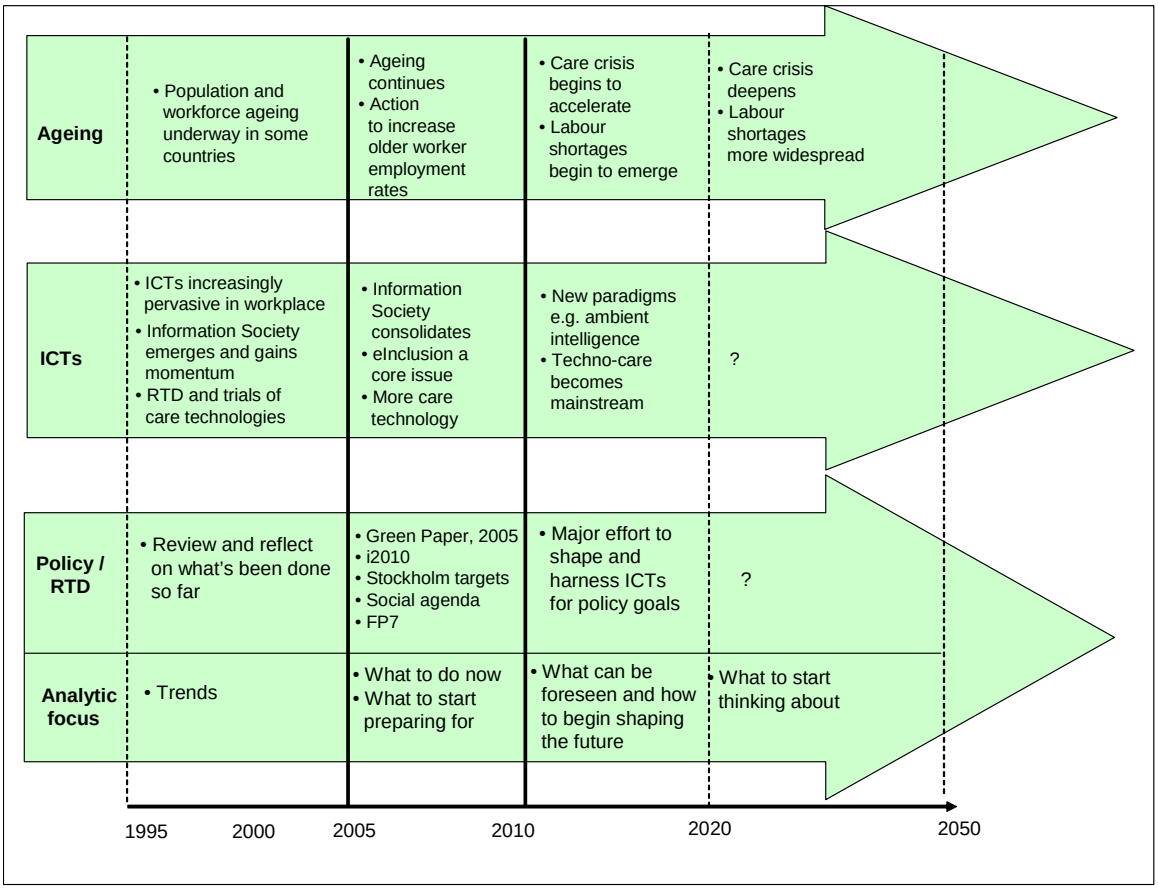
As indicated in section 1.2, demographic ageing is a process that will evolve over a long period of time in Europe. Some countries are already experiencing significant ageing of the population and workforce; in others the process is only beginning but is ultimately inevitable. In addition, the development and deployment of ICTs and the Information Society is also evolving. Some countries are already at a relatively advanced stage, with the Internet now being used by a majority of the population and incorporated as a standard feature of their daily lives; other countries have not yet reached this stage, with only a minority using the Internet at present and with much less integration of the Internet into daily life.

This raises the issue of what timeframes would be most appropriate for the analyses of the intersections between these two trends that are unfolding and interacting over time. For purposes of this study the main consideration has been to address a timeframe over which we can draw reasonably robust and reliable conclusions about the interactions between demographic ageing and technological change, and one that fits with the type of timeframe that policy can address in a practical manner.

With this in mind, a pragmatic approach has been adopted that takes into account some key EU policy timelines at present whilst also giving some attention to the longer-term and what needs to be done to prepare for the more distant future even if we cannot reliably foresee how technology and society will unfold.

The basic time perspectives that underpin the analyses are summarised in Exhibit 1-9 below.

Exhibit 1-9: Time horizons for the analysis



Source: the authors

1.4.1 Green Paper on demographic change

The Green Paper "Confronting demographic change: a new solidarity between the generations (CEC 2005a) outlines some key issues associated with demographic ageing. In the context of intergenerational solidarity, a key focus is on the need to support families, both in relation to increasing fertility rates (through better reconciliation of family life and work) and to supporting families in caring for older people. The analysis in this report addresses some important ICT dimensions to these themes, including the role that ICTs may play in increasing (or decreasing) work-life balance and the role that ICTs can play in supporting independent living and care for older people.

1.4.2 Information Society policy

Relevant ICT developments that can be expected in the 2005 to 2010 timeframe include a real consolidation of the Information Society in all aspect of economic and social life, a concomitant emergence of eInclusion as a core element of cohesion and fracture in society, and increasing attention to the use of ICTs in care services for older people. After this, it can be expected that a new paradigm of “ambient intelligence” will emerge, whereby the functionality now provided by ICTs in computers, mobile phones and so on becomes much more pervasively applied in everyday things and everywhere. Examples of relevance for an ageing population include smart homes, smart transport and smart public places, where embedded ICTs provide un-intrusive support in getting around and managing everyday life.

The i2010 programme will provide the main near-term EU ICT policy vehicle to address these developments (CEC 2005b). The overarching aim of i2010 will be to ensure that Europe’s businesses, governments and citizens make the best use of ICTs in order to improve industrial competitiveness, support growth and the creation of jobs, as well as aiming to address key societal challenges. There is expected to be a strong focus on achieving an inclusive European Information Society that promotes growth and jobs in a manner that is consistent with sustainable development and that prioritises better public services and quality of life. Themes to be addressed include making sure that ICTs benefit all citizens; making public services better, more cost effective and more accessible; and improving quality of life through improving the health of citizens via new ICT enabled medical and welfare services and thus contributing to the response needed to the challenges of demographic ageing.

Each of the three main themes of the current study – an age-friendly Information Society; ICTs and employment & work for older workers and ICTs for independent living and care – has a central relevance for the i2010 agenda.

1.4.3 Ageing workforce and encouraging higher employment rates

A second major theme concerns the ageing of the workforce and the encouragement of higher employment rates amongst older workers. During the 2005-2010 period the workforce ageing that can already be detected in some EU countries will continue and begin to manifest itself in others. This demographically-driven process will be influenced by the policy environment as well, in particular by the efforts to achieve the Stockholm Council target of 50% employment amongst the 55-64 years age group and the Barcelona Council target of increasing the average exit age by five years over the same timeframe.

In parallel with this there will be an increasingly wider penetration of ICTs into the workplace, posing both opportunities and risks for older workers and potential workers and, ultimately, for the achievement of the EU targets in this area. This study provides an evidence-based analysis of the wide-ranging dimensions of this issue and indicates how policy can help to

harness and shape ICT developments to promote work-related active ageing to the benefit of all.

1.4.4 The wider social agenda

The analysis also seeks to be of relevance for the wider social agenda as outlined for the 2005-2010 period (CEC 2005c).

A key aspect of this concerns the pursuit of positive interplay between economic, social and employment policies. One relevant theme addressed in this study is the implications of ICTs for employment rates and competitiveness in the face of demographic ageing. Another key theme is the response needed from the ICT industry and the opportunities that are presented for it by the increasing demand for age-friendly products and services.

A further aspect of the social agenda is the promotion of quality to improve human and social capital. This study addresses this theme in each its three main thematic analyses.

The agenda also draws attention to the need to take account of the "cost of the lack of social policy". This study aims to throw light on this by examining how technological change can be expected to play out for an ageing population without specific policy intervention and, on the basis of this, identifying how policy can help to shape developments in desired ways and so harness the positive potential and minimise any negative consequences.

The interactions between demographic ageing and technological developments are also very relevant for the two main strategic lines of the agenda. One focus of the strategy is on strengthening citizens' confidence which is essential for managing the process of change. This is an especially pertinent issue for older workers confronted with technological change in the workplace and in the labour market.

A second focus of the strategy is on the two major themes of employment and equal opportunities / inclusion. In the employment area there will be a renewed and reinforced attention to quality of work and health and safety at work, with a new strategy to be put forward for the period 2007 to 2012 that will focus on new and emerging risks. The issues raised by ICTs for older workers must be given a high visibility in this.

Finally, the theme of equal opportunities for all runs throughout the analysis in this report. This includes opportunities and risks posed by ICTs for the participation of older people in all aspects of society, as well as the particular issues that arise in relation to equality in employment and work.

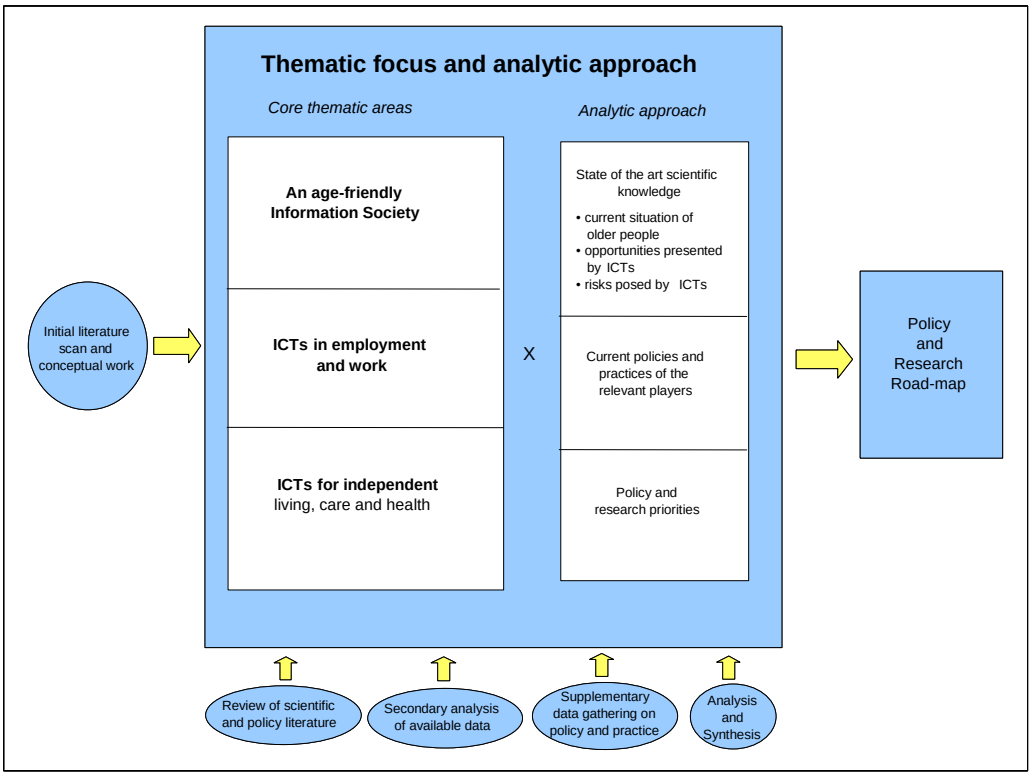
1.4.5 RTD

Finally, the analysis in the report has an important contribution to make to the development of the forthcoming 7th Framework Programme of Research and Technological Development. It takes stock of the current state-of-the-art in relation to technology and ageing and identifies priority themes and issues that need to be addressed if RTD is to be optimally tuned to address the policy themes outlined above.

1.5 The basic analytic perspective and approach

Chapters 3, 4 and 5 present detailed analyses of the three core themes – an age-friendly information society; ICTs, work and employment; and ICTs for independent living and care. Each chapter elaborates a specific analytic perspective and approach that fits with the particular characteristics of the theme in question. This section outlines the basic overarching analytic perspective and approach that has been applied across all three themes and for the study overall. Exhibit 1-10 presents a schematic view of the overall approach.

Exhibit 1-10: Basic overarching analytic perspective and approach



Source: the authors

The main work of the study has focused on preparing detailed analyses of each of the three core thematic areas – age-friendly information society; ICTs and employment & work; ICTs for independent living and care. Each topic has been addressed through a review of the scientific and policy literature; secondary analysis of available data; supplementary data gathering on policy and practice; and an integration, analysis and synthesis of the evidence base and its implications.

2 An age-friendly Information Society

2.1 Introduction

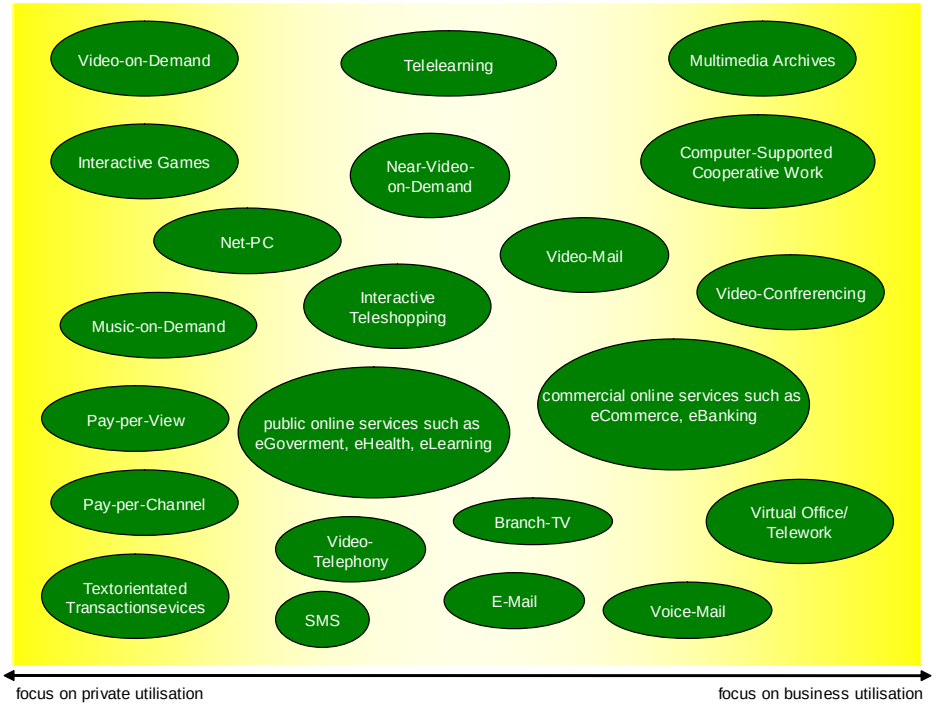
This chapter focuses on the intersection of demographic ageing with the emergence of an Information Society. As set out in the beginning of this report, here emphasis will be given to ICTs in everyday life and how these are impacting on the ways that everyday things are done and the everyday things that are done.

For about the past ten years the concept of an Information Society has been one of the most prominent topics in debates on medium- and long term techno-economic and socio-technological trends in the developed countries. However, despite the extensive attention that this concept has received in political and scientific circles, there is still a sizable amount of confusion about the usefulness of the concept, its definition and meaning for policy-making[5] (DUCATEL et. al. 2000; LASH 2002; MATTERLAT 2003; KLUMPP 2003; CASTELLS 2000a, 2000b, 2004). Nevertheless, there seems to be consensus among the majority of analysts that a core characteristic of the Information Society is the emergence of a socio-technological environment where access to information, interpersonal communication and products is becoming available through a variety of digital access technologies. ICTs allow for a level of interconnectedness which was unthinkable before, giving rise to networks of agents (people, economic entities, other organisations, machines) which develop where interconnection offers new possibilities for improved efficiency, effectiveness and value-added.

Driven by the evolution of telecommunications networks, computer technology and more generally digitisation, and in combination with market and policy related developments, growing parts of the population live and work in digitally "networked" environments. Within these environments new forms of technology-mediated communication, collaboration and production emerge to the effect that "…existing computer-mediated human activities undergo fundamental changes, and a wide variety of new ones appear, such as access to on-line information, e-communication, digital libraries, e-business, on-line health services, e-learning, online communities, on-line public and administrative services, e-democracy, tele-work and tele-presence, on-line entertainment, etc.." (STEPHANIDIS 2001). From a specialist's device, the computer is being transformed into an information appliance for the citizen in the Information Society. Ultimately, a "universe" of new ICT-based applications and services is emerging that goes beyond traditional forms of computing and technology-mediated communication. This is graphically summarised in Exhibit 2-1.

[5] There has recently also been criticism of the concept of the Information Society itself (as being fundamentally different to earlier stages of socio-economic development); see Webster 2002, 2003 for an overview). This debate, however, is of limited value for real-life policy-making, since the fact that ICT-related developments have had a considerable influence on the economy and daily life of people is beyond any doubt.

Exhibit 2-1: The emerging application space in relation to everyday communication and transaction



Source: Adapted from BÜLLINGEN and STAMM 2001: 74

It is beyond dispute that the online world is gaining in relevance not only for professional computer users such as scientific or business users, but also for large parts of the overall population. The latest statistics from Eurostat (CEC 2005d) show that in 2004 47% of citizens within the EU25 were online. Furthermore, broadband penetration is increasing, overtaking previous generations of midband connections such as ISDN (CEC 2005d). Broadband is seen as vital for increasing the value users derive from using the Internet, and for making the Internet become "embedded in everyday life" (VAN DIJK 2005: 113; see also HORRIGAN and RAINIE 2002). Provision of both commercial and public services via the Internet is gaining momentum: eGovernment, eHealth, eLearning and eCommerce applications are showing increasing maturity and acceptance by the EU population. Also, for an ever increasing part of the population, mobile telephony is fully integrated in all aspects of daily life. More than 70% of adult Europeans used a mobile phone in 2003, with further growth now concentrated primarily in the new member states (CEC 2005d).

Primary functions of ICTs for everyday life are usually classified into four main groups: information, communication, transaction and entertainment (cp. VAN DIJK 2005: 112). For the purposes of this study these can be outlined as follows:

- *information retrieval* includes common Internet applications such as searching the web for news, information on political and government related issues, information about health related topics, travel information, weather etc. Online activities that are directly related to transactions (see below) such as search for information on things to buy preceding an online or offline purchase are also covered by this primary function. The mobile phone can increasingly be used for receiving information in data format through text messaging or (in 2.5G and 3G networks) dedicated online services.
- *communication* includes communication via interpersonal channels such as e-mail, instant messaging, chat rooms, participation in online discussion forums. In a wider sense, sharing files and creating web content also fall into this category. Phone calls over the Internet are increasingly becoming common, albeit the application has not reached the mainstream market yet. The most important mobile application is, of

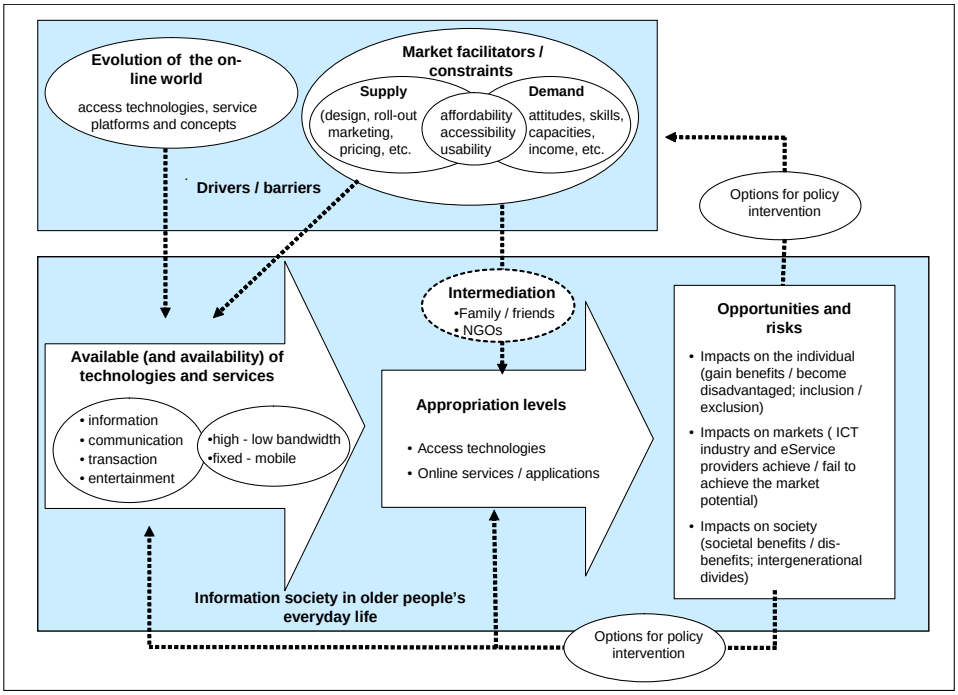
course, making phone calls with mobile devices. At the boundary between communication and information retrieval is phone communication between humans and machines as in the case of intelligent telephone services that generate voice messages as replies to incoming calls.

- *transactions* include online banking and other financial services via the Internet (or applications specific to mobile phone users), as well as online ordering and making reservations via the Internet (or via a data connection accessed by a mobile phone as end device). Many eGovernment applications (e.g. submitting electronic forms), insofar as they involve a transaction in the legal sense, also fall into this category. One of the more fascinating effects of the Internet has been the evolution of online trading and selling between private households through the Internet, mainly by means of online auctions.
- *consumption/utilization* includes popular entertainment related online applications such as retrieval of information on hobby or leisure activities (e.g. sports), downloading or streaming of music files or films, playing games, visits to adult web sites etc. Education applications such as eLearning courses and related services also fall in this category. Depending on definition, there are some overlaps with information retrieval (see above). Consumption/utilization usually involves a preceding financial transaction in the case, for example, of music or film downloads or streams which are provided by commercial services and charged for.

Whether or not ICTs are used for these purposes depends on an actual appropriation of both access technologies (e.g. telecommunications networks and devices) and specific applications (e.g. writing an e-mail, browsing the World Wide Web). Various factors affect the nature and extent of appropriation amongst older people, including the pace of technological developments, market processes and socio-economic and attitudinal factors.

As online applications increasingly penetrate all spheres of life, their utilisation as well as non-utilisation can have an impact on people's every day life, on market developments and on the society as a whole, and older people are no exception to this. Such impacts can pose both risks and opportunities in relation to policy challenges emerging from the demographic change.

Exhibit 2-2: Basic analytic framework



Source: the authors

The analysis in the remainder of this chapter centres particularly on actual ICT appropriation among older people for the primary functions identified above, and on the identification of options for policy intervention directed towards minimising the risks and optimising the opportunities that may go along with this. The overall framework for the analysis is graphically summarised in Exhibit 2-2.

2.2 Older people's current appropriation levels

The following sections present an overview of the available data on the nature and extent of older people's take-up and usage of ICTs and of the online applications and services in the Information Society.

2.2.1 Current utilization of access technologies

Internet through PC

The personal computer (PC) and the Internet are the most prominent examples of so-called Information Society Technologies (IST) today. The PC, originally a stand-alone computing device which depended on floppy disks and keyboard strokes for information input, has been turned into a networked communication device, mainly by more and more computer users logging on to the Internet. PCs have also been made more mobile with the advent of the laptop and notebook computer. Today, simple cell phones contain more computing power than a common desktop PC did only a few years ago. However, for a number of reasons, most of them having to do with usability, the PC is still by far the most common end device for accessing the Internet: 95% of EU25 households with access to the Internet connected to the Internet using a PC, with the rest using other types of access such as digital TV or mobile devices (EUROSTAT 2004).

The SeniorWatch study revealed that a considerable proportion of the 50+ population in the EU15 Member States had already gained hands-on experience with a PC. Some 49 million people (40%) had ever used a computer once in their life. However, this included only 20% of those who were in their 70s and a mere 10% of those aged 80 and above. Roughly one third (36%) had access to a computer at home, and 8% or some 10 million said that they were likely to purchase a computer during the next one or two years. The latter figure did not include those who already owned a PC and planned a renewal of their equipment.

Exhibit 2-3: Computer access and usage among the EU 50+ population in the EU15 countries by age (row %)

Age	PC at home already	Likely to have a PC at home within next two years	Ever used PC / other Computer	Regular computer user	Use of computer at work-place
50-59	56.8	10.8	59.1	46.3	43.3
60-69	31.6	9.3	38.7	22.0	23.8
70-79	19.0	5.0	22.0	11.0	10.5
80+	16.0	2.8	12.1	6.2	2.6
total	36.1	8.2	39.6	26.6	25.7

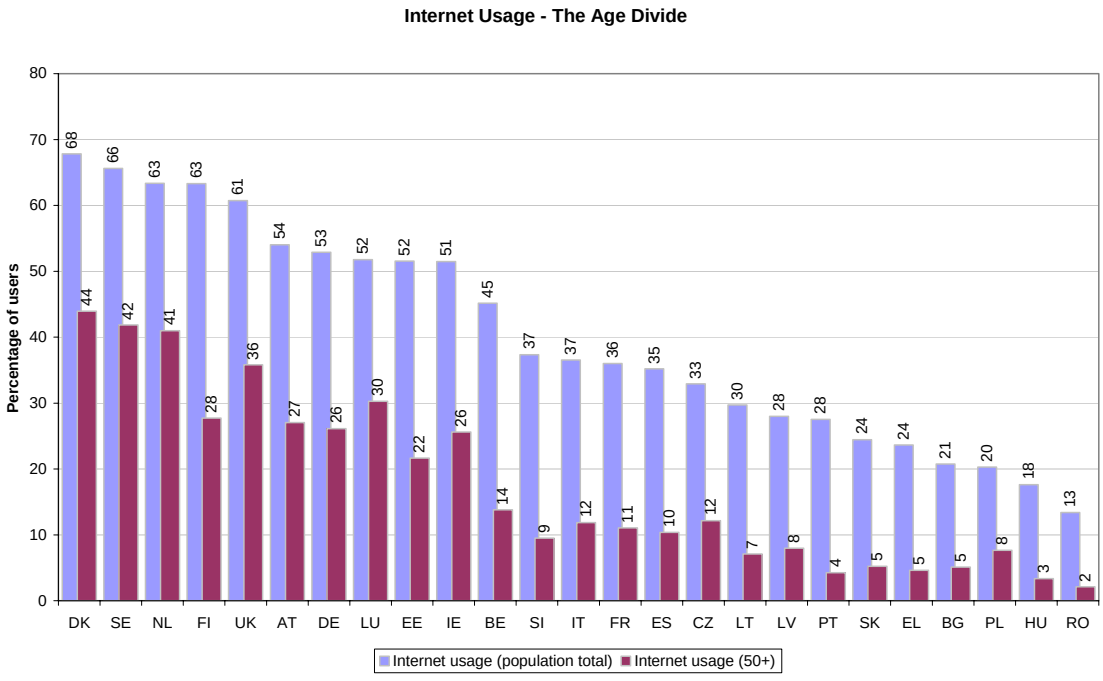
Base: all respondents

Source: SENIORWATCH 2002a: 52

The availability of a computer at home, however, does not necessarily mean that this technology is actually being used. A more recent survey revealed that in the EU15 countries on average 31% of respondents aged 50 and above had actually used a PC during the last four weeks while in the New Member States 14% reported to have done so (SIBIS 2003b). Also, a certain proportion of older adults could be classified as "lapsed users", since they had previously used a computer at earlier times in their life but are no longer doing so on a regular basis. According to the SeniorWatch study, about one quarter of those who had used a computer once in their life time did not do so within the last three months, and another 12% reported to use a computer less often than once a week (SENIORWATCH 2002a). These figures suggest that there may be a significant proportion of older adults who rarely apply their computer skills or have even completely "given up" using this technology. This finding is supported by evidence available from qualitative research suggesting that individuals who had used a computer at work may not necessarily see it as having a role in their life when they retire (SELWYN 2004).

When it comes to Internet usage, the distinction between access in the home and actual usage appears to be somewhat less pronounced. The SeniorWatch study found that in 2001 22% of the 50+ population in the EU15 lived in a household with Internet access while 17% were regularly online, i.e. at least once a month. Overall, the survey results suggested a growth potential for Internet usage in this age group of about 60% between 2001 and 2003, which turned out as fairly realistic. Towards the end of 2002, SIBIS (2003b) reported 25% of the EU15 population in the 50+ age range being Internet users. Despite a steady growth in Internet usage among the 50+ population during recent years usage rates are however still lower when compared with the overall population, and there is noticeable variation as regards the width of the age gap across the European member states (Exhibit 2-4).

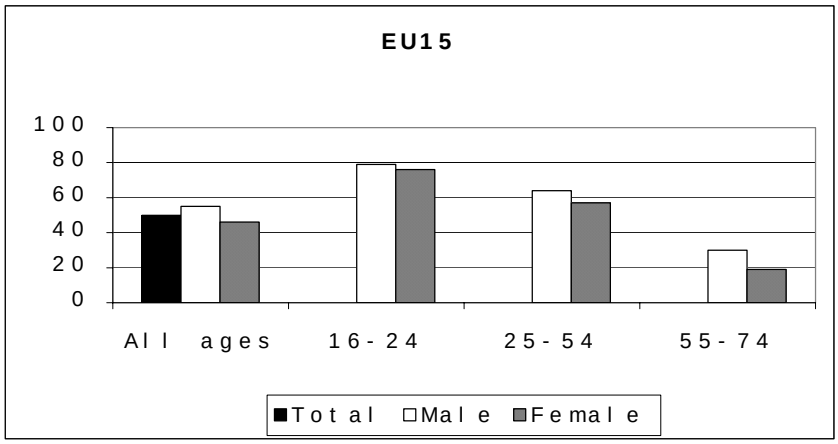
Exhibit 2-4: Internet usage among the 50+ population in the EU25 (in%)

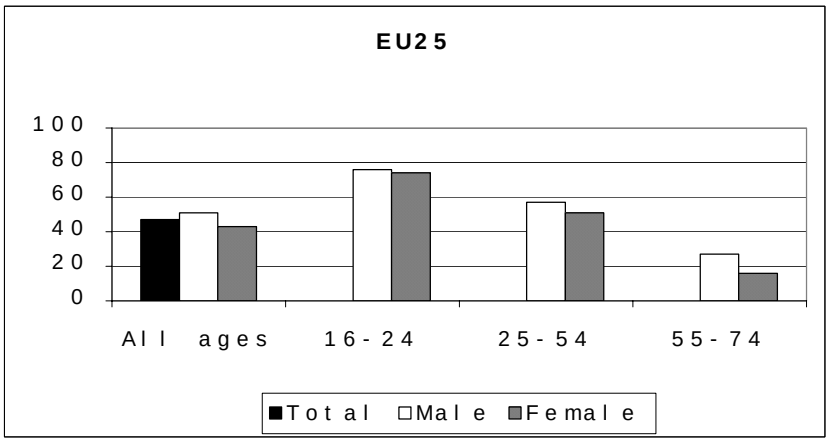


Source: SIBIS 2003b

Exhibit 2-5 shows that in all Member States, and for both men and women, Internet usage is highest amongst those aged 16 to 24, and decreases with age. Across the EU25, three quarters of those aged 16 to 24 used the Internet in 2004 (men: 76%, women: 74%). Amongst those aged 25 to 54 it was just over half (men: 56%, women: 50%), and for those aged 55 to 74 it was a quarter or less (men: 26%, women: 15%).

Exhibit 2-5: Proportion of individuals using Internet 2004 (%) by age and sex (EU-15; EU-25)

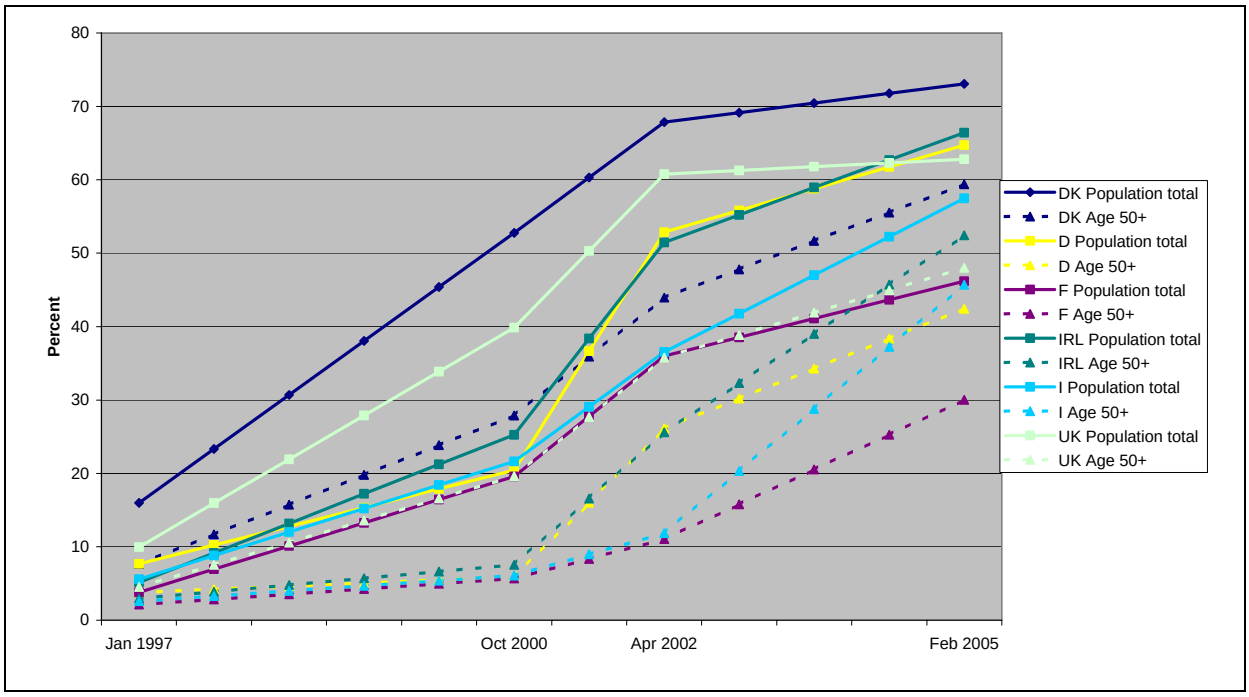




Data source: EUROSTAT 2005 (online database)

Over time, Internet usage among the 50+ population clearly has been increasing with the growing adoption among the general population (Exhibit 2-6). However, only in some countries, for example Ireland and Italy, the width of the "age gap" has narrowed to a noticeable extent during recent years, while in others it remained fairly stable, such as in Germany.

Exhibit 2-6: Development of the age gap in Internet usage in selected countries



Source: own calculation based on data available from Eurobarometer, SIBIS and eUser

This compares with 2004 data for the USA (FOX and PEW INTERNET 2004) that 58% of Americans age 50-64 use the Internet and 22% of those over 65 years of age are online, a jump of 47% between 2000 and 2004 (FOX and PEW INTERNET 2004), although different U.S. surveys have found quite diverging results in this area[6]

There is a burgeoning group of Americans slightly younger than retirees who appear to be very attached to the online world. In early 2004, 62% of Americans aged 50-58 and 46% of Americans aged 59-68 had Internet access in contrast to the 17% of Americans aged 69 and older who had access. The report by FOX and PEW INTERNET (2004) also found that the gender gap which had been 60/40 male to female in 2000 had narrowed to parity in 2004. Online seniors still comprised predominately white, highly educated and living in households with higher incomes.

For Europe it is worth noticing that the usage disparities across different age cohorts within the 50+ age range that were already observed by the SeniorWatch study appear to remain quite stable. The SIBIS survey revealed for instance that while 30% of those in the age range between 50 and 59 years regularly use the Internet only some 5% of those who were 70 years and older reported to do so. Also, the younger age cohorts are more likely to migrate from lower speed to higher speed connections (SIBIS 2003b).

Exhibit 2-7 shows at what type of location people access the Internet. Aggregate data such as this hides considerable differences between countries. These concern, in particular, the role of Public Internet Access Points (PIAPs). In the more advanced Member States, existing evidence suggests that users of PIAPs tend to be those who use the Internet at other places as well (such as students and business travellers) rather than people who cannot afford a home connection. Still, VAN DIJK (2005: 211) points out that PIAPS in the developed world

[6] Earlier surveys in 2003 found more older adults online than the 2004 Pew survey. A 2003 American Association for Retired Persons (AARP 2003) survey found 48% of adults aged 50 or older and 32% of adults aged 65 and older were online. Another random telephone survey by the Center for the Digital Future of 2009 households in the U.S. in 2003 found 67% of adults aged 56-65 and 38% of adults over aged 65 going online.

"help a large part of the 'truly unconnected' and intermittent users to get access when they want it".

Exhibit 2-7: Percentage of individuals with access to the Internet broken down by place of access (EU25) 2004 (in %)

	All ages	16-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	>75 years
Place of education	8	38	7	3	1	1	0	n.a.
Home	35	51	45	42	34	22	10	n.a.
Workplace	19	12	31	28	22	10	1	n.a.

Data source: EUROSTAT 2005 (online database)

For countries with comparably low overall Internet penetration and (related to this) low average household income, data from SIBIS (Exhibit 2-8 and Exhibit 2-9) indeed indicate that PIAPs play a sizable role for providing physical access to the Internet. While in the EU15, the ratio of home access to access exclusively via a PIAP is seven to one, this ratio is on average 1.5 to one in the New Members States and Accession Countries from Central and Eastern Europe.

Exhibit 2-8: Home access to the Internet and use of Public Internet Access Points[7] in the EU15 (in%)

	NL	SE	DK	US	CH	UK	FI	IE	DE	LU	AT	IT	BE	ES	FR	PT	EL	EU 15
Broadband	15	15	16	17	10	10	6	2	9	3	11	3	16	6	5	3	2	8
Narrow/ midband	48	36	37	35	31	23	35	30	30	37	26	24	14	15	17	12	10	24
Unknown access	10	15	11	12	20	25	17	21	11	10	10	13	11	10	8	6	5	13
No Internet access	28	34	36	37	40	42	42	47	50	50	53	59	60	70	70	79	83	56
Thereof: PIAP users	3	5	7	7	2	7	7	9	6	7	7	3	8	10	6	7	8	6
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: own calculation based on data available from SIBIS 2002

Exhibit 2-9: Home access to the Internet and use of Public Internet Access Points in 10 Newly Associated States (in%)

	SI	EE	CZ	PL	HU	LT	BG	SK	LV	RO	NAS10
Broadband	2	7	0	0	1	1	1	0	0	0	0
Narrow/ midband	27	15	14	11	9	7	8	8	5	4	9
Unknown access	5	4	4	2	1	2	1	1	2	1	2
No Internet access	66	73	81	87	89	90	91	91	93	96	89
Thereof: PIAP users	4	12	7	5	4	13	9	10	12	8	7
Total	100	100	100	100	100	100	100	100	100	100	100

Source: own calculation based on data available from SIBIS 2003

[7] Including educational institutions, libraries, Internet cafés, etc.

Some national governments have started to implement a public infrastructure made up of PIAPs in order to target, in particular, older citizens. One such example is the UK where about 6000 online centres addressing this special group were successfully established in 2002. The National Audit Office- NAO (2003) found first evidence that such services can indeed play a vital role in bringing non-users in contact with the Internet and allow them to gain first-level experience with using it. Conditions for success, however, are that the offer is clearly targeted to those who are least likely to use the Internet otherwise (e.g. the majority of the elderly) and that practical support and guidance is offered by experienced trainers with sufficient time available.

Broadband Internet

Broadband is offered on the market often with a flat rate tariff structure which enables users to stay "always on" – this has been found to make a radical difference to the way people perceive the Internet as daily tool, and how they behave with regard to the types of activities they carry out online (NTIA 2002).

The abolishment of metered online access has been found to have radical effects on user behaviour, which might go so far as to turn on its head traditional usage patterns. For the USA (which had flat rate tariffs much earlier than Europe), WEISS (2001) reported that the lower (!) the Internet user's income the more time she or he is likely to spend online. The report concluded that Americans at the lower end of the socio-economic ladder are more likely to regard the Internet as a kind of home entertainment centre – assuming they can at least afford basic access.

When preparing the follow-up to the first eEurope Action plan, the European Union recognised the importance of broadband access and made it one of the cornerstones of the eEurope 2005 Action Plan (CEC 2002g). It included measures on removing the obstacles to the deployment of broadband networks and connecting schools, workplaces and healthcare organizations to broadband. The promise of broadband for seniors as outlined by ADLER (2002) is that it will enhance communications with family and friends, expand opportunities for lifelong learning, improve the delivery of health and medical services, support independent living and create new options for entertainment (ADLER 2002).

Eurostat data (EUROSTAT 2005, online retrieval) shows that among the Member States for which data is available, the proportion of households with a broadband connection in 2004 was highest in Denmark at 36%. Countries with low broadband penetration rates were Greece (0%), Cyprus (2%) and Ireland (3%). Closer analysis of the data by EUROSTAT (2005a) notes "that in many countries, broadband penetration has now overtaken ISDN in households. It is notable that, from the data available, broadband take-up is greater in households with dependent children rather than those households with no children." Given that older adults generally live in households without dependent children this finding has implications for the penetration of broadband to this age group.

Exhibit 2-10 presents data from the EUSER project (2005) on types of Internet access homes were fitted with broken down by age. These data show that the standard dial up via narrowband or mid-band was the most prevalent mode of access across all age groups. Also, it can be seen that likelihood of being in a broadband household decreases with age.

Exhibit 2-10: Type of Internet access at home

Age	Broadband	Narrowband or Midband	Unknown bandwidth	Total
18 - 24	46.7	47.4	5.9	100.0
25 - 34	40.6	53.4	5.9	100.0
35 - 49	39.1	52.8	8.1	100.0
50 - 64	34.1	51.5	14.4	100.0
65+	28.7	54.7	16.7	100.0
Total	38.8	51.9	9.3	100.0

Base: All who have Internet access at home

Data source: EUSER 2005, EU10.

In the U.S., FOX and PEW INTERNET (2004: 3) found that 72% of U.S. seniors with home access connect to the Internet via a dial-up connection, compared to 54% of the general population with home access. Broadband penetration in the U.S. more than doubled from 9.1 percent in September 2001 to 19.9 percent in October 2003 according to a report by the National Telecommunications and Information Administration and the National Economics and Statistics Administration (2004: 1). This report found that users with broadband connections are more likely to be daily Internet users (66.1%) compared to those with dial up service (51.1%) and that those with broadband at home also engage in more types of activities online, particularly in the areas of entertainment, banking, purchasing products or services and obtaining information.

Mobile networks and end devices

When compared with the Internet, the European mobile phone market has matured more quickly. While the highest share of mobile phones users can today be found in the age group up to 24 (86% in 2002-3) (SIBIS 2003a), older adults use this technology to a significant extent as well. Today, mobile telephony using digital networks is the ICT which is most widespread among all age adult groups, and text messaging one of the most popular applications in the digital domain. This makes the mobile phone device of special interest for the development of services that are targeted at the entire population. This development also poses considerable challenges, though, since the trend towards miniaturisation which has been guiding developments of mobile end devices is problematic from a usability viewpoint.

As in the case of the Internet and personal computers there are considerable differences between Member States. While in the EU15 Member States 63% of the 50-64 year olds and 38% of those aged 65+ own a mobile, only 32% and 12% do so, respectively, in the New Member States.

Although many older adults seem to appreciate their mobile phone in the first instance as a kind of security device rather than as a tool for social communication, they nevertheless appear to regularly utilise this technology for communication purposes. According to the SeniorWatch survey about one half of the mobile phone owners aged 50 and above in the EU15 Member States stated that they had obtained their mobile phone mainly for security reasons while only 27% said that they had obtained it mainly for their own convenience. Only 10% responded that the main reason for obtaining a mobile phone was to communicate with friends and family. On the other hand, nearly 90% had used their mobile phones during the last month (SENIORWATCH 2002a: 79).

According to the more recent SIBIS survey, text messaging (SMS) has a fair share of older users, contrary to perceptions that associate SMS mainly with young people. For the EU15

SIBIS gives a SMS usage figure of 34% of the 50-64 age group and 15% for those aged 65 and over. Interestingly, figures for SMS usage are even higher in the New Member States, with 62% for the 50-64 age group and 30% for the 65+ group. All age groups use SMS primarily for communication; downloading ringtones and logos or paying for services via SMS is generally still in its infancy and happens hardly at all in the older age groups (SIBIS 2003b: 26-27).

Other access technologies

Other ICTs such as interactive television, video telephony and smart cards may also become more common as the trend towards the networked society further progresses. Considering a range of electronic media and devices that one can commonly come across in today's households, the SeniorWatch survey found that, contrary to popular belief, older adults are not per se "technophobes" and that many use electronic applications and devices to a significant extent (SENIORWATCH 2002a). On average, 4.5 electronic applications/devices were used among the 50+ population in the EU15 member States. Importantly, the study also revealed that the 50+ population within a given country must not be seen as homogenous group in relation to ICT usage, and it was found that considerable diffusion disparities across countries exist. The Dutch 50+ population used 6.5 applications/devices on average whilst Portuguese seniors used only 2.2. A clear north-south gradient emerged from these data. As regards specific devices, while the traditional TV set reached equal penetration levels – between 97% and 99% – across different age cohorts, utilisation of more sophisticated electronic applications/devices – e.g. digital TV, DVD players, answering machines and the like – clearly declined with increasing age (SENIORWATCH 2002a: 85).

Interactive services through digital television do not yet play any significant role in most EU countries. An exception is the UK where – according to a report by MORI (2002) – 43% of viewers had access to digital television in 2002. The UK government has started to experiment with using digital television for the delivery of public services. A number of public sector websites are now available in versions for digital television, allowing users to interact with it through their remote control (NAO 2003). There is the hope that the television may be successful in reaching people – especially older citizens – who are unlikely ever to be won over to use a computer for accessing government services. It is too early yet, however, to assess the success of the initiative: The NATIONAL AUDIT OFFICE (NAO 2003: 27) warns that "interactive services [for television] are expensive to develop and the market remains volatile".

2.2.2 Internet usage for primary functions everyday life

As noted earlier, physical access to the Internet is a necessary requirement, but by no means a sufficient condition for older person's full participation in the Information Society. Equally important are the purposes for which the Internet, and other ICTs such as mobile end devices, are used, and the personal benefits derived from utilisation of these tools.

The following Exhibit 2-11 and Exhibit 2-12 show the use of the Internet by application and by age group with the percentages changing depending on which groups are examined. E-mail is universally popular among all age groups with younger adults more likely to download music or games. It is interesting to note the use of financial services and finding out about goods and services by the 55+ age group.

Exhibit 2-11: Percentage of individuals using the Internet for specific purposes (EU25, 2004)

	All ages	16-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	>75 years
E-mail	40	62	55	46	35	23	11	-
Financial services	18	16	30	24	17	11	5	-
Playing/downloading games/music	17	48	24	15	10	5	2	-
Finding out about goods and services	38	51	55	47	35	22	9	-
Reading/downloading online newspapers	18	29	27	18	14	8	3	-

Source: EUROSTAT 2005 (online database)

Exhibit 2-12: Individuals who used the Internet in the last 3 months for specific purposes, as percentage of Internet users (EU 25, 2004)

	All ages	16-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	>75 years
E-mail	81	80	84	81	78	80	84	-
Financial services	37	21	45	43	39	39	36	-
Playing/downloading games/music	35	62	36	27	21	18	18	-
Finding out about goods and services	77	66	84	83	78	75	70	-
Reading/ downloading online newspapers	35	38	42	32	32	29	23	-

Source: EUROSTAT 2005 (online database)

The 2002 Flash Eurobarometer 135 (EOS GALLUP EUROPE 2002) gave a slightly wider selection of applications (Exhibit 2-13) which shows the 55+ age group less active in each category but (amongst those who were Internet users) clearly using the Internet almost as often as Internet users in the younger age groups for e-mail, online banking, seeking health information, seeking information on travel/tickets and booking for events. E-mail is a universally popular use of the Internet across all generations online.

As regards the purposes the Internet is utilised for, older Internet users do not appear to have radically different interests compared to younger onliners, apart from some exceptions. Regardless of age, the Internet is in the first instance regarded as a means to look up information on certain issues and to communicate with others by e-mail (Exhibit 2-14). Using the Internet for transaction purposes appears to be somewhat less important for all age groups, with young adults being an exception in this regard. Older users in particular appear to be less interested in downloading music/games and online purchasing.

Exhibit 2-13: Purposes of Internet use, as percentage of all Internet users (EU15)

	15-24 years	25-39 years	40-54 years	55+ years
send/ retrieve your e-mail	82	79	74	73
online banking op.	21	39	36	32
look for news/ topical items	78	75	72	60
seek health-related advice	33	43	42	40
find job ads	35	39	28	9
take part in forums/ discus.	45	20	15	8
education improve training /education	59	47	42	32
seek travels info, tickets,	53	68	67	62
book shows/ events tickets	26	33	30	24
for other private use	2	2	1	2
not used for private use	2	4	6	7

Data source: Flash Eurobarometer 135 (EOS GALLUP EUROPE 2002)

Exhibit 2-14: Importance of online activities, by age group (average score, 1=not important, 5=very important)

	18 – 24 years	25 – 49 years	50 – 64 years	65+ years	Total population
(a) being able to keep in touch with people through e-mail	3.91	3.85	3.71	3.57	3.81
(b) being able to look for information about important or interesting things	4.46	4.45	4.29	4.05	4.39
(c) using it for leisure pursuits, e.g. playing online games or downloading music	3.10	2.48	2.08	2.10	2.47
(d) being able to pay bills or doing your banking online	2.91	3.22	2.88	2.67	3.07
(e) being able to buy goods, book tickets and so on online	3.32	3.35	2.96	2.43	3.20

Base: All who have used the Internet last three months for private purposes

Data source: EUSER 2005, EU6.

Exhibit 2-15 presents data from FOX and PEW INTERNET (2004: 10) sorted by activities that are pursued by online seniors (here defined as persons aged 65 or older) more or as much as by Internet users in younger age groups. Types of activities more popular among younger users included using search engines to find information (90%/80%), researching products before purchasing (79%/60), information on hobbies (77%/52%), check the weather (76%/60%) get news (71%/59%), surf the web for fun (68%/54%) get sports information (44%/ 34%), sending instant messages (40%/28%).

Exhibit 2-15: Older Americans' online activities

Share of Internet users in each age group who have used the Internet for some popular online activities			
	16-64 years	**65+ years**	**all users**
Uniform popularity			
Send or read e-mail	91	94	91
Look for health or medical information	66	66	66
Go to web site that provide information or support for a specific medical condition or personal situation	54	53	54
Get financial information	44	41	44
Play a game	40	35	39
Look for religious or spiritual information	29	26	29
Buy or sell stock, bonds or mutual funds	12	15	13
Make a phone call online	11	9	11
More popular among wired seniors			
Research family history or genealogy	23	36	24

Source: FOX and PEW INTERNET 2004: 10

A survey by SENIORNET (2004), the large U.S. based organisation dedicated to train older adults on computers and Internet, in the summer 2004 also indicated the wide range of online interests among elderly Americans – e-mailing friends and family (71%), e-mailing photos (39%), finding health information (37%), being more efficient at Internet transactions or online shopping (33%) and creating printed photos or photo albums (32%).

Loges suggested that that digital divide between older and younger people extends beyond access. In a study he found that the difference in connectedness was specifically due to older adults pursuing a narrower scope of goals and activities online, using fewer Internet applications and using the Internet in fewer places than younger adults. The relationship between age and Internet connectedness remained even after controlling for substantial inequalities of access by ethnicity (LOGES and JUNG 2001).

2.3 Facilitators and constraints of take-up and usage

As presented in the previous section, there is extensive empirical evidence that ICT uptake tends to be considerably lower among older adults than among younger age cohorts. The reasons for this are manifold (see SENIORWATCH 2002c for an overview). This section looks at available evidence on the factors that facilitate or constrain take-up and usage of ICTs by older people. Attention is given both to demand side (relevant characteristics of older people) and supply side (activities of the main market players) factors. The role of intermediaries in relation to older people's engagement with the Information Society is also briefly explored.

2.3.1 Personal characteristics and circumstances

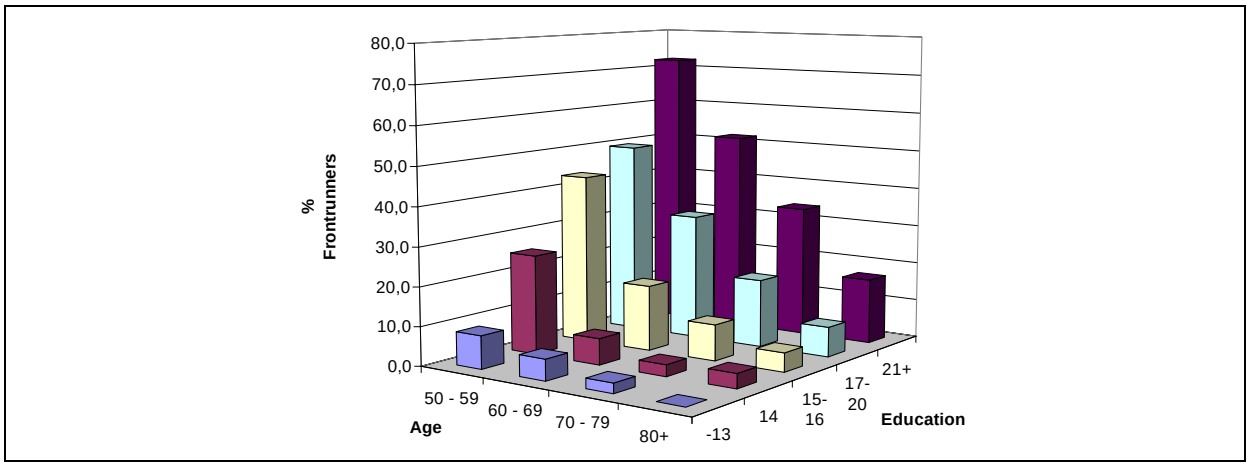
It appears that a variety of factors come into play in affecting take-up and usage amongst older people, reflecting both the usual "digital divide" faultlines of socio-economic stratification such as education and income and some factors that are more closely linked to

older age groups, per se, such as functional changes associated with ageing, attitudes and history of exposure to technology (MURDOCK 2002).

Socio-economic factors

Socio-economic factors appear to have a strong impact on older European's propensity to get involved in ICTs. Those older people who utilise ICTs for their purposes tend to be younger but also better educated; they tend to have a rather active life style and are on average better off in economic terms (SENIORWATCH 2002c; FOX and PEW INTERNET 2004). In other words, whether or not older Europeans engage themselves with ICT cannot merely be regarded as a matter of biological age, but is strongly associated with several dimensions of social stratification. The SeniorWatch study revealed, for instance, that the better educated "older old" are more likely to belong to the group of "experienced frontrunners" than the less educated "younger old" (Exhibit 2-16). Both factors - age and educational attainment - exhibit an independent influence on the propensity to utilise ICTs. Keeping the age factor constant, ICT uptake increases with educational attainment and – vice versa – keeping educational attainment constant ICT use decreases with age. Similar patterns can be observed with respect to other dimensions such as income and life style.

Exhibit 2-16: The "experienced ICT frontrunners" among the EU-15 50+ population according to age and education[8] (in%)



Source: SENIORWATCH 2002c: 9

Although older adults' propensity to utilise ICTs is influenced by the interplay of various socio-economic dimensions, multivariate analyses of the Seniorwatch data suggest that a person's educational attainment has an particularly strong influence and that income is also a very discriminating factor. Both dimensions are of course linked to occupational participation and professional characteristics that are likely to facilitate or obstruct access to and/or usage of ICTs during working life. Furthermore, educational background and consequently occupational status may affect the development of the personal capabilities that are required when coping with technology-related innovations. This may for instance concern the acquisition of required skills, but also habitual strategies in coping with problems in one's working life. In this regard, for example, a study by CUTLER et al. (2003) found that the lower rates of home computer availability and use exhibited by older persons can be accounted for to some extent by age group compositional characteristics (education, income, race, disability etc) but that attitudes, experience and support also seem to play a role.

[8] This chart was derived from a clustering of respondents according to their level of ICT involvement measured in terms of ICT usage as well as ICT-related skills and attitudes. The level of educational attainment was measured in terms of the age at which education was terminated.

Analysis of the socio-economic factors which correlate with differences in uptake of an innovation are usually carried out through multivariate analysis. While this type of analysis helps to shed light on the underlying discriminating factors that (partly) explain the likelihood of a person taking up an innovation such as the Internet, multivariate analysis suffers from some shortcomings. Mainly, it does not tell anything about the processes, cognitive and otherwise, which are involved in the decision to adopt the technology (or to stay away from it). For guiding policy-making, it is therefore necessary to take a closer look at the attitudes and behavioural patterns of ICT users and, in particular, non-users. Most of the research findings of relevance for this purpose stems from survey research based on interviews or from qualitative research, for example using focus group discussions and user trials. Some of the main findings are presented below.

Attitudes and motivation

On the basis of a representative survey of older adults' computer usage as well as ICT-related skills and attitudes, the SENIORWATCH study (2002c: 5) calculated a generic typology describing people's engagement with ICTs :

- The "experienced frontrunners" include computer users with professional or advanced skills and/or using a computer at least once a week (27% of the 50+ population in the EU15 in);
- The "late beginners" include computer users with less than advanced skills and/or using a computer less often than once a week (13%) ;
- The "technologically open minded" include non-computer users who are keen on learning about new technology and/or who wish to improve their computer skills (29%);
- The "digitally challenged" include non-computer users who are not interested in learning about technology and/or who do not wish to improve their computer skills (31%).

According to this typology, the majority of 50+ population tends to be open-minded towards new technologies in a general meaning. Even within the age range between 70 to 79 years more than one half were at least interested in ICT, and among those who are 80 years and above interest was not much lower (49%). At the same time, nearly one third of the EU 50+ population in the EU 15 were not at all interested in ICT, and this concerns not only the older age cohorts. Nearly one fifth of the respondents who are in their 50's belong to the technology "want-nots", and even 30% of those in the age range between 60 and 70 years do so (SENIORWATCH 2002c: 6).

Many other studies have confirmed that lack of interest and low motivation are key reasons for non-usage and non-access among large parts of the elderly. FOX AND PEW INTERNET (2004) found wide-spread lack of interest, with eight in 10 offline seniors thinking they will never go online. These people usually do not have people who use e-mail or the web among their peers, which might be one reason why they claim not to know why they should spend time and money on learning how to use a computer. With respect to home access to the Internet, the EUSER survey revealed that in the age range between 50 and 64 years about half of those who do not want home access mentioned perceived lack of usefulness being a reason for that (Exhibit 2-17). Among those aged 65 years and above, the share even increases to 61%. For a noticeable part of older non-users the perceived potential benefits of the Internet do not seem to justify the costs and effort that would be involved in going online.

Findings by SELWYN (2004) reveal that older users question the relevance to their everyday lives. She argues that older adults should be involved in changing ICTs to make them a more interesting, attractive or useful option for themselves.

Exhibit 2-17: Reasons for not having Internet access (% of all respondents per age group)

	18 – 24 years	25 – 49 years	50 – 64 years	65+ years	Total population
(a) Access to Internet elsewhere sufficient	71.4	53.9	41.7	29.0	43.5
(b) Internet not interesting/useful enough	33.2	29.7	51.6	60.9	46.1
(c) Costs too high	41.9	45.5	43.3	41.1	43.2
(d) Internet too complex to use	10.2	18.4	37.1	50.9	33.7
(e) Privacy or security concerns	13.0	34.7	41.7	35.7	35.4
(f) Physical impairment	0.7	2.6	6.5	12.5	6.8

Data source: EUSER 2005, EU6. Base: All who have no Internet access at home Source: EUSER 2005, EU6.

Computer anxiety (ROCKWELL and SINGLETON 2002) and intimidation by technology also appears to affect a considerable share of older persons and many older people express a fear that they will break new technology they attempt to learn. VAN DIJK (2005) distinguishes computer anxiety from computer frustration which occurs as a consequence of initial contact with computers. SEGRIST (2004a,b) investigated the barriers to continued computer usage among older graduates of a SeniorNet computer training programme. Among those who did not continue using a computer the primary reasons given were technical inhibition, reliance on others, and insufficient motivation.

Older persons also often have difficulties in formulating problems and face barriers in interacting with hotlines and call centres staffed by young employees. Psychological hindrances included impatience, uncertainty, and anxiety in exposing themselves by asking stupid questions. Manuals (or the absence of same) seem to be particularly problematic.

Another issue is the fast pace of hardware and software development which is problematic because older people often prefer to stick to machines and programmes with which they are familiar. The EUSER (2005) survey found that, with the exception of the youngest generation in the sample (18-24), all age groups are similarly affected by the impression that "taking up with computer developments takes very much time". Every second person over the age of 24 agrees to this statement (values 4 or 5 on the five-point scale). This, therefore, does not seem to represent a problem which is specific to age, but rather to the structure of the market and the speed of market-driven developments in the home computing area. However, it may have a stronger effect on older users because social pressure to update hardware and software is likely to be smaller.

Skills

Another cause for lack of interest, but also a logical outcome of it, are missing skills in how to access and use the Internet and the access device, which today still means a personal computer in the large majority of cases. As the SeniorWatch study has shown, many older people appear to lack the necessary skills to fully utilise products and services, which they may in principle be interested in. For instance, about one half of those 50+ who reported to have hands-on experience with a computer said that they possessed merely rudimentary computing skills, and 10% even said that they 'virtually do not have a clue' (SENIORWATCH 2002a). Similarly, Exhibit 2-18 to Exhibit 2-21 present the results of the EUSER investigation into self-assessed skills in using Internet and computer. Note that what is assessed here is not necessarily the degree of skills, but rather the confidence of users (and non-users) in their skills.

This difference is important because it can be hypothesized that for feeling happy with using the Internet as an alternative to more established channels to receive public services (in EUSER: government/public administration services, lifelong learning and health services), people must feel confident in using computer tools and the Internet. Confidence here means

that they must feel to be in control of things and that they feel able to achieve online what they expect to achieve. Exhibit 2-19 shows that among all adults with Internet user experience (however fleeting), about 58% are very confident about their skills in using search engines. This share decreases with age. Still, only 12.5% of Internet users aged 65 or older feel not confident in using a search engine.

Exhibit 2-18: Confidence in own digital skills

	18 – 24 years	25 – 49 years	50 – 64 years	65+ years	Total population
Using search engine	4.54	4.31	4.00	3.89	4.25
Using e-Mail	4.50	4.36	4.19	4.10	4.33
Dealing with Computer Problems	2.86	2.64	2.33	2.20	2.58

Scale: 1 (not at all confident) –5 (very confident); Base: Respondents who have at least once used the Internet

Data source: EUSER 2005, EU6.

Exhibit 2-19: Confidence in skills to use search engine, by age group

Age	not at all confident ◄				very confident ►	dk	Ø	Base as share of total pop.
	1	2	3	4	5			
18 – 24 years	2.3	2.2	5.8	18.8	70.8	0.1	4.54	95.1
25 – 49 years	4.3	3.0	10.8	21.3	60.3	0.3	4.31	83.5
50 – 64 years	7.3	5.9	14.9	22.6	48.7	0.6	4.00	57.2
65+ years	7.9	4.6	15.1	28.6	38.0	5.8	3.89	26.1
Total population	4.9	3.6	11.2	21.7	57.9	0.7	4.25	68.1

Base: Respondents who have at least once used the Internet

Source: EUSER 2005, EU6.

As regards confidence in using e-mail (Exhibit 2-20) a similar pattern emerges. However, more of the older age group feels very confident in this case. This underlines the character of online mail as a “killer application” for all age cohorts. More critical is the situation with regard to skills in dealing with computer problems (Exhibit 2-21). In the age groups 50-64 and 65 or older, the majority feel not confident in dealing with technical computer problems. While this is an important issue for younger persons as well, older Internet users are much more likely to be influenced in their decisions about online activities by their lack of confidence in mastering the technology they are having to use for this purpose.

Exhibit 2-20: Confidence in skills to use e-mail, by age group

Age	not at all confident ←				very confident →	dk	Ø	Base as share of total pop.
	1	2	3	4	5			
18 – 24 years	3.5	2.4	6.3	16.0	71.6	0.2	4.50	95.1
25 – 49 years	5.5	3.5	8.0	14.7	67.5	0.7	4.36	83.5
50 – 64 years	4.9	3.3	15.8	19.3	55.7	1.0	4.19	57.2
65+ years	8.1	4.8	10.3	18.2	53.2	5.4	4.10	26.1
Total population	5.3	3.4	9.5	16.1	64.7	1.0	4.33	68.1

Base: All who have at least once used the Internet

Source: EUSER 2005, EU6.

Exhibit 2-21: Confidence in skills to deal with computer problems, by age group

Age	not at all confident ←				very confident →	dk	Ø	Base as share of total pop.
	1	2	3	4	5			
18 – 24 years	18.8	18.2	32.9	18.1	12.0		2.86	95.1
25 – 49 years	26.2	19.8	27.6	14.0	11.2	1.1	2.64	83.5
50 – 64 years	39.0	16.1	23.0	12.0	8.1	1.8	2.33	57.2
65+ years	38.5	19.8	23.1	8.0	6.0	4.6	2.20	26.1
Total population	28.6	18.8	27.1	13.8	10.3	1.3	2.58	68.1

Base: All who have at least once used the Internet.

Source: EUSER 2005, EU6.

The environment

Compared to younger people, older adults are disadvantaged by lacking access to the Internet outside their home, for example in an educational or occupational context. As will be discussed further below, this is an even more important factor in explaining disparities between young and old in endowment with digital skills. Several studies point to adult children or close relatives as being instrumental in getting older adults online and in teaching them how to use the Internet and related applications. It is likely that this lack of support/encouragement or ability to provide support to aging parents or relatives is also a barrier to older adults getting online. An investigation by EUROSTAT (2005a) found the size of household was related to the uptake of broadband with households without dependent children less likely to have broadband. This is significant since elderly people are more likely to live alone or in a household without dependent children. Flash Eurobarometer 135 (EOS GALLUP EUROPE 2002) found there is an increasing relationship between the size of household and access rates with respondents living in larger households more likely to use the Internet than those living alone.

Data from the USA show that one in four Americans has neither used the Internet nor knows anyone who does it. Seniors naturally make up a large portion of these "truly disconnected" Americans (FOX AND PEW INTERNET 2004). An American Association for Retired Persons (AARP 2003) survey of younger people aged 25-44 in 2003 found that six in 10 respondents

helped set up a computer for older relative. Eight in ten respondents said they taught an older relative how to use a computer and forty-five per cent of seniors asked their children or other younger relatives for help searching for information related to travel and entertainment. Older adults first contact with computers is often via their children giving parents a computer they are upgrading (ADLER 2002).

Adoption rates of new technologies are also slower because the large majority of today's retired adults have not been exposed to them when still in employment. Many were simply not at work anymore when computers became standard issue in the workplace. Recent research in the U.S. showed that many seniors have an antiquated notion of computers, counting their experience of punch cards in the 1960s or of dumb terminals connected to giant mainframes as computer experience (FOX and PEW INTERNET 2004).

Because of the specific features of computers and the Internet, practical experience with using these as tools for carrying out tasks which are related to everyday life is of strong importance for convincing people of their practical usefulness. For Europeans who do not belong to the age cohorts that have grown up with the Internet, using personal computers and the Internet at work is usually the decisive step for becoming interested in using at home, for private purposes, as well (VAN DIJK 2005).

Functional restrictions

Gerontological research has shown that sensory capabilities (e.g. visual, audio, tactile) as well as cognitive ones – particularly in relation to apperception speed – tend to decline with growing age (REISCHIES and LINDENBERGER 1996; MARSISKE et al. 1996). Also, there is a link between age and disability in the sense that a large proportion of disabled people are older adults (ROE 1995). The SeniorWatch survey provides strong evidence that a large proportion of older adults face functional restriction when using ICTs, while the severeness of the reported restrictions tends to increase with age (Exhibit 2-22). For instance, in the EU15 Member States 26 million people aged 50 and above (21% of this age group) are severely functionally restricted in manipulating a keyboard, reading small print on a screen or in relation to their hearing capabilities (SENIORWATCH 2002c: 26).

Exhibit 2-22: Prevalence of functional restrictions as % of older population

	Age class				
	50 - 59	**60 - 69**	**70 - 79**	**80+**	**total 50+**
Vision problems					
severe problems	10.2	10.0	14.0	23.3	12.1
some problems	26.4	25.4	30.8	24.8	27.1
Hearing problems					
severe problems	3.0	3.8	5.8	12.5	4.7
some problems	18.5	28.0	31.8	36.2	26.2
Dexterity problems					
severe problems	6.0	10.0	12.6	15.8	9.7
some problems	17.4	18.1	20.4	27.3	19.2
Any of these					
severe problems	16.7	19.3	25.1	38.6	21.4
some problems	41.1	43.9	44.6	39.7	42.7
total: problems	57.7	63.2	69.7	78.3	64.1

Source: own presentation based on data available from SeniorWatch 2002

The survey also revealed that older persons who are functionally restricted (visually, dexterity) are significantly less likely to frequently use a computer, and this is not the case because they were less open minded towards technology (KUBITSCHKE et al. 2002). In fact, they tend to be even more keen on learning about new technologies or to improve their computer skills when compared with overall 50+ population. Their share in the group of the "technologically open minded" is significantly higher than the share of those without any functional restrictions. There is strong evidence which suggests that functional restrictions and disability have a negative effect on the likelihood of a person using ICTs, also after controlling for correlating third factors such as age, educational attainment, household status etc (SENIORWATCH 2002a).

In a U.S. study by FOX and PEW INTERNET (2004: 12), 28% of seniors reported that a disability or chronic illness kept them from participating fully in work, school, housework or other activities. Americans of all ages who are living with a disability have among the lowest rate of Internet access in the country, 4 in 10 compared to 6 in ten for the general population. Non-users with a disability are less likely than other non-users to believe they will ever use the Internet and less likely than others to have friends or family who go online.

A recent Eurobarometer study (EOS GALLUP EUROPE 2002: 4, 9) investigated that EU citizens with health problems, illnesses or disabilities are a lot less likely to have access to the Internet – 25% compared to the global 43%. On further cross analysis it was found that 13% of those with a physical or mental illness or disability that hampered their daily activities had access, an even wider gap between this group and the global population.

A U.S. National Telecommunications and Information Administration (NTIA 2001) report states that the relatively few respondents who have disabilities at the lower end of the age range and the relatively few respondents who use computers and the Internet at the upper end of the age range severely limit the degree of desegregation that could be undertaken in considering the question of computer and Internet use by people with disabilities within relevant age categories. Nevertheless in looking at very broad age categories they found that people over the age of 60 are less likely than other age groups to have a computer in their home or to use the PC or the Internet in the home and for those with a disability the use rates are even lower. In addition people in this age group were much less likely to use the Internet outside of home. The report concludes that the data suggests that people with disabilities tend to use computers and the Internet at rates below the average for the population.

Data in a follow up report (NTIA 2004) which delineated access by age and disability status is presented in Exhibit 2-23 below.

Exhibit 2-23: Percentage of Internet users living in a broadband household (october 2003)

	Internet users (per cent)	Lives in a broadband household
Total Population	58.7	22.8
Age Over 60		
Multiple disabilities	8.3	5.9
Blind or severe vision impairment	23.0	11.0
Deaf or severe hearing impairment	23.6	6.2
Difficulty walking	20.7	6.6
Difficulty typing	26.1	9.6
Difficulty leaving home	10.5	6.3
None of these disabilities	34.2	10.9

Source: NTIA 2004

The same report also provided the same breakdown by age and disability for non-Internet users which is presented in Exhibit 2-24. This shows the rate of non-use for older people with a disability are significantly higher than the general population.

Exhibit 2-24: Percentage of non-Internet users with a disability over 60 years of age (october 2003)

	Non-Internet users (per cent)
Total Population	41.3
Age Over 60	
Multiple disabilities	91.7
Blind or severe vision impairment	77.0
Deaf or severe hearing impairment	76.4
Difficulty walking	79.3
Difficulty typing	73.9
Difficulty leaving home	89.6
None of these disabilities	65.8

Source: NTIA 2004

Costs

According to the EUSER survey high costs play a role for around 40% of persons without home access, regardless of age. It appears that costs do play a role for households with low income across all age groups. However, since low income households tend to be over represented among the older age groups in most EU countries, financial incentives will play some role for addressing the issue of non-use among older persons.

2.3.2 Market processes

Older adults represent a market segment that - if adequately addressed - offers tremendous market opportunities for the telecommunications industry, equipment manufacturers and service providers. As already discussed earlier, two thirds of the respondents of the SeniorWatch survey stated for instance that they were generally open-minded towards ICT. But at the same time more than 70 % said that new technologies were always connected with young people in the media, and almost one half did not see their interest in adequate design being considered by IST manufacturers. Interestingly, these critical concerns were expressed irrespective of the actual personal involvement in ICT (SENIORWATCH 2002b: 13). Clearly, factors at the supply side seem of relevance for ICT take-up among older people. This includes various aspects as outlined in the following.

Design

Earlier in this report, it was shown that many older people are hampered in using mainstream ICTs by functional limitations. Generally, the human ageing process brings about specific user needs in relation to ICTs in two ways (FORESTER RESEARCH/ MICROSOFT CORPORATION 2004). On the one hand, as people age, existing mild functional limitations can become more severe. On the other hand, people are likely to develop new difficulties and impairments. Ubiquitous Design for All (DfA) solutions are therefore required if this population segment is to be adequately addressed. The DfA concepts aims at designing ICT products, services and applications, which are demonstrably suitable for most of the potential users without any modification. In cases where this is not an appropriate solutions ICT products should be

easily adaptable to different user categories (i.e. by incorporating adaptable or customisable user interfaces). At least, they should have standardised interfaces, capable of being accessed by specialised user interaction devices, so called Assistive Technology (AT) devices (http://www.e-accessibility.org/design-for-all.htm, accessed August 2005).

With regard to the world wide web, detailed design guidelines on how to design content, authoring tools and user agents in accessible formats have been available for quite some time (http://www.w3.org/WAI/, accessed August 2005). However, although there are many examples of good practice, particularly in the eGovernment domain, there is evidence that " … most websites are still inaccessible to many disabled people and fail to satisfy even the most basic standards for accessibility recommended by the World Wide Web Consortium. It is also clear that compliance with the technical guidelines and the use of automated tests are only the first steps towards accessibility: there can be no substitute for involving disabled people themselves in design and testing, and for ensuring that disabled users have the best advice and information available about how to use assistive technology, as well as the access features provided by Web browsers and computer operating systems." (DISABILITY RIGHTS COMMISSION 2004: V).

Clearly, there is plenty of scope for improvements with regard to web site accessibility. In particular commercial enterprises seem to assign rather low priority to their online accessibility. A recent decision maker survey in seven selected Member States revealed for instance that 59% of the companies surveyed have had low priority attached to making their websites accessible to people with visual difficulties. The corresponding figures for people with limited dexterity was 56%, while for nearly 58% reaching people with limited literacy appeared also to be of low priority. On the other hand, a significant proportion of companies which did not initially assign a high level of priority to their online accessibility (46%) reported that their web site could be adapted relatively easily with the view of accommodating to the potential online users with special accessibility needs. This finding could be viewed as a confirmation that quite a few companies are becoming aware of possibilities to expand the accessibility of their website to a wider audience (SIBIS 2003d: 49 f.).

More generally, ICT equipment can be made accessible to people with functional limitations by incorporating specific accessibility functions in mainstream products (MONSER 2003). Such options in a product allow older users with functional limitations to adjust the product settings to accommodate their individual accessibility needs. However, such personalization clearly can benefit a much wider range of users by offering increased usability and comfort. Accessibility features are capable of accommodating a range of user needs, e. g in relation to vision, hearing, mobility, language and learning capabilities. For instance, they allow a user to increase font size, change font settings or choose different colours for their computer screen. The option for users to receive announcements from their computer through sound notifications (a "ding" when new e-mail messages arrive), or visual notifications (a dialog box that appears, notifying users of new e-mail messages) can be mentioned as examples as well.

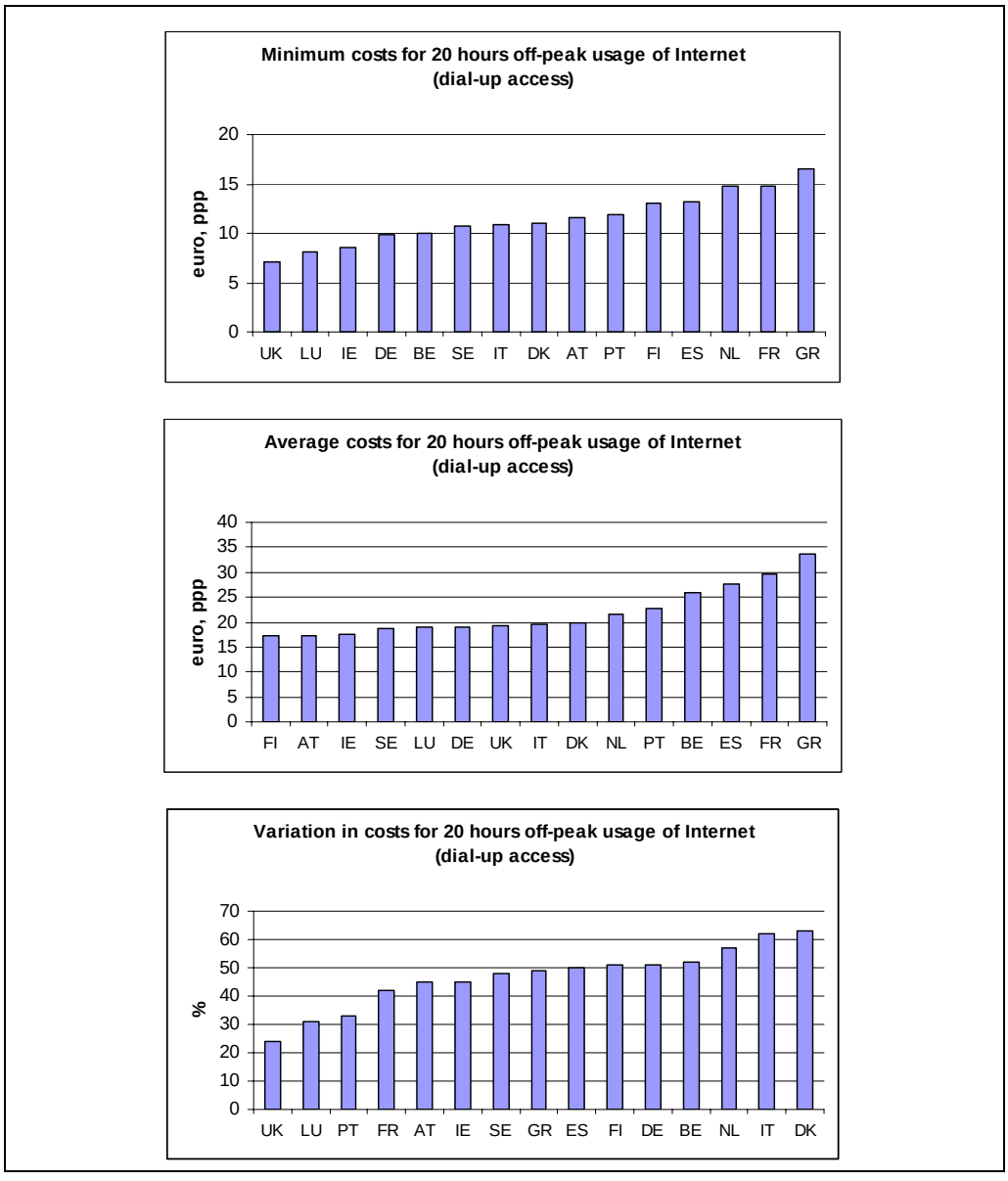
Some mainstream ICT manufacturers such as Microsoft, IBM and Nokia have started to include such features into their products, sometimes offering online information on how to select accessibility options and change settings (c.f. e.g. www.microsoft.com/enable, www-306.ibm.com/able/, www.nokiaaccessibility.com/hearing.html). Due to the lack of robust market data, it is however difficult to make a reliable assessment to what extent mainstream ICT industry is actually adopting the design-for-all approach. There is some anecdotal evidence that in the USA - despite existing legislation - the introduction of inclusive design seems to have been quite slow yet (ROE 2001a: 114). A benchmarking study announced in the recent Communication of the Commission on eAccessibility may soon shed light on the situation in Europe (CEC 2005e).

Pricing

Despite the fact that older adults comprise a large potential market, cost sensitivity is likely to be high in many cases. Although older people may have generally improved their income over the past decades in many countries, still many live on low income. Apart from these, for a noticeable part of the elderly population perceived potential benefits of the Internet do not seem to justify the costs and effort that would be involved in going online, even if they could in principal be afforded.

Thus, pricing seems to be an important issue when it comes to addressing older market segments. As shown above, home access is affected by costs for a considerable proportion of older people. The biggest initial barrier may be the cost of PC purchase, and this may be especially the case for many in the new Member States as well as for low-income groups in the old Member States. In addition, Internet connection and ongoing usage costs can be a significant barrier for those on low incomes.

Exhibit 2-25: Comparison of dial-up Internet usage costs* across the EU15



Source: TELIGEN (2004); *PSTN rental charges not included

Despite the fact that telecommunications costs have decreased in the EU during recent years, costs (in euro, purchasing power parity) of Internet usage vary considerably across the EU (Exhibit 2-25). Countries with low prices and low variation will generally have a low price level, while low prices and high variation means that there are other packages that are significantly expensive on the market. Comparing the lowest price with the average for each country minimises the effect of any very expensive packages that may exist. The variability of prices within countries suggests that comprehensive and transparent consumer information to help cost-conscious selection is an important issue, especially for older people with lower levels of income.

Marketing

As already mentioned above, older people tend to feel not being adequately considered by ICT manufacturers. In general, they will be less motivated to develop any interest in concrete ICT products and services unless they believe that the products and services available on the market really meet their needs and preferences. As discussed elsewhere in this report, nearly one third of the 50+ population in the EU15 Member States is not interested in ICTs. In relation to this issue, there is however evidence that older people appear to be interested in things that can be done with the help of IST rather than in the technology itself (SENIORWATCH 2002a). Marketing of ICT products and services therefore would need to highlight the benefits that older customers may be able to gain from their offerings instead merely of "selling the technology". There is at least some anecdotal evidence that "the state of understanding of the mature market is not well developed, compared with other market sectors" (METZ and UNDERWOOD 2005: v). A recent study suggests that businesses need to better address older customers: "the products range, product cycle and supply chain all need to be rethought." (ibid.: 180).

2.3.3 Intermediaries

The availability and support of intermediaries is also very relevant to the engagement in the Information Society by older people. Family members and friends may use the Internet on behalf of older people, and older people's organisations may provide online portals and other relevant supports.

Family and friends

To be able to properly utilise the services of the Information Society one needs to have computer and Internet skills, and endowment with these skills is highly correlated with ICT usage experience. Today, such skills appear to be obtained through learning by doing rather than through more formal learning arrangements. It is therefore not surprising that those who lack opportunities to gain hands-on experiences with ICTs in an occupational context, at school or through peer groups tend to lag behind in relation to utilisation of online services (EINCLUSION@EU 2004). For older adults, particularly if they are not in employment anymore, it is therefore important to have access to help by other household/family members or friends when it comes to participating in the online world.

To explore this question, the recent EUSER survey included a question phrased as follows: "How easy would it be for you, for instance in your household or circle of friends, to find people who would be able and have the time to help you use computers or the Internet?" This question was posed only to non-users of the Internet. Exhibit 2-26 shows the results. While there are some differences according to age (with older non-users being less likely to have easy access to help from others), it appears striking that a large share of non-users across all age cohorts consider it very easy to obtain help in learning how to use the computer, if they wished so. This finding might indicate that – at least for the two thirds or so

who would find it very or quite easy to get help - access to skills is less of an issue than perhaps the motivation to acquire such skills.

Exhibit 2-26: Access to help for using computer (% of all respondents per age group)

	18 – 24 years	25 – 49 years	50 – 64 years	65+ years	Total population
very easy	40.4	40.4	41.1	32.7	40.4
quite easy	30.8	28.5	25.4	23.5	30.8
not very easy	14.1	18.0	14.0	14.7	14.1
not at all easy	9.5	11.7	15.9	20.0	9.5
dk	5.1	1.4	3.7	9.1	5.1
total	100.0	100.0	100.0	100.0	100.0

Base: All who have not used the Internet last 3 months.

Data source: EUSER 2005, EU6.

Older people's interest groups / NGOs

General support

The existence of pressure groups lobbying at the policy level for older people can be an important variable influencing whether the specific needs older people are addressed in ICT-related policy and market developments. For the purposes of this study it is also important to assess the level of interest these pressure groups have in relation to ICT products and services that benefit older people. Sometimes initiation of awareness campaigns and training for computer usage can stem from the activity of lobby groups. Lobby groups can also make submissions to government on IT-related issues, and the like.

In relation to the EU15 Member States, the SeniorWatch study investigated whether lobby groups are active in highlighting the potential benefits of ICT applications to older people in each Member State. The following table (Exhibit 2-27) presents an overview of the level of activity of lobby groups identified in each of the Member States and assesses the level of interest towards ICTs or ICT applications as an issue. Almost all countries reported the existence of lobby groups for older people and the majority of countries showed a significant level of activity in this area with several active lobby groups existing generally.

Exhibit 2-27: Selected EU countries with pressure groups for older people

Lobby groups for older people		ICT applications as an issue for these pressure groups	
Country	**Level of activity**	**Country**	**Level of interest**
Austria	Very active	Austria	Important issue
Belgium	Very active	Belgium	Not an issue
Denmark	Very active	Denmark	Important issue
France	Very active	France	Not an issue
Finland	Very active	Finland	Marginal issue
Germany	Very active	Germany	Important issue
Greece	Very active	Greece	Marginal issue
Ireland	Very active	Ireland	Marginal issue
Italy	Very active	Italy	Marginal issue
Luxembourg	Marginal activity	Luxembourg	Not an issue
Netherlands	Very active	Netherlands	Important issue
Portugal	Not active	Portugal	Not an issue
Spain	Marginally active	Spain	Not an issue
UK	Very active	UK	Important issue
(Norway)	Very active	(Norway)	Important issue

Source: SENIORWATCH 2002a: 25

However, the level of interest shown in ICT issues is not always a true reflection of policy-related activity. For example, Belgium and France reported a lot of activity amongst lobby groups but ICTs were not an issue for any of the groups. For other countries with high levels of activity in lobby groups, ICTs were assessed as being of 'marginal' importance as an issue. For example, in Italy many pressure groups exist that act as networks or federations and due to their size, geographical coverage and central co-ordination structures act as very effective lobby groups promoting policies at both the national and local level. However, ICTs have not appeared as an important issue for these influential groups and their involvement in ICTs is limited to having an Internet presence or organising training courses for older people on the use of the Internet, but these activities seem not to be systematically organised and remain as once-off initiatives.

Online services

Apart from generally lobbying for older people, pressure groups have been offering ICT-related online information and services to older people for some time already, including online as well as onsite ICT training. Globally, the American Association of Retired Persons (AARP) and SeniorNet have certainly played a trailblazer role. However, there are a number of European lobby groups that offer such services as well.

2.4 Risks and opportunities

This section examines the risks and opportunities that are posed by interactions between demographic ageing and the evolution of the Information Society, including consideration of whether or not the age-divide will disappear over time and the implications for individuals and society of patterns of engagement (or not) by older people in the Information Society.

2.4.1 Will the age-divide disappear over time?

The term “digital divide” has now become established in the public debate (see GUNKEL 2003 for an overview of the discussion) although diverse discourses have emerged in the policy arena and in scientific circles as well, and it is not always clear how the term “digital divide” is actually used.

First of all, there is a digital divide between nations (OECD 2001): uptake and utilisation of ICTs differ strongly between Member States. SIBIS (2003a) identified three Internet penetration clusters among the EU15: Greece, Portugal, Italy, Spain and France are in the low penetration cluster, while the Netherlands together with the Nordic member states can be regarded as forerunners, with rates of uptake often higher than in the USA. Among the 10 new Member States, Estonia and Slovenia have rates of Internet penetration above the average even of the EU15. These digital divides at the cross-country level determine to a certain extent how likely it is that a person can take advantage of the potential of ICTs for her or his own benefit - all other factors being equal, a Greek citizen is significantly less likely to have access to the Internet than a Swedish citizen.

The second meaning of the term “digital divide” is the emerging polarisation in society between those who have access to and use the potentialities of the information and communication technologies for their own achievements, and those who are not in a position to access or use these potentialities in the same manner (NTIA 1995, 1998). The digital divide is usually described and measured by statistical differences in access and use of Internet-related services between different social groups, characterised by demographic (gender, age, type of household), socio-professional (education, job, professional status, income) and geographical variables (housing, urbanisation, geographical location, regional features; see NTIA 1999).

Current evidence suggests that up to now, age followed by gender and disability have been the most significant personal categories determining access disparities to the online world. As far as positional categories are concerned, the strongest influence seems to stem from labour market participation and educational position, followed by contextual categories in terms of being part of a particular type of household and nation (VAN DIJK 2005). All available data is clear about one fact: older age groups show significantly lower levels of take-up of ICTs compared to younger citizens.

In the context of the discussion on the demographic challenge and its interrelation with Information Society developments, we need to ask the question why the digital divide by age is important and is it likely to disappear "naturally" over time. After all, differences in uptake of technological innovations between subgroups of the population are hardly something new. Rather, they are a common phenomena, which has been experienced in relation to all mass market technologies that have penetrated the household market in the past, such as the automobile, radio, television, electric household appliances or the VCR. Such disparities in the uptake of technological innovations do not necessarily pose any problems, per se. Experience shows that the diffusion process usually starts from a technology-oriented urban elite who possess the skills, financial means and motivational context that are needed for the purpose (ROGERS 1995). If the conditions for successful diffusion are in place (such as inherent user value of the innovation and a favourable market environment), penetration then starts to encompass larger and larger parts of the population in what is termed a trickle-down principle.

The diffusion process is often modelled in the form of an S-curve of adoption, which results from a slow start with only innovators and early adopters taking up the innovation, then a sharp rise in which the majority (of potential users) accepts the innovation, and then a levelling out of growth towards the saturation point – this late stage marks the phase when late adopters (typically the elderly, people with low social status and those living in

peripheral, often rural parts of a country) finally get around to accept the innovation. Starting from the frequently made assumption that ICT diffusion – in particular Internet diffusion - will follow such an S-curve model, there are three basic reasons why the digital divide by age is important (NORRIS 2001; EINCLUSION@EU 2004; VAN DIJK 2005):

- firstly, the sheer likely duration of the catch-up process if developments are left to the market alone;
- secondly, the fast development of all things to do with ICTs and the Internet, which means that "the Internet" as a technology actually consists of a succession of innovations – in basic infrastructure as well as in access channels and in online applications;
- thirdly, the fact that the Internet differs in fundamental ways from the innovations which are subject to analysis in classical diffusion theory. These differences mean, basically, that access to the Internet is just one of the necessary steps which are needed for making full usage of ICTs to achieve personal objectives.

If we assume, to begin with, that the Internet and other ICTs are innovations that can be compared to other technological innovations (such as the ones mentioned above), the question of the digital divide would primarily be a question of whether the duration of the adoption process – if left to market forces – is considered too long to be socially acceptable. Governments also need to explore whether market failure prevents the development of a more advanced market for Internet-related products that are targeted at senior citizens, and therefore is partly responsible for the length of the catch-up process.

Available evidence indicates that the gap in Internet uptake between subgroups of the population, for example younger and older age cohorts, begins to shrink in relative and total terms once the more advanced groups reach saturation level. This is the case in the EU member states which are most advanced in Information Society developments (HÜSING and SELHOFER 2004). One explanation for this observation is the simple fact that the population is ageing, which means that the age cohorts who are dominated by people who have never used the Internet get smaller as a result of mortality, while the age cohorts entering the older age segments have already higher levels of Internet usage. For the EU overall, however, a simple projection of Internet take-up rates by age group under "no change" assumptions (Box 1) reveals that the effect of this process is by no means large enough to ensure that the majority of elderly Europeans will make use of the Internet in the short, medium or even long term.

There are other reasons to believe that diffusion of the Internet is following a different path than would be expected if traditional diffusion theory is applied. A basic distinction follows from the fact that the Internet will not remain the same over the period of time used for the analysis. Indeed, the Internet today is something quite different from the Internet ten years ago, when the WWW was not even fully established. By way of comparison, a car has the same basic functions than it did 20 years ago, whereas this does not apply to the Internet as accessed by a common, networked PC. The Internet is the basic infrastructure for a huge variety and number of applications, the further development of which poses continuously evolving requirements on end devices and the network infrastructure.

Box 1: The influence of the "cohort effect" on closing the divide

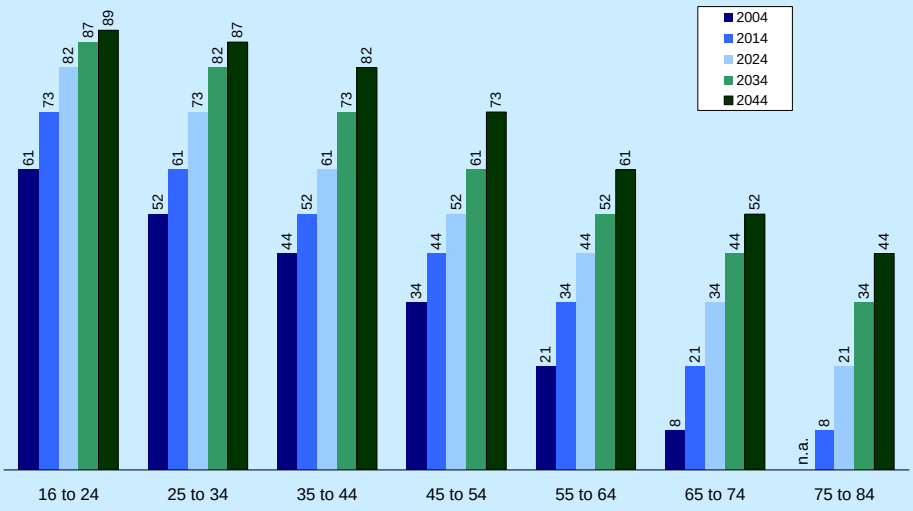
The future diffusion of the Internet is not only the result of uptake of the Internet by the population. It is also affected by the basic demographic fact that the population is ageing, and that the share of the population who have at least once used the Internet in their lifetime will inevitably increase under the assumption that future generations will have a higher probability of using the Internet than today's. This assumption appears to be valid given the patterns of Internet uptake by age which can be observed today.

In order to demonstrate the effect of this so-called "cohort effect" on Internet uptake, we have calculated future penetration rates under the following assumptions:

- *Whether people become Internet users or non-users is decided once they enter the age cohort 16-24: People who are not Internet users at that point in time will remain non-users for the rest of their lives.*
- *There are no drop-outs: People who are regularly using the Internet at one point in time will continue doing so as long as they live.*
- *The share of the population in the youngest age cohort (16-24) who are using the Internet (in each of the countries included) is determined by the relation of Internet users in older age cohorts to Internet users in the next younger age cohort (in the sum of all countries for which data are available).*

In other words, these assumptions are representing "no change" conditions where people who once get online remain Internet users, and non-users remain offline, with exception of the youngest age cohort, future rates of Internet uptake of which are determined by past experience in frontrunner countries. The result is presented below for the total EU excluding BE, CZ, FR, HU, MT, NL, SI, SK. Source of the 2004 Internet penetration data is Eurostat.

Regular Internet Users by Age Group (EU25)



Source: Own calculation based on demographic projection from EUROSTAT 2005 (Online retrieval)[9]

The chart shows that in 10 years time (under "no change" assumptions), the rate of Internet uptake will have increased by 10 percentage points in the age group 45-54, and by 13 percentage points each in the age groups 55-64 and 65-74. In spite of these considerable leaps in uptake, in 2014 Internet users will still be outnumbered by non-users in all age groups above age 45. It will take roughly 30 years before Internet users become the majority of Europeans aged 55 to 64.

[9] Queen tree path used: Population and social conditions – Information Society statistics – Policy indicators – Percentage of individuals regularly using the Internet

This calculation shows that the cohort effect is likely to play a role in explaining increasing rates of uptake among elderly Europeans, but that this effect can hardly be considered to be sufficient if the aim is to make the large majority of the EU population participate in Internet-based Information Society applications.

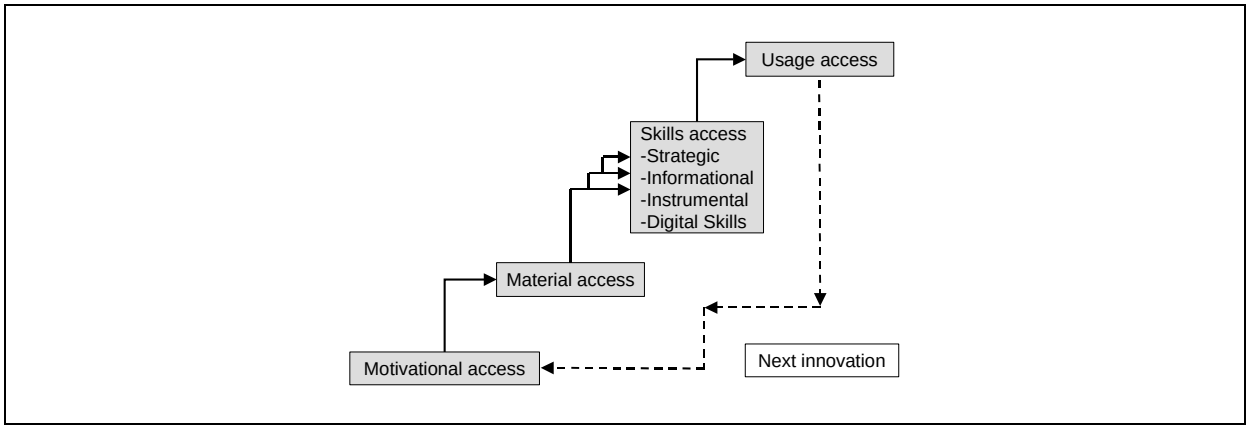
Most important for the topic of this report, however, is the fact that the Internet differs in important respects from the kind of innovations which have been the subject of classical diffusion theory-led analysis. Because much of the discussion about the digital divide is based on the implicit assumption that uptake of the Internet is the most important indicator for participation in Information Society developments, superficial analysis of available statistics has given rise to the observation that the abolishment of the digital divide – in terms of access to ICT and the Internet in particular – may be a question of time only. Apart from the fact that the catch up process may not happen as quick as public debate sometimes suggests (Box 1), the digital divide is not just about having access to ICTs merely in technical regard.

Access to the Internet, per se, does not produce much added value from the viewpoint of citizens. Only utilisation of the Internet for achieving personal aims will do so. Particularly in the earlier debate on the digital divide this issue has not received much attention. However, more recent contributions shed light on the question what "access" actually means in relation to the digital divide debate (VAN DIJK 2005; STEYEART 2002; EINCLUSION@EU 2004). In his recent work, VAN DIJK (2005) for instance conceptualises "access" as a sequence of different access dimensions including (Exhibit 2-28):

- motivational access, in the sense of motivation to use digital technology;
- material or physical access, in the sense of possession of computers and Internet connections or permission to use them and their content;
- skills access, in the sense of possession of digital skills (operational, informational, and strategic);
- usage access, in the sense of diversity of applications and usage time.

When analysing "access" disparities in relation to the Information Society, it is thus not sufficient to consider whether or not particular population groups – such as for instance older people – have access in terms of possessing required IT equipments or an Internet connection. Rather a range of subsequent access dimensions needs to be taken into account including motivational access, material access, skills access and usage access.

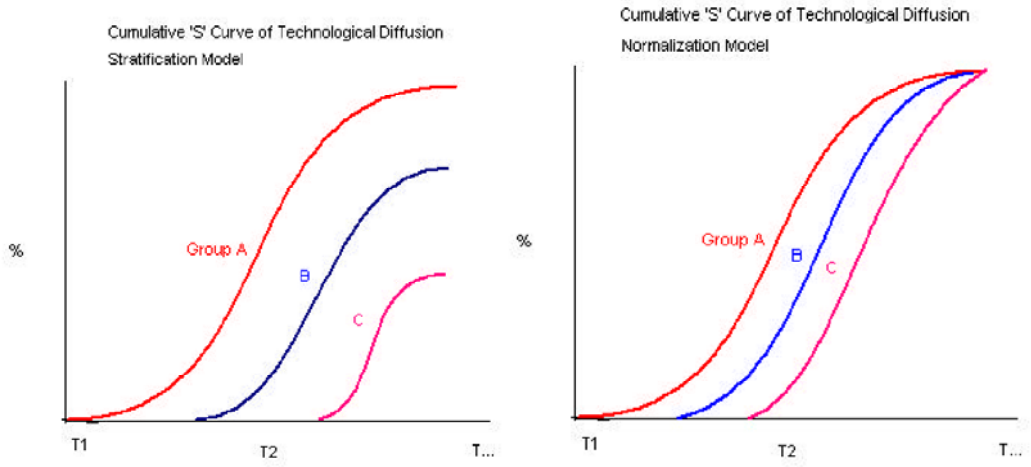
Exhibit 2-28: A cumulative and recursive model of successive kinds of access to digital technologies



Source: VAN DIJK 2005: 22

These aspects have begun to be addressed in the general literature on ICT diffusion, particularly in regard to the question of whether eventually every household will acquire the innovation or not, with two possible models - normalization and stratification - being contrasted (NORRIS 2001, p. 30-31) (Exhibit 2-28).

Exhibit 2-29: Alternative model of Internet diffusion



Source: NORRIS 2001: 30-31

In the normalization model, eventually all citizens have access to the innovation and it ceases to be a divider in society. In the latter model, this is not the case and certain groups maintain a lower level of access to an innovation. In fact, there is a third model possible, in which access to a specific innovation (e.g. dial-in Internet access from home) follows the normalization model, but is supplemented with another innovation (e.g. un-metered access to Internet through cable or DSL) and yet another innovation (e.g. wireless Internet access), in which case particular groups might normalise in terms of the first innovation, but still be in the stratification model for the second and third generation of that innovation. Through these mechanisms, older people are particularly likely to be at risk of being continually on the wrong side of access and usage divides in the Information Society.

2.4.2 Implications for individuals, society and the market

In the second half of the 1990s, countless books and magazine articles were filled with descriptions of the benefits to be derived from the “Internet age”. In spite of the much-needed sobriety which has entered the discussion after the meltdown of the Internet craze in 2000, much of what has been written still holds true in principle, although the scale and the speed of Internet-induced changes will in many cases be more modest than expected in those years. Moreover, as the unintentional, huge success of text messaging via cell-phones has demonstrated, developments often do not follow the paths that are thought most likely when new technologies are first introduced on the market. Nevertheless, there are many potential benefits for older people from the Internet and online services. Some of these they share with other age groups and some are especially pertinent for older people.

As regards individual older people the basic question must be posed in relation to their current extent of engagement with or (often) lack of engagement in the Information Society - does it matter for them, for society overall or for the relevant markets? A number of dimensions need to be considered in this regard, including:

- practical logistics of time and place,

- easier access to (more) information,
- social interaction,
- social capital,
- consumer choice and cheaper prices,
- access to opportunities that are *only* available online,
- age-friendliness of ICTs and equality of opportunity,
- supply-side / market failure.

Practical logistics of time and place

ICTs enable communication and many forms of interaction across distance which, together with the trend towards informatisation of economic activity and digitisation of products and services, means that it becomes increasingly possible to do things online that would previously have required physical travel / transportation. One benefit of this is the ability to do many more things from home than would previously have been possible.

This has particular utility potential for older people who experience mobility restrictions, for example, because of physical disability, increased frailty or fears about crime in the neighbourhood or beyond. Online shopping, banking and other everyday transactions can provide considerable benefits in this regard. However, the age divides in Internet access that are evident in the data presented in section 2.2 mean that older people are much less likely than other age groups to be gaining these types of benefit.

In addition, the possibilities for provision of remote health and care services that are discussed in Chapter 4 are also especially relevant for older people, both as supports for independent living and as alternatives to having to frequently visit healthcare services for routine matters that can now be dealt with remotely. These tend to be provided as more structured service packages as opposed to something that people do themselves as part of their everyday lives and are discussed in more detail in Chapter 4.

Mobile communications also have an important relevance in this regard. Mobile networks and phones now enable (nearly) ubiquitous availability which can be of great benefit in calling for help in emergency situations. The increasing functionality of mobile phones (more and more becoming smart-phones, i.e. combinations of phones and personal information managers (PIM)) and the offering of value-added information and alerting services, including location-based services, are also opening up new possibilities. All of these developments could be expected to have particularly high utility value for older people, in terms of security and help with getting around.

Easier access to (more) information

Although critics of the Internet and Information Society have drawn attention to the vast amounts of useless or inaccurate information that is now so easily accessed, as well as to the potential for information overload, the Internet is nevertheless a source of information that can be very useful for older people. Perhaps the most obvious is health information, given the increasing likelihood of chronic and other health conditions amongst older people.

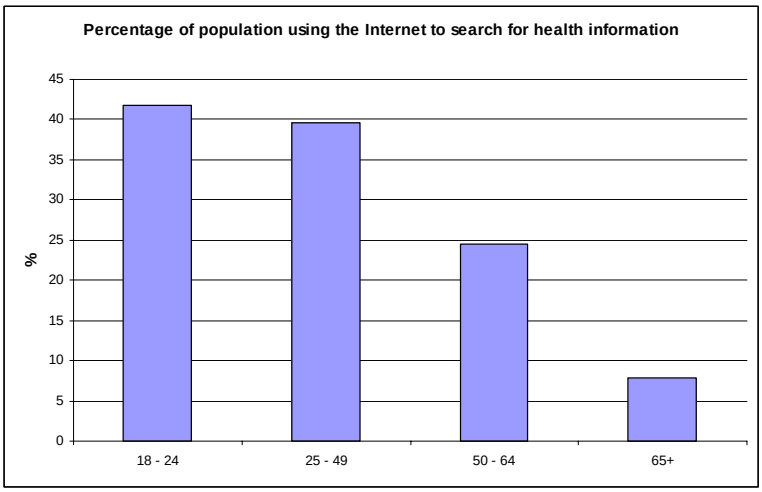
In this regard, recent research has documented the growing importance of online health information in health management activities of European citizens (EUSER 2005). In the 10 EU countries surveyed:

- almost one-in-three (30.6%) of the adult population have used the Internet to search for health information and the Internet is the most important source of health information for three-in-five (59.25%) of these;

- more than one-quarter of the adult population (28%) say that the Internet has made them more informed about health matters;
- many people are using the Internet in this way for practical purposes - preparing for of following-up after a consultation with a doctor;

The age divide in Internet usage means that older people, despite the potentially high relevance and benefits, are much less likely to use the Internet for health information than younger age groups (Exhibit 2-30).

Exhibit 2-30: Usage of the Internet to search for health information



Source: EUSER (2005)

When older people are Internet users they are just about as likely as other age groups to use it to look for health information. However, given the likelihood of higher need amongst the older age group, this could be interpreted as a relative under-utilisation. Interventions that help older people to get onto the Internet in the first place and then to use it in ways that are especially beneficial for them therefore seem warranted.

The Internet is also a central source of other information of practical usefulness in everyday life. One of the most common uses is searching for (consumer) and comparing information about products and services. As will be discussed in more detail later, this can be very empowering for consumers, enabling cheaper and better products to be sourced. Again, the age divide in Internet access puts older people at a disadvantage in this regard.

Social interaction

The Information Society has also seen a burgeoning of new types of social contact, including e-mail, chat rooms and other online discussion fora, and mobile text messaging. Despite fast and ongoing developments in the area of Internet technologies, e-mail communication has remained largely the same over the years. And although newer, security-related issues (SPAM, Phishing, etc.) have cast some doubts on its 'boundless' usefulness, the advantages of this form of electronic communication cannot be gainsaid. First of all, e-mails are fast and easy to send if compared to the more laborious regular mail (so-called "snail mail") or to fax. The transmission times for an e-mail are (usually) very short, being a matters of seconds or minutes. The cost for sending e-mail are, again if compared to regular mail and fax, very low. Within the computer network of a medium or large company (comprising basically of a server architecture and a dedicated line Internet connection with a flat rate), the costs or a single e-mail will be immeasurably small. In most cases, e-mails (or more exactly the recipients inbox) can be accessed from every location where there is an Internet connection. By the use of file-attachments, e-mail not only allows for the sending of messages but also of every other

kind of binary information (i.e. data files). Both, message and files can be easily reused by the recipient (e.g. by copy/pasting text to a word processor). Additionally, there is a large number of smaller advantages like being able to send a message to multiple recipients, relay messages to other addresses, use e-mail to organize and to invite to meetings etc..

Social scientists have put much emphasis on the fact that these trends are making it increasingly easy for people to exert choice on the persons / agents they are interacting with and the sources they are drawing information from – with potentially large-scale impacts on the structure and functioning of our society (VAN DIJK 1999). Communities which are determined by co-location (in a street or town, at a workplace or place of education etc.) are increasingly being replaced by communities organised along network structures which often cover huge distances but connect to individuals, places, organisations only very selectively (CASTELLS 2000a,b). While there is much debate about the overall desirability of this trend, there is no doubt that people who utilise ICTs to increase their number of choices will ultimately be better off than people who do not do so (VAN DIJK 2005).

Juxtaposed with this is the so-called 'internet paradox' (KRAUT et al. 2002; KRAUT et al. 1998), where there seems to be a decline in social contact and social capital at the same time as there is so much more communication going on. Whether or not, or in what direction, there may be causal links here is not clear - is social capital under pressure because we increasingly possess and make use of new media or is it the other way round, do we have more intensive information exchanges to escape our socially impoverished world?

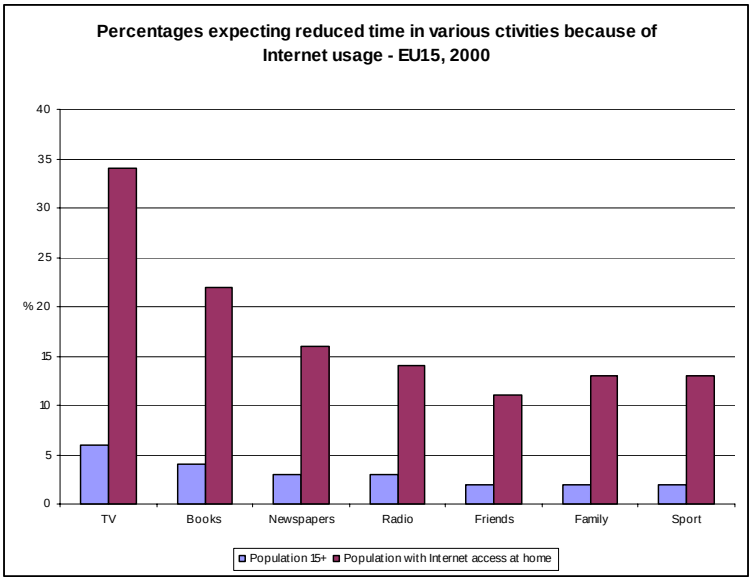
In the early days of the Internet, a number of authors elaborated optimistic scenarios about local and regional virtual communities based on shared interest (RHEINGOLD 1993) and digital villages or neighbourhoods (COHILL & KAVANAUGH 1997). Others voiced their concern about the effects of Internet usage on social networks.

The research evidence in relation to these utopian and dystopian visions is still quite limited, and we do not yet have a good picture of how the Internet is affecting family relationships and communication patterns, if at all, or its wider impacts on patterns of social engagement and networking, either for the population overall or for older people and intergenerational communications. For example, we do not know much about the role that e-mail is playing in relation to contacts between older people and their families, for example, in terms of substituting for or complementing phone-based and face-to-face contacts.

Apart from these one-to-one modes of contact, the Internet has also introduced some radically new modes of social interaction, including (asynchronous) discussion lists and (synchronous) chat rooms. Given the relatively low levels of usage of the Internet by older people and their apparently much lower likelihood of usage of these if they do use the Internet it seems unlikely that these developments are yet having any major impacts on the patterns of social engagement of the majority of older people.

A more indirect effect relates to time displacement - where time spent online comes from, and which daily activities receive less time. There is some European data on this aspect from Eurobarometer (CEC 2000b). About one-third of people with Internet access at home expressed the expectation that Internet usage would result in less time spend on television and reading, and 11% and 13%, respectively, felt that there would be less time available for friends and family.

Exhibit 2-31: Expected impacts of Internet usage on time usage



Source: Eurobarometer 53 (CEC 2000b)

These data relate to people's perceived and/or expected time displacement, however, and initial findings from actual time diary methods suggest that Internet time may not influence television time at all, but reduce time spent on reading printed material (newspapers, books) and social contacts (BREEDVELD and VAN DEN BROEK 2001; NIE and HILLYGUS 2002a, b).

Social capital

The concept of social capital has received quite a lot of attention in recent times, both in the context of individual resources (e.g. in terms of contacts to help get a job) and of wider social cohesion and the social dimensions of society (e.g. extent of social engagement and civic contribution).

At the individual level, the social capital literature differentiates between two types of social capital: bonding and bridging (a third type, linking social capital, is sometimes suggested but ill defined). Bonding social capital refers to people belonging to a social network or social group, and is inward looking. Bridging social capital refers to links between groups of citizens (e.g. between young and old, between people with different ethnic backgrounds) and is outward looking. Both have very different effects on social inclusion: "bonding social capital is, as Xavier de Souza Briggs puts it, good for 'getting by', but bridging social capital is crucial for 'getting ahead'" (PUTNAM and FELDSTEIN 2000: 23). There has not been much research on the impacts of the Internet in these areas, although recent data from the U.S. suggests that practical bridging benefits are more likely to be achieved by those who are already advantaged in this regard (e.g. working professionals). The implications, if any, for older people have received little or no research attention.

In addition, it might be expected that bridging effects would be more relevant for the younger old (those in the working age range) whereas bonding might be more relevant for the older old, although such stereotypes of older people may have to be reviewed in the light of changing social patterns over time. For example, it has been argued that a new pattern of 'networked individualism' is emerging (BOASE and WELLMANN 2006, in print), characterised by relations being both local and long distance, personal networks being sparsely knit but including densely knit groups and finally relationships that are more easily formed and abandoned. The development towards networked individualism is supported by new media and the possibility to address individuals rather than households; a household used to share

one postal address and one telephone number, but e-mail addresses and mobile telephone have taken this to the individual level. Such trends may emerge over time in the form of lifestyle patterns amongst at least some online older people.

More generally, it might be imagined that Internet can have an effect on either/both bonding and bridging social capital (FERLANDER 2003), with the Internet enabling users to find people with mutual interests, however peculiar those might be. This might, on the one hand, increase the homophily in social networks (MCPHERSON et al. 2001) and, on the other hand, might increase serendipity and generate bridging social capital through the many weak contacts that one can have through Internet, e.g. in a public chat room or through discussion lists.

Consumer choice and cheaper prices

In economic terms, technological developments in the area of ICTs (together with favourable market conditions) are having the effect of falling costs for transport of all things which can be digitised. This applies to all "information" products and much communicative interaction.

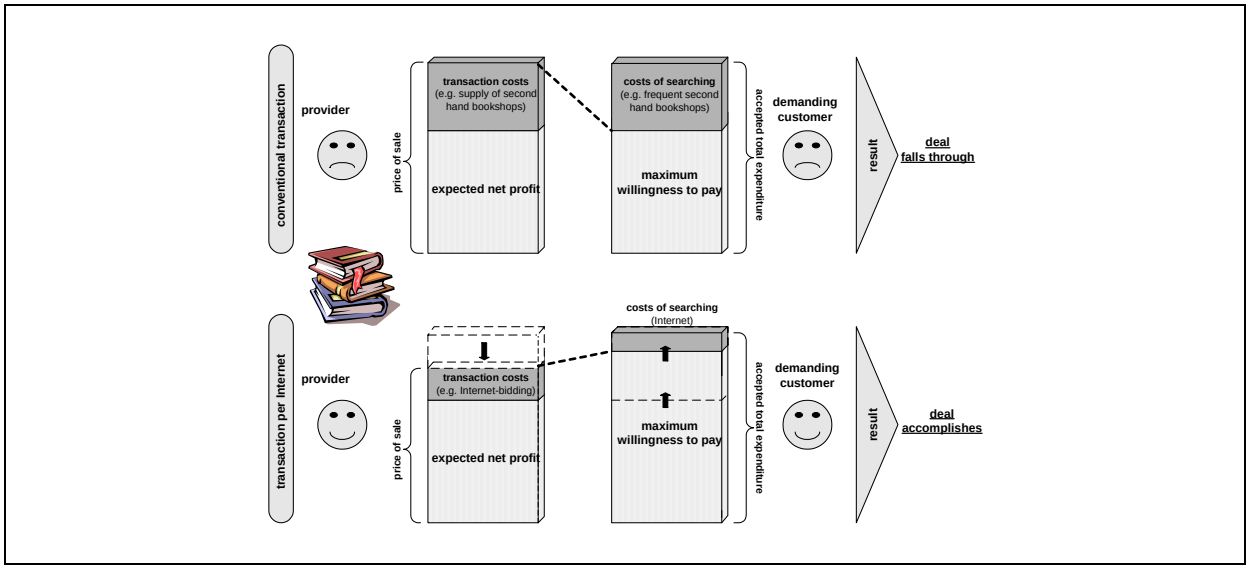
Transaction cost theory was originally developed to explain the existence and boundaries of business enterprises (WILLIAMSON 1975). It suggests that there are marked differences in the costs of executing transactions inside of organisation as opposed to on the market. This leads to the theoretical finding that profit-maximising companies execute those transactions internally that would cost more to conduct through market contracts. As was noted by the early transaction cost theorists already, transaction costs can be altered by technological progress. ICTs in general, and the Internet, in particular, have been shown to reduce the costs of many types of transactions. An important component of the transaction costs that are incurred by activities for acquiring information are search costs. These arise when market participants have to invest in activities to find the information they need to decide how to behave on the market, e.g. to take part in the labour market or stay out. Search costs are determined by the nature, number and intensity of search activities, but also by the technique and technology used for investigating information. For this reason, ICTs have a major influence on search costs, not only on their overall level, but also on their composition and the relative costs of different search techniques.

By applying these theoretical approaches to markets into which ICT-mediated communication and interaction are introduced, research has begun to identify the changes which are likely to arise and the benefits which are to be expected for each of the groups involved (consumers, suppliers, intermediaries).

GAREIS et al. (2000) summarise advantages of electronic commerce from consumer viewpoint as follows (Exhibit 2-32):

- convenience (fewer time and place constraints, no opening hours);
- access to larger supply (number of providers);
- anonymity (of relevance for some product categories);
- instant access to broader information about market situation (prices, suppliers), often in real time;
- easier access to independent advice through communities of interest (e.g. product ratings by other consumers);
- time savings (instant delivery in case of many digitised information products);
- enhanced interactivity through e-mail, embedded voice mail, etc.;
- personalization (providing consumers with information and offers which are tailored to their individual preferences and/or needs).

Exhibit 2-32: Emergence of new markets enabled by Internet related decreases is transaction costs



Source: Translated from GAREIS et al. 2000: 14

Some changes induced by electronic commerce are benefiting all consumers. For example, falling transaction costs on specific markets (especially those with heavy competition) have often been reflected in falling end prices also in brick-and-mortar outlets. However, there are many examples which show that lower prices are often primarily being made available to consumers who use electronic ways of purchasing or booking. One such example is the airline industry.

Moreover, the Internet has also enabled the emergence of new markets which have not been sustainable before, because transaction costs were prohibitive (see figure) – a typical example of market failure which the Internet and other ICTs were able to abolish. By shrinking transactions costs (here: the costs for identifying a person interested in buying a used book on the one side, and the cost for finding a copy of a sought after book on the second hand market on the other side), Internet platforms such as eBay have created markets which ultimately lead to everybody being better off – with the possible exception of intermediaries who cashed in on the lack of transparency of the market before.

It has also been shown that prices on electronic markets tend to be lower than on offline markets, which benefits consumers (BAKOS 1998, OECD 1999). People who are shut out from such markets have to live with higher prices, or with the fact that they cannot purchase (or, in the case of eBay, sell) a product at all.

Access to services that are *only* available online

This raises concerns about what dis-benefits may be experienced by older people and others through not being online. It has been observed, for example, that the quality of services offered online is rising at the same time as the quality of at least some services offered offline may be declining (STEYAERT 2004). The freedom of choice and conditions of online services sometimes surpasses that of physical offices and shops, giving those who are online citizen and consumer benefits and extra resources. Many examples can be given both the commercial and public sectors. Banks offer higher interest rates on online saving accounts; people looking to buy or rent a house benefit from online websites, whereas those relying on e.g. newspapers advertisements are often too late; travellers buying train or airline tickets at the counter often pay extra compared to those who do it online, and some airlines now offer online check-in and the avoidance of long queues; some airlines only make reservations

online; citizens needing forms from their local authority can avoid long queues and limited opening hours by downloading or completing e-forms online; some public services now refer those who phone for information to their websites because staff don't take or get the time anymore to provide basic information.

Age-friendliness of ICTs and equality of opportunity

As already discussed earlier in this chapter, a considerable proportion of older people are hampered in making use of ICTs because of functional changes in physical and cognitive functioning associate with ageing. As has been shown in the SeniorWatch study, older adults with functional restrictions are significantly less likely to frequently use a computer when compared with non-restricted respondents. This is not because they are less interested in computer technology (Exhibit 2-33); in fact, they tend to be even more "keen on learning about new technologies or to improve their computer skills" when compared with those who do not suffer from any functional restriction. Their share in the group of the "technologically open minded" is significantly higher than the share of those with-out any functional restrictions.

Exhibit 2-33: Functional restrictions among the EU 50+ population by computer involvement (in %)

	Vision			Hearing			Dexterity			All 50+
	no problems	some difficulty	severe problems	no problems	some difficulty	severe problems	no problems	some difficulty	severe problems	
The digitally challenged	29.6	31.4	39.5	30.0	33.9	35.7	28.6	30.8	52.1	31.3
The technologically open minded	27.7	31.9	29.6	28.3	31.1	30.4	26.9	36.4	31.0	29.1
The old age beginners	13.0	13.1	12.4	13.5	11.9	11.2	13.7	12.6	8.1	13.0
The experienced frontrunners	29.7	23.6	18.5	28.3	23.2	22.7	30.8	20.2	8.8	26.7
	100	100	100	100	100	100	100	100	100	100
Tau b			-.077			-.056			-.150	
Spearman Rho			-.087			-.062			-.167	
Sig.			.000			.000			.000	

Base: all respondents (N=9661)

Source: KUBITSCHKE et al. 2002: 8

This means that many older people, as a result of age-related changes in functioning, do not currently have equality of opportunity to participate in the Information Society. Supply-side and market failures linked to this issue are discussed in the following section.

Supply-side and market failure

The restricted physical, sensory and cognitive capabilities that are quite prevalent among older people impose particular requirements on the characteristics and features of the access devices and services of the Information Society. The term "eAccessibility" has come to be used to encompasses issues and concerns that relate most closely to the particular functional difficulties experienced by disabled people and older people, because of disability

or the ageing process. A central aspect of the eAccessibility approach is to ensure that the physical and information/knowledge dimensions of the Information Society are such that they do not make it harder for people with disabilities to use them, or even prevent them from using them at all (EINCLUSION@EU 2004). Typically this is achieved through specific design features incorporated into mainstream technologies and / or the provision of so-called assistive technologies such as specific input and output devices enabling people with disabilities to access mainstream ICTs such as personal computers. The eAccessibility issue is closely linked with the Design for All (DfA) perspective and approach, whereby the emphasis is on designing the mainstream tools and services of the Information Society from the outset in a way that meets the requirements and characteristics of the widest possible range of people and circumstances.

Available evidence seems to suggest that the accessibility-related needs of older people – in the sense of the eAccessibility and DfA concept – are not adequately met by ICT industry. As discussed earlier in this report, the SeniorWatch study found that about half of the 50+ population in the EU-15 Member States did not see their specific requirements adequately considered by ICT industry (SENIORWATCH 2002a). Although it is difficult to accurately assess the demand for specific assistive technology products or better designed mainstream ICTs enabling older people with functional restriction to participate in the typical applications of the Information Society, it is possible to put at least some boundaries on the on the potential demand for such solutions.

Based on the data on the prevalence of selected functional restrictions among older people available from the SeniorWatch study, Exhibit 2-34 shows an extrapolation of the share of the EU's 50+ population that can be expected to be functionally restricted as the demographic shift further progresses.

Exhibit 2-34: Estimated market potential for DfA products and assistive technologies among the EU25 50+ population (in Mio)

Indicator of potential market size		Demand potential in Mio			
Indicator for need	**Degree of impairment**	**2005**	**2010**	**2020**	**2050**
Vision problems	slight/ moderate	43.1	46.3	53.1	59.1
	severe	19.1	20.5	23.5	26.2
Hearing problems	slight/ moderate	41.4	44.4	51.0	56.7
	severe	8.0	8.5	9.8	10.9
Dexterity problems	slight/ moderate	30.2	32.5	37.2	41.4
	severe	15.9	17.1	19.6	21.8
More than one of these	slight/ moderate	68.5	73.5	84.3	93.7
	severe	33.4	35.9	41.2	45.8

Source: Own calculation demographic data available from SENIORWATCH 2002 and demographic projections from Eurostat 2005

It may be fair to assume that those who have moderate functional restrictions would clearly benefit from mainstream ICTs designed according to the DfA approach. Thus, the demand potential for DfA products among older people can be assessed to reach the two digit million level already today, while a considerable increase can be expected in future. The same holds true for assistive technology solutions assuming that those who are severely restricted constitute the core target market here.

In the context of demographic ageing, therefore, significant market opportunities are being lost in two ways - through the loss of uptake and usage of mainstream products and services because of their inaccessibility and through the loss of market opportunities for assistive technologies.

2.5 Current European and Member State policy and activity

The main EU-level and Member State policies and activities relating to the age-divide in engagement in the Information Society can be found in the contexts of *eInclusion* and *eAccessibility*:

- Awareness, motivation and skills;
- Access and affordability;
- Accessibility and Design for All.

2.5.1 Awareness, motivation and skills

There is a lot of activity across Europe focusing on raising Internet and Information Society awareness, motivation and skills amongst older people. Exhibit 2-35 presents an overview of some of the range of initiatives from the Member States.

For these types of measure a variety of different levels of action (government, local, NGO, and so on) are relevant and appropriate. The variety of initiatives and approaches in part reflect tailoring to local needs and circumstances. In part, however, it reflects the widely varying levels of attention and resourcing of the issue across countries, regions and localities. Although this field of activity clearly requires a strong bottom-up dimension, there is a lack of a European-wide mechanisms for benchmarking and exchange of good practice in the area of ICT literacy and skills for older people. There is also a lack of common targets across the Member States, for example, as regards the percentages of older people to be reached by awareness raising and skill developing programmes. Apart from the current cohorts of older people, more attention also needs to be given to those in other age groups who face a risk of enduring age divides, for example those who are outside the workforce so that age-divides in the future old age cohorts are minimised.

2.5.2 Access and affordability

Issues of access and affordability on the Internet for older people are also being addressed, although to a considerably lesser degree. One approach is through the provision of Public Internet Access Points (PIAPs). Driven in part by the eEurope initiative, most Member States (particularly the New Member States) have implemented significant initiatives as regards the installation of PIAPs, although there are relatively few examples of initiatives targeted specifically towards older people. In addition, the evidence suggests that older people are a lot less likely to use PIAPs than younger people so other types of interventions are also important.

Public Access Points can play an important role in this but the real convenience benefits of the Internet especially derive from personal access at home, particularly for those who do not have workplace access. In this regard there is evidence that home access is affected by costs for a considerable proportion of older people.

Exhibit 2-35: Examples of initiatives on awareness, motivation, training in the Member States

Country	Examples of initiatives
Czech Republic	• National Programme of Computer Literacy – basic PC skills supported by the state targeting entire population www.micr.cz/scripts/detail.php?id=1673 . • Expo INVEX – promotion of new ICTs for all categories of users, including older people www.e-invex.cz.
Estonia	• Look@World Internet Training Project – Aimed to increase Internet penetration and use in Estonia. 100,000+ people participated. • Research on the Digital Divide – completed in 2002. Aimed to identify the social factors that inhibit the engagement of new users with ICT, to identify those groups that use ICT less than others, to clarify the needs, attitudes prejudices and expectations towards ICT products and services, and to identify relevant channels for the effective provision of ICT products and services.
Finland	• Citizenship skills in the information society – aims to equip all citizens with ICT skills. Target groups include older and retired people. • ICT Skills courses – provision of affordable courses in ICT for all citizens. Some of theses courses target older people such as the adult education centre in Helsinki and open university programmes for the third age. • eTampere – comprehensive information society development programme run by City of Tampere. Included training for older people. • ENTER – a senior citizens' association for the promotion of electronic data processing skills. • Ministry of Education Information Society Projects 2000-2004 placed particular emphasis on providing motivation, awareness raising and ICT skills training to middle-aged adults and older people among others. • Recreation and Services for Senior Citizens – a research project that investigated how the effects of ageing should be considered in the design and implementation of network-based services (2001-2003) www.vtt.fi/tte5/english/index.html.
France	• Generations Numériques – a small company providing ICT training for older people www.gnf.fr
Germany	• Third Report on Elderly Citizens (2001) – recommends supporting measures and projects to familiarise older people with ICTs. • Online Competence for People Aged 50+ - aims to encourage older people to use the Internet for various purposes www.50plus-ans-net.de. • Project SeniorNet – facilitates older people's access to and use of ICTs www.seniorennet.de.
Greece	• PEFETE – Pan-European Network for the Elderly. A European Project including Greece. Three objectives: 1) the transfer of knowledge, methods, and good practices in senior citizen education, 2) the development of trilateral learning partnerships, 3) the dissemination of knowledge on senior citizen education. One of the outputs included the creation of a website: www.pefete.wz.cz.
Hungary	• 'Click on it Grandmother' – electronic communication course to encourage older people to use ICTs and provide the necessary skills for them to do so. • Publishing memoirs on the Internet – tender launched in 2004 by the Ministry of Informatics and Telecommunications to motivate retired people to write their memoirs and publish them online
Ireland	• New Connections: A Strategy to Realise the Potential of the Information Society – aims to increase ICT education and skills training. Older people are one of the target groups. • Implementing Equality for Older People – recommended that existing educational and training institutions should address the ICT training needs of older people. • eInclusion report in 2003 recommended that an awareness campaign should be conducted aimed at the two largest target groups, retired people and women working in the home. Also recommended the prioritisation of late adopters for ICT literacy programmes. • Third Age Centre – ICT training for older people www.thirdage-ireland.com. • Vocational Education Committees – older people form one of the largest target groups for ICT training. • Community Application of Information Technology (CAIT) programme – older people were a significant target group for the various projects implemented under this programme.
Italy	• Ministerial decree for the setting up of a Commission to develop ICT usage among target groups including older people.
Lithuania	• Window to the Future – programme to provide ICT training for 20,000 Lithuanian residents. 60% of participants were aged 35-60, 35.5% aged 18-35, the remainder were aged over 60. www.langasiateiti.lt • Programme for Universal Computer Literacy 2004-2012 – aims to enable all Lithuanian residents to achieve computer literacy regardless of age, gender, special needs, social status or location. • Special library website for older people or people with visual impairment – website adapted for older people or people with visual impairment. Provides information on library facilities for older people and general information relevant to older people www.biblioteka.lt/eng/index.html.

Exhibit 2-36: Examples of initiatives on awareness, motivation, training in the Member States (contd.)

Country	Examples of initiatives
Netherlands	• eLearning Module (HOVO) – offers training for older people, increasingly via eLearning. • Digitale Trapvelden (digital education centres) – offer training in ICT in large urban centres for those who lack ICT skills, especially older people. • Surfende Senioren – research on current demographics, use, competencies and fear of ICTs among older people www.scp.nl. • SeniorWeb – a portal site containing online computer courses, information and recreation resources www.seniorweb.nl. • NPOE – advocacy for older people on a European level www.npoe.nl.
Poland	• Strategy for the Development of the Information Society – includes provision for facilitating access to the Internet for all social groups, including older people. www.mnii.gov.pl/_gAllery/30.302.pdf • The Association of the Fullness of Life Academy – an association representing middle-aged and older people. Places emphasis on providing access to ICTs through a range of initiatives.
Portugal	• ICT Basic Skills Diploma – aims to improve ICT literacy. Targeted specific at-risk groups including older people. • Project TiO – Creation of an Internet portal for older people. Contains information on topics such as health, leisure and rights. www.projectotio.net
Slovakia	• National Action Plan for Social Inclusion – supports access to ICT for at-risk groups including older people. • Senior Citizens' University – delivery of training courses by universities for older people in different areas including ICT. www.education.gov.sk
Slovenia	• Senior 60+ - provides older people with access to and training in ICT. • eSchools – aims to ensure equal opportunities in accessing ICT. Older people targeted. • Digital Divide or eInclusion for Older People? A round-table discussion organised at the Teleinfos Conference, April 2004 http://www2.arnes.si/~ljztoks2/starejsi/gradivo/izzivi/gradivo4.html.
Spain	• Madrid Communidad Digital. Provides courses and seminars in ICT skills for older people. • Ciberualas para Mayores – digital literacy training for older people in Aragón. • Plan de Formación Digital Para Colectivos en Riesgo de Exclusión Social Basado en Talleres de Ocio – a plan to enhance ICT training for groups at high risk of social exclusion in Navarra.
Sweden	• 'Information Society for All' – a policy setting out goals and priorities for the development of ICT in Sweden. Initiatives targeting older people have been implemented. • 'IT and Elderly' – a report on the usage of IT by older people and how policy can support this. • Elderly Policy in the Future – Parliamentary policy investigation on how to develop future ageing policies. Acknowledges the need for ICT training to integrate new technologies into older people's lives. • SeniorNet – offers ICT training to older people through local clubs www.seniornet.se. • Äldreprojektet – project to implement the Action Plan for elderly policies (ended in 2001). Developed ICT training for older people as one element. • PROsIT – an initiative to organise ICT training (with emphasis on the Internet) for members of the older persons' organisation, PRO. • Networking for Accessibility: Elderly People and New Technology. Research project completed in 2002 investigating types of practices evolving to reduce the digital divide and bring ICT to older people. • Senior Akademin (Senior Academy) – private educational organisation that offers ICT courses to people aged 50+. • KomIT – a centre for applied research and innovation aimed at generating user-friendly and functional ICT products and applications targeting older people. Currently dormant due to lack of funding, but specific projects are run by the Interactive Institute www.komit.se.
UK	• 21st Century – Realising our Potential (2003). Policy document that makes a commitment to help adults gain ICT skills. • Enabling a Digitally United Kingdom – policy that aims to improve eSkills among hard-to-reach groups via the national network of UK Online centres. • Challenging Age: Information, Advice and Guidance for Older Age Groups – research project that consulted older adults and analysed their views on what has or has not worked for them. Most of the research participants were on IT skills courses. • Hairnet Computer Training – a private company providing 1:1 ICT training for people aged 50+.

Source: own analysis based on data collected by EINCLUSION@EU project (2004)

There are various approaches that, directly or indirectly, can help older people to access and afford ICTs and usage of the Internet.

Specific financial measures

Some Member States, sectoral interests and ICT suppliers have implemented fiscal / financial approaches to help overcome cost barriers to access to ICTs and the Internet (ACCESS4INCLUSION 2005). These have included discounted prices, direct subsidies, financial incentives to taxpayers and financial incentives to employers. Many of these measures are, by their nature, not very relevant for older people who are not in employment or for whom tax relief may not be relevant. Therefore, although these types of measures should be examined for their potential contribution to reducing cost barriers for older people, the most effective lines of action may be within the wider reach of more universal provisions.

Universal service and related mechanisms

One way is through provisions in relation to Universal Service[10]. The EU Universal Service Directives enable national regulators to introduce measures that help to make access to basic telephone services affordable to low income and special needs groups, including people with disabilities. Most Member States now have schemes in place under their national universal service regulations that provide some degree of cost subsidy for vulnerable groups. The subsidies may take various forms and may be paid for in different ways, including various mixes of universal service funds operated by telecoms providers and financial subsidy to the industry from government. Apart from provisions within the universal service context, many Member States also have provisions through social protection schemes that provide support for telephone costs for low income people and households. These now extend to mobile phone costs for at-risk individuals in some countries.

An issue that has been on the agenda in the universal service debate for a number of years has been whether the scope of such provisions should be extended from basic telephony services to mobile services and, indeed, to Internet access. This is an issue that has been examined in various studies in the 1990s and the argument has been put forward that if access to services that can be considered to be “public goods” (e.g. health services) is increasingly dependent on Internet access then Internet access should fall within the scope of the universal service concept (e.g. WIK, 1999).

In the particular case of access to online health information and services a study for the European Commission in 1999/2000 concluded that any need for extension of universal service obligations in a manner that would facilitate the affordability of online access to health services for citizens would depend on the extent to which such services become a normative and central feature of health activity of citizens (EMPIRICA and WRC 2000). The study recommended that this issue be kept under review as the Information Society evolves in Europe. The latest evidence suggests that the Internet is now coming to play an increasingly central role in the public’s health management in Europe and that enduring income-related digital divides now pose a risk of contributing to wider health divides (EUSER 2005). Against this background it seems timely that the issue of financial support for access to the Internet be revisited and re-examined.

2.5.3 Accessibility and Design for All

Even if older people are interested, have the skills and can afford to access and use the Internet and other components of the Information Society this does not guarantee usage. As

[10] Directive 2002/22/EC of the European Parliament and if the Council of 7 March 2002 on universal service and users' rights relating to electronic communications networks and services (Universal Service Directive).

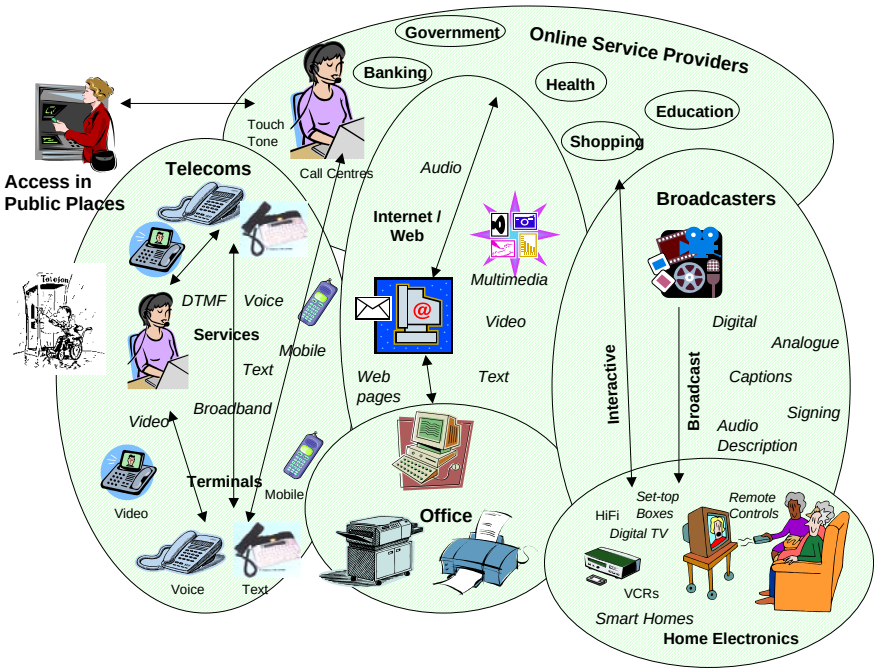
indicated in previous sections, lack of accessibility and the lack of more general attention to Design for All, including the more subtle and gradual changes in physical and cognitive functions that occur with ageing, pose major barriers for many older people and the numbers at risk in this regard will increase proportionately as the population ages.

Although there are not rigid boundaries between the notions of accessibility and Design for All, it is useful to use the term "accessibility" to refer to the problems posed by more severe functional restrictions and disability and "Design for All" to cover both the major disability-related accessibility challenges *and* the wider range of issues that arise because of the more subtle and gradual changes with ageing. Both aspects must be addressed, as reflected, for example, in the reference to "accessibility and Design for All users" in the revised EU Public Procurement Directives.

eAccessibility

The eAccessibility policy space has been investigated in-depth by the EINCLUSION@EU project (2004). To begin with, the analysis emphasised that eAccessibility is not solely a question of accessible web sites, even if this is one central issue for the policy agenda. In fact, a number of traditionally different sectors are involved, including telecommunications (services and equipment), broadcasting, home electronics, and computing and electronic office equipment (Exhibit 2-37). Increasingly there is convergence and blurring of the boundaries between these domains. A variety of locations of usage are also indicated, including the home, the office and public places.

Exhibit 2-37: Sectors, value chains and ICT products and services of concern for eAccessibility

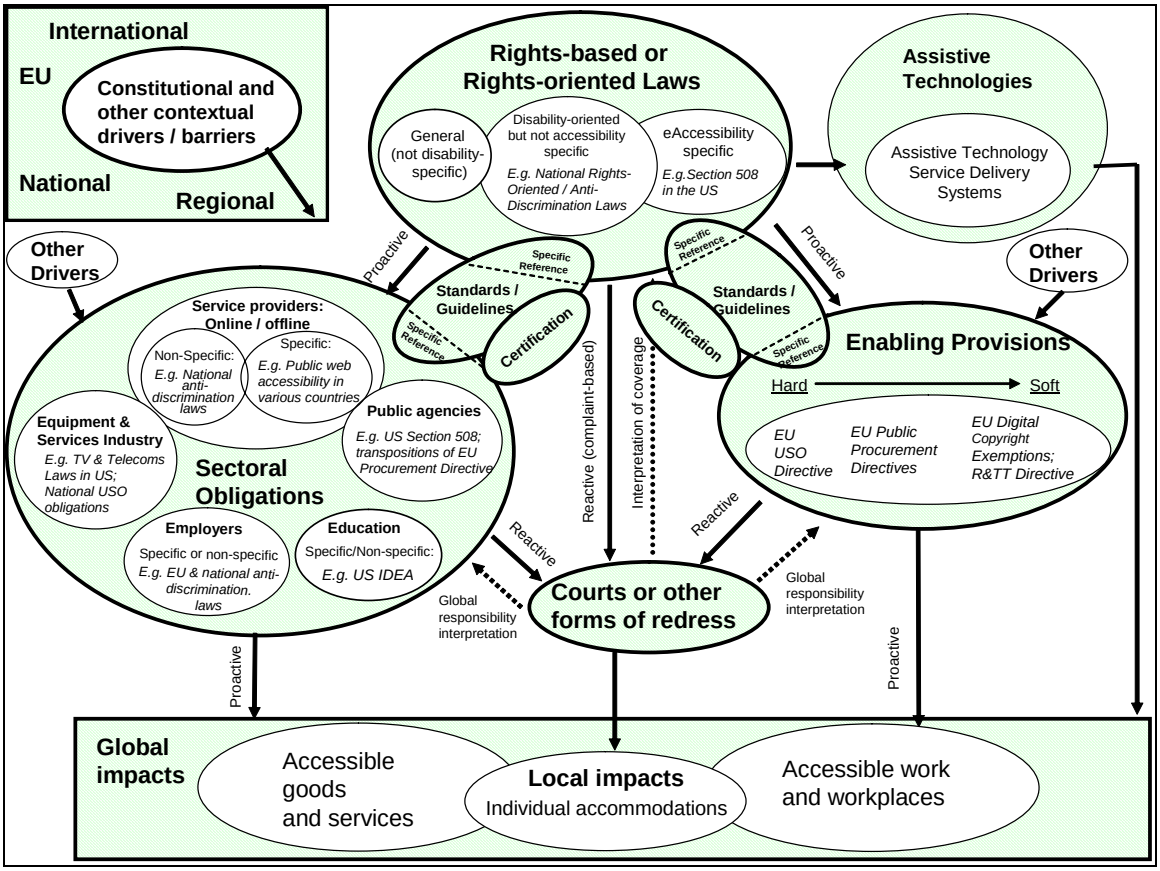


Source: eInclusion@EU (2004)

The eAccessibility policy situation internationally represents something of a patchwork at the moment, with different issues being addressed in different countries as well as different policy approaches being employed to address similar issues across countries. This is an area where the international dimension is important, not least because of the global marketplace for ICTs and the global implications of accessibility requirements in public procurements whether in Europe, the U.S. or elsewhere. In this regard, eAccessibility is a topic in the EU-U.S. dialogue processes (c.f. e.g. http://europa.eu.int/information_society /policy/accessibility/regulation/pubproc_ws_2004/index_en.htm).

Against this background, the analysis in the EINCLUSION@EU project (2004) gave some attention to the development of an overall framework to help conceptually and analytically structure the domain (Exhibit 2-38) and ultimately make a contribution to the formulation of harmonised EU, international (where appropriate) and Member State legislative / regulatory approaches.

Exhibit 2-38:Overview of the legislative / regulatory environment for eAccessibility



The main elements of current EU policy that specifically addressed eAccessibility are:

- Communication on eAccessibility (CEC 2005e),
- Council resolution on accessibility of public websites[11] and eAccessibility more generally[12],
- eAccessibility in the EU Public Procurement Directives[13],
- Digital rights management (exemptions allowed to enable accessibility for disabled people in the Copyright Directive[14]).

There is also potential to address eAccessibility in some other policy contexts, including:

- The Universal Service Directives[15],

[11] Council Resolution of March 2002, "on the eEurope Action Plan 2002: accessibility of public websites and their content"

[12] Council resolution 5165/03 e-Accessibility: improving the access of people with disabilities to the knowledge based society, OJ 14 January 2003.

[13] Directive 2004/18/EC and Directive 2004/17/EC

[14] Directive 2001/29/EC of the European Parliament and of the Council of 22 May 2001 on the harmonisation of certain aspects of copyright and related rights in the information society

- The Terminals Directive[16],
- The Framework Directive on Employment Equality[17].

One important issue will be to ensure that the accessibility needs of older people are given prominent attention in all relevant regulatory and other contexts. More generally, there is evidence that the national transpositions of the various EU Directives do not always give direct attention to or specific prominence to the eAccessibility dimension, in the first place, and that there is wide variation across countries (EINCLUSION@EU 2004). For these reasons there is a clear need for EU level activity to encourage and provide guidance to the Member States on strong national transpositions of the various directives so that they give due and appropriate emphasis to the eAccessibility dimension and good prominence to the needs of older people. This aspect is further considered in chapter 3 in relation to the public procurement and employment equality directives.

Finally, as regards the follow-through of the Council resolutions on accessibility of public websites and eAccessibility more generally, the current picture across Europe is quite patchy, in terms of both whether and how the issue is being addressed (EINCLUSION@EU 2004). Again the need for EU-level encouragement and support is indicated, as well as a specific emphasis on the accessibility needs of older people.

Design for All

Complementing the accessibility approach is the broader Design for All approach. This has been supported at the EU-level through help with the establishment of the European Design for All Network (EDeAN). Part of the work of this network is on the development of Design for All curricula for designers and other relevant stakeholders. It will be important that this work gives prominent attention to the changing perceptual, dexterity and cognitive functioning of people as they grow older.

More generally, evidence from research on the current levels of receptivity to Design for All principles amongst designers and other players within the ICT industry suggests that a lot of awareness raising will be required if Design for All is to become mainstreamed (DASDA 2001).

2.6 Conclusive summary and policy implications

As set out in the beginning of this report, this first main chapter focuses on the intersection of demographic ageing with the emergence of an Information Society. The focus of the analysis thereby is on ICT appropriation in everyday life and how these are impacting on the way that every day things are done. In the following key outcomes are summarised and their implications for EU-level policy are assessed.

2.6.1 Challenges and opportunities

The analysis revealed challenges and opportunities in relation to a number of key themes including:

[15] Directive 2002/22/EC of the European Parliament and if the Council of 7 March 2002 on universal service and users' rights relating to electronic communications networks and services (Universal Service Directive).

[16] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity

[17] Council Directive 2000/78/EC of 27 November 2000 establishing a general framework for equal treatment in employment and occupation

- a prevailing age divide in the virtual space,
- structural group characteristics and circumstances holding older people back from going online,
- advantages older people can take from going online,
- and finally, risks associated with the Information Society.

These are discussed in the following.

The prevailing age divide in the virtual space

Despite the fact that ICT uptake among older citizens has steadily increased during recent years, clearly they do take less advantage of the tools and services of the Information Society when compared with younger people. There is manifold evidence that older adults have considerably less access to ICT devices – in particular to the PC still being the core means of accessing the online world – and the Internet, and that they less often use these technologies. Disparities in online access and usage are even higher when it comes to broadband technologies. Those who are online do however not appear to have radically different interests compared to younger onliners. Regardless of age, the Internet is today by the majority of users in the first instance regarded as a means of looking up information on certain issues and communicating with others by e-mail.

There are good reasons to assume that the age divide in the virtual space will not diminish by itself, at least not in the near future. On the one hand, the age cohorts who today are dominated by those not having gained any experiences with the Internet may not diminish as quickly as public debate sometimes suggests. For instance, under a “now change” assumption – i.e. assuming that those not yet having gone online will also in future keep off-online – mere 61% of the Europeans who will be in the age range between 64 and 74 years in 2044 would be online then. The corresponding figure for those aged between 65 and 74 years is 52%, and mere 44% for those aged between 75 and 84 years. And it would take roughly 30 years from now before the majority of Europeans in the age range between 55 to 64 would become Internet users. On the other hand, the digital divide is not merely about having access to the online world in technological regard. Rather it is about a range of access dimension – e.g. motivational access, material/physical access, skills access, usage access - impacting on the extent to which one is capable of making use of online technologies for achieving personal aims, and here older people tend to be disadvantaged in several regards when compared with younger people.

Structural characteristics and circumstances holding older people back from going online

Whether or not older people engage themselves with ICT cannot merely be regarded as a matter of biological age. Those older people who utilise ICTs for their purposes tend to be not only younger but also better educated; they tend to have a rather active life style and are on average better off in economic terms.

Many studies have confirmed that lack of interest and low motivation are key reasons for non-usage and non-access among large parts of the elderly. Many older people usually do not have people who use e-mail or the web among their peers, which might be one reason why they question the relevance of the online world for their every day life. Computer anxiety and intimidation by technology also appears to have an effect in this regard, and the fast pace of hardware and software development as well.

Another cause for lack of interest, but also a logical outcome of it, are missing skills in how to access and use the Internet and required access devices. Those older adults who actually are online are more likely to be influenced in their decisions about particular online activities by their lack of confidence in mastering the technology when compared with younger users.

The working environment seems to play a crucial role when it comes to acquiring the skills required for exploiting online technologies for ones own purposes, and those who have not been exposed to ICTs and the Internet at the work place lack an important opportunity to gain hands-on experience with the online world – which holds true not only for the majority of today's retired adults.

Further to this, physical impairments negatively impact on older people's engagement in ICT-mediated activities. A large proportion of older adults face functional restriction when using ICTs, e.g. in relation to their ability to see, to hear or to manipulate devices with their fingers, while the severeness of such restrictions tends to increase with age. On the other hand, there is evidence that older persons who are functionally restricted (visually, dexterity) are not less interested in such technologies, when compared with their non-restricted counterparts.

Finally acquisition and usage costs hold a considerable part of the older population back from going online. There are two somewhat different aspects that need to be considered here. On the one hand, low income households tend to be over-represented among the older age groups in many EU countries. On the other hand, cost sensitivity may be particularly high among older households because many older adults question the relevance of the online world to their every day life.

Advantages older people can take of being online

There are many potential benefits for older people from the Internet and online services. Some of these they share with other age groups and some are especially pertinent for older people. First of all, ICTs enable communication and many forms of interaction across distance which, together with the trend towards informatisation of economic activity and digitisation of products and services, means that it becomes increasingly possible to do things online that would previously have required physical travel / transportation. This has particular utility potential for older people who experience mobility restrictions, for example, because of physical disability, increased frailty or fears about crime in the neighbourhood or beyond. In addition, the possibilities for provision of remote health and care services that are discussed in chapter 4 are also especially relevant for older people.

Further to this, the Internet has become a central source of other information that can be very useful for older people. Perhaps the most obvious is health information, given the increasing likelihood of chronic and other health conditions amongst older people. In this regard, recent research has documented the growing importance of online health information in health management activities of European citizens. Also, information of practical usefulness in everyday life is increasingly becoming available over the Internet. One of the most common uses in this regard is searching for (consumer) and comparing information about products and services. This can be empowering for older consumers, enabling cheaper and better products to be sourced.

Risks associated with Information Society developments

Apart from potential benefits that emerge from Information Society developments, also potential risks can be identified. As already mentioned, a considerable proportion of older people are hampered in making use of ICTs because of functional changes in physical and cognitive functioning associate with ageing. From a normative perspective, there is a risk of discriminating an increasing share of the population, if the specific user requirements older people have are not adequately met. Taking a more pragmatic view, this bears the risk of depriving increasing parts of the population of services and products that are *only* available online, or that are available offline only at a lower quality or higher price. It has been observed, for example, that the quality of services offered online is rising at the same time as the quality of at least some services offered offline may be declining. Also, the freedom of choice and conditions of online services sometimes surpasses that of physical offices and

shops, giving those who are online citizen and consumer benefits and extra resources. This does however not only relate to commercial offerings. Even some public services now refer those who phone for information to their websites because staff don't take or get the time anymore to provide basic information.

A more indirect effect of the utilisation of online media relates to time displacement - where time spent online comes from, and which daily activities receive less time. There is some evidence that the time spend with the Internet may reduce social contacts. Such a development bears the risk of eroding social networks, and this could be particularly relevant for older people as their social interactions tend to anyhow decline with growing age. However, the research evidence available in this regard is quite limited. All in all risks that may emerge in relation to the life circumstances of older people from increasing virtualisation of social and economic interactions need to receive a more research attention.

2.6.2 Market response

In relation to the question, whether market players adequate responds to the challenges and opportunities identified above, two key areas of concern emerge from our analysis including:

- the availability of products and services meeting the needs of older people,
- and lobbying for older consumers and provision of supportive services to them.

These are discussed in the following.

Availability of products and services meeting the needs of older people

In view to the functional limitations experienced by large parts of the older population, ubiquitous Design for All (DfA) solutions are required if this population segment is to be adequately addressed. The DfA concept aims at designing ICT products, services and applications, which are demonstrably suitable for most of the potential users without any modification. In cases where this is not an appropriate solution ICT products should be easily adaptable to different users (i.e. by incorporating adaptable or customisable user interfaces). At least, they should have standardised interfaces, capable of being accessed by specialised user interaction devices, so called Assistive Technology (AT) devices. Although there are examples of products and services where such an approach has been adopted, clearly there is plenty of scope for improvements. Due to the lack of reliable market information, it is however difficult to make a reliable assessment to what extent mainstream ICT industry is actually adopting the DfA approach. There is some anecdotal evidence that in the USA - despite existing legislation - the introduction of inclusive design seems to have been quite slow yet. A benchmarking study announced in the recent Communication of the Commission on eAccessibility may shed light on the situation in Europe (CEC 2005e).

More generally, many ICT products and services do not seem to offer benefits that many older people would appreciate, or these may not be visible to them. As discussed earlier, there is some evidence that the state of understanding of the mature market is not well developed among ICT industry and online service providers when compared with other market segments. Older people as a specific customer group may however more and more come to the fore as "younger markets" start to saturate. The evidence base available today shows that older people indeed have a diverse range of interests and are interested in many of the same online services as other age groups. Moreover, some services may be of particular interest to them such as information on health issues, pensions and retirement. However, older age cohorts are less likely to speak English and are therefore more likely to find the current dominance of "cyber jargon" in the online world rather off-putting. Both availability of content and utilisation of technical terms in national language therefore seem important for making the online world more attractive to older Europeans.

As also discussed above, price sensitivity seems to be comparatively high among older population groups. Particularly in relation to the Internet, the variability of prices within countries suggests that comprehensive and transparent consumer information to help cost-conscious selection is an important issue, especially for older people with lower levels of income.

Lobbying for older consumers and providing supportive services to them

The existence of pressure groups lobbying for older people has shown to be an important variable influencing whether the specific needs older people are addressed in market and policy developments. Such groups exists in almost all European Countries, and there are many examples where such groups deliver high value to their older members through information, advocacy and service. However, ICT-related themes in particular seem to have been taken up to a noteworthy extent only by some of these yet.

Many ICT manufacturers and service providers seem to have not yet recognised the market demands that exist for products adequately meeting the needs of older people. Consumer organisations have an important role to play in making these market demands visible to industry. As demonstrated by some lobby groups in the U.S. and Europe, ageing organisations can play an important role in gaining ICT industry's attention with regard to the particular needs and preferences of older consumers. On its home page the AARP publishes, e.g. research results and information on older people's preferences regarding IST products and services. Through articulating the consumer power of its members, the organisation gives older people a strong voice, which cannot be ignored by market players and the policy makers. In this sense, aging organisations can use the collective purchasing power of their members to influence the market. For example, they can influence the shape of the market by bargaining for volume discounts or for the development of particular product lines, as well as merely increasing the size of the demand.

However, individual user organisations vary a lot across the European Union in terms of the coverage of their operations and the level of technological sophistication available to them. Some organisations in some countries are very much state-of-the-art and indeed are often a major force in both technical innovation and policy formulation. Other organisations have more limited expertise and resources. Likewise, some organisations have a European and international perspective whereas others focus primarily on the particular circumstances of their local membership. In this situation, it appears useful to work together in order undertake joint representations to policy makers and to equipment and service providers. This co-operation should occur at both national and EU levels. Collective action can often have a greater impact than separate representations from several small groups. Also, such a collaboration and pooling of available information on age-related ICT issues could be useful with regard to encourage and enable older people to exercise informed choices; to come forward with constructive criticism of the products they are offered; and to complain forcibly when products or services fall short of reasonable expectations.

2.6.3 Policy implications

One the basis of the analysis in previous sections, the main policy issue for the moment is the age aspect of the digital divide, namely, the low levels of usage of the Internet and online services by older people in Europe. Cohort effects in combination with the more general increase in uptake across the population will decrease the mere age gap in mere technical access to the online world over time, although this may not happen as quickly as one would perhaps assume. Nevertheless there are some key areas that warrant attention in policy and practical action at present, both to bring the benefits of the Internet and online services more quickly to the current population of older people and to help prevent enduring barriers in the

future. The barriers to access and usage are the most pressing policy concern for now and this aspect is the main focus of this section.

However, as the Information Society evolves the so-called "second-order" digital divide is beginning to emerge, with important differences between social groups in terms of the benefits that are being gained. There are also concerns about new risks for older people that may be presented by the more general dimensions of the Information Society, in particular the increasing virtualisation of social interaction and day-to-day transactions. Finally, there are possibilities for new ways of supporting the mobilisation of older people as an interest group and encouraging intergenerational cohesion. These aspects also need to be given appropriate policy attention.

Tackling barriers to access and usage

There are three main areas where barriers to access and usage need to be addressed including

- Awareness, motivation and skills;
- Availability and affordability;
- Accessibility and Design for All.

There is a lot of activity across Europe focusing on raising Internet and Information Society awareness, motivation and skills amongst older people. Although clearly requiring a strong bottom-up dimension, this field of activity would however benefit from a European-wide mechanisms for exchange of good practice and benchmarking in relation to ICT literacy and skills for older people. Here, attention should however not only be given to the current cohorts of older people. Also those in other age groups who face a risk of enduring age divides need to be considered, for example those who are outside the workforce so that age-divides in the future old age cohorts are minimised. A better understanding of the ICT-related learning preferences and needs of older people - and of how the various stake holders can best respond to these – should be sought by giving these issues a prominent place relevant research programmes.

In relation to affordability of Internet access, older age groups largely do not seem to take advantage of Public Access Points (PIAS) which are by now available in many countries. Therefore, options should be examined to make home access affordable to older people with low income, e.g. through provisions in relation to Universal Service[18]. The EU Universal Service directives enable national regulators to introduce measures that help to make access to basic telephone services affordable to low income and special needs groups, including people with disabilities. Here, it should be examined whether the scope of such provisions could be extended from basic telephony services to Internet access.

When it comes to eAccessibility related policy, an international dimension is important because of the global marketplace for ICTs and the global implications of accessibility requirements in public procurement. One important issue will be to ensure that the accessibility related needs of older people are given prominent attention in all relevant regulatory and other policy contexts. More generally, there is a need for EU level activity to encourage and provide guidance to the Member States on strong national transpositions of the various EU directives relevant in relation to eAccessibility so that they give due and appropriate emphasis to the eAccessibility dimension and good prominence to the needs of older people. When it comes to web accessibility in particular, EU-level encouragement and support is indicated in relation to a thorough follow through with the Council resolution on

[18] Directive 2002/22/EC of the European Parliament and if the Council of 7 March 2002 on universal service and users' rights relating to electronic communications networks and services (Universal Service Directive).

accessibility of public websites, and with specific emphasis of accessibility needs of older people.

In relation to Design for All aspects, it will be important that ongoing EU-level activities such as the development of Design for All curricula for designers pay specific attention to the requirements of older people. Knowledge in the area can be facilitated by giving this issue a prominent place relevant in EU-level RTD programmes. Also, there is a need for more encouragement of attention to age-friendly design among ICT industry and other relevant stake holder groupings, e.g. by means of awareness rising measures.

Avoiding new risks and exploiting new opportunities

There are three main areas where opportunities and new risks emerge from Information Society developments that warrant attention in relation to policy intervention:

- second order digital divides,
- newly emerging risks of virtualisation,
- and the support of older people's interest groups.

The term second order digital divide has come to use in relation those access dimension that go beyond mere technical access to the Internet. Once older people do go online it will be important that they are knowledgeable about and have the skills to use the Internet effectively and gain real benefits, for example, in managing health matters. This requires second order skills, i.e. skills that go beyond mere basic computer skills, in information searching and extraction of quality. These types of skills also need to be encouraged amongst older people, and any EU-driven efforts to develop ICT skills amongst older people also needs to give attention to this aspect. Also, the benefits Internet usage actually holds for older people and the skills need for fully exploiting this technology for ones own purposes should receive more research attention, and dis-benefits of not using it as well. The latter will become increasingly relevant from an equal opportunities perspective as the Information Society further matures and ICTs increasingly penetrate all spheres of economic and social life.

Another important issue for policy are the new risks of exclusion that the virtualisation brought by the Information Society can present for older people. One aspect of this is social contact, and it will be important to monitor for negative impacts such as loneliness and isolation and, if these are emerging, to try to counteract these through awareness-raising measures. More practically, the growth of online services is already encouraging a reduction of more traditional "bricks-and-mortar" outlets. This runs the risk both of reducing opportunities for social contact and also of excluding those who are not online from essential services. This is another important issue to be monitored and for policy to ensure that essential services continue to be offered in more traditional as well as online modes. This can be supported by setting common benchmarks on the quality of social interactions as a key indicator of social cohesion and social capital. Socio-economic research should be harnessed to monitor the impacts of increasing virtualisation on access to services of public interest and on social interaction and possible isolation.

There are already examples of older people's organisations widening their reach and influence through the Internet. This is an area that warrants support within the context of social inclusion policies, where strengthening of NGOs is an important component. Enhanced attention needs to be given to ICTs in ongoing programmes to support NGOs, including those involving older people.

Exhibit 2-39: Overview over policy and research priorities

Theme	Policy priorities	Research priorities
Awareness, motivation and training	EU driven effort to collate and exchange good practice, benchmark developments and set common targets for numbers of older people reached; this could be instantiated within the framework of the EQUAL programme	Learning preferences and needs of older people in relation to ICT skills Roles and contributions of the different players at the different levels (national/local, sectoral, and so on)
Affordability	Review and re-examination of the possibility of extending the scope of universal service provisions to include mobile and Internet access	Socio-economic research on the importance of the Internet for accessing essential services and of cost barriers for older people in this regard
EAccessibility	Develop a comprehensive, multi-pronged EU level approach, with prominent attention to the needs of older people EU to encourage and give guidance for strong implementation by the Member States of the accessibility provisions of the various EU Directives; to include EU driven guidance and encouragement of specific attention to age-friendly design of ICTs	Increased attention to understanding age-related changes in perception, dexterity and cognition and the implications of this for ICT design Specific targeting of this issue in the RTD Framework Programmes
Design for All	Continued emphasis and encouragement of the Design for All approach to address the diversity of user needs, with special attention to changing needs as people get older EDeAN work on curriculum development to give prominent attention to the needs of older people	Specific targeting of this issue in the RTD Framework Programme
Counteracting second-order digital divides	Increased emphasis on second-order skills to make the best use of the Internet in areas of key public interest, with prominent attention to older people	Socio-economic research on the benefits of the Internet (and dis-benefits of not using it) for older people, the skills needed, and monitoring of skills gaps
Avoiding new risks of virtualisation	Promotion amongst the Member States of the importance of access for all (especially for older people), including those not online, to services of public interest Setting common benchmarks on the quality of social interactions as a key indicator of social cohesion and social capital	Socio-economic research to monitor the impacts of increasing virtualisation on access to services of public interest and on social interaction / isolation
Supporting older people's interest groups	Give enhanced attention to ICTs in the ongoing programmes to support NGOs, including those involving older people	Socio-economic research and RTD on the needs, opportunities and ICT-enabled solutions for NGOs, including those involving older people

3 ICT, employment and work

3.1 Introduction

This chapter presents an analysis of the implications of ICT-based technological change for employment and work amongst the older segments of the working age population. In line with the analyses of the other core themes (ICTs in everyday life and ICTs for care) the main focus is on older workers and potential workers aged 50 years and over.

Key features of current and future demographic change in this area include:

- ageing of the workforce,
- encouragement of increased employment rates for older workers,
- discouragement of early retirement.

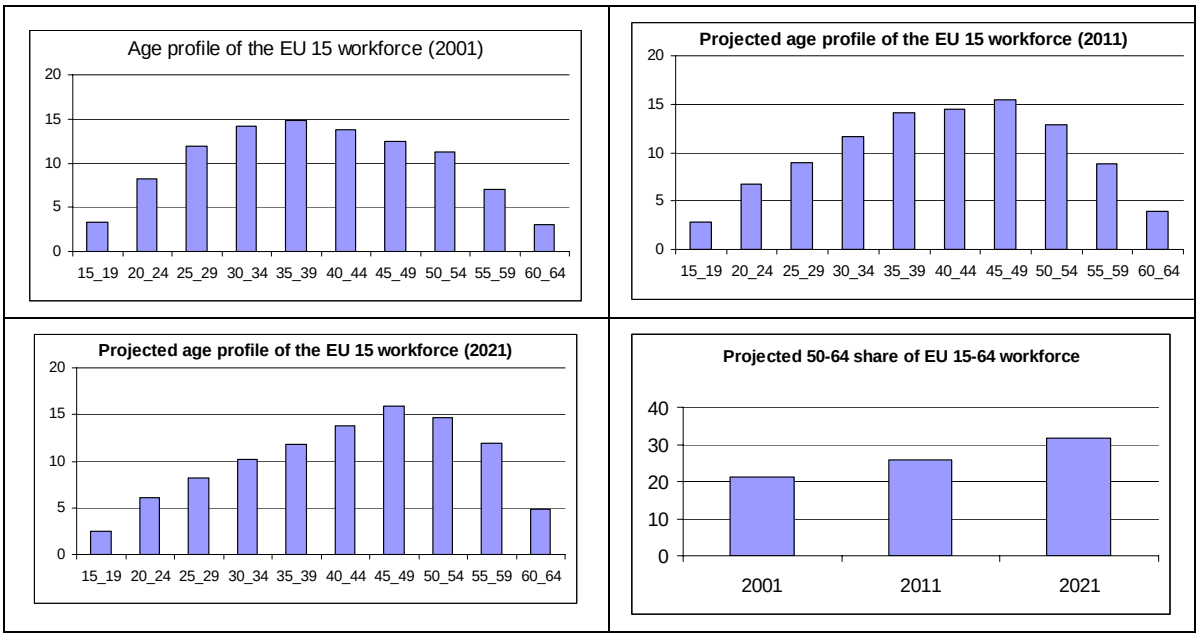
For purposes of this chapter these various processes and changes are addressed under the umbrella term "work-related active ageing" to distinguish it from the more general term "active ageing" which is more usually used to refer to the continuance of activity and participation by people in the older, post-retirement age groups.

Although the main focus of the analysis is on the links between technological change and *formal or paid work* some attention is also given to the theme of *informal or unpaid work*. From an individual and societal point of view, caring for older and disabled people, childcare and civic activities contributing to overall social capital are of fundamental importance, so the focus must be wider than employment rates alone.

3.1.1 The scale of the work-related active ageing issue

Overall, workers aged 50 years and older now comprise just a little under one-quarter of the EU workforce and projections based on population trends for the EU 15 suggest that the share of older workers may increase to almost one-third by 2021 (Exhibit 3-1).

Exhibit 3-1: Projected age profile of EU workforce

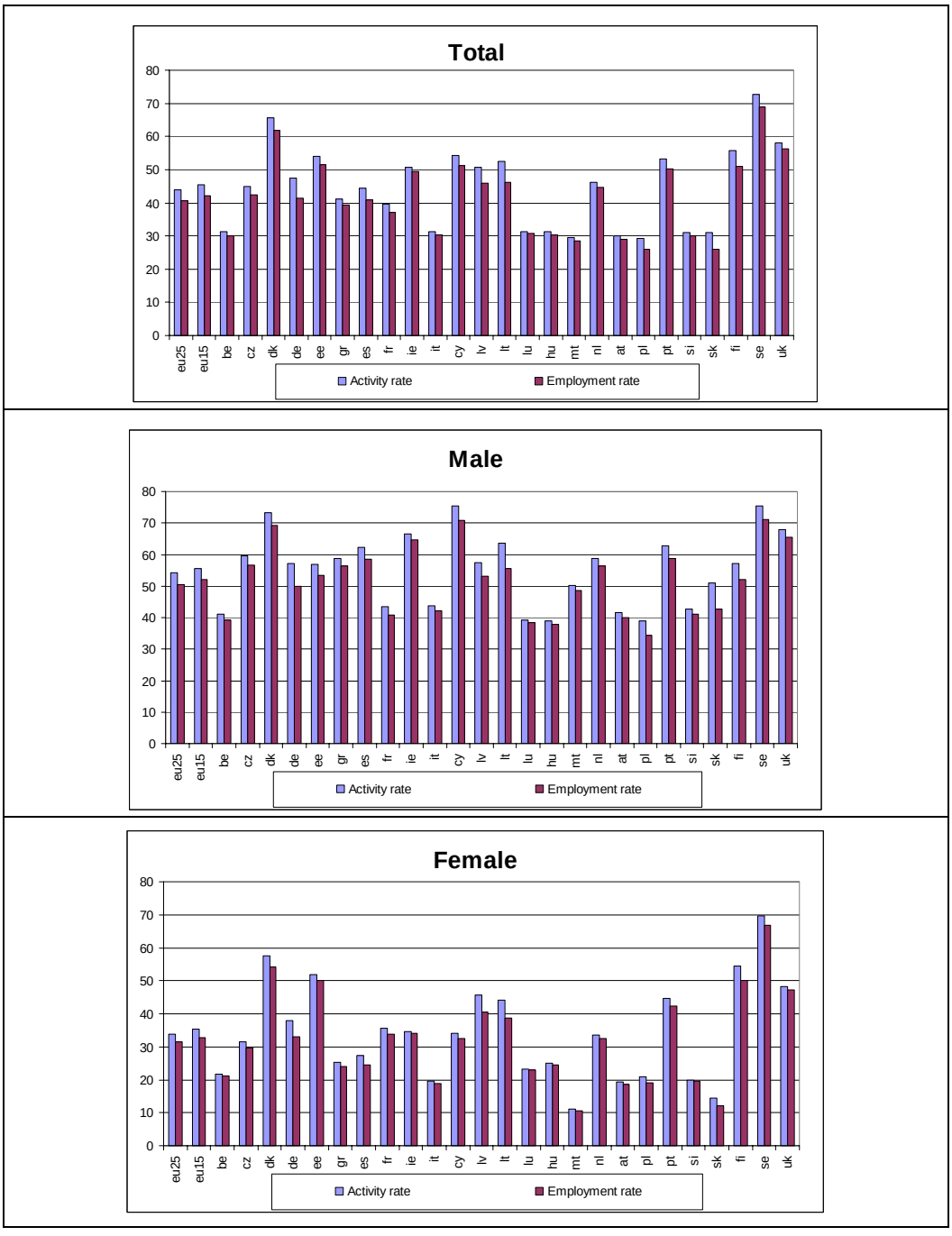


Source: EU LABOUR FORCE SURVEY for 2001; COOMANS 2004

Older workers are therefore an increasingly important group whose needs must be given consideration within the workplace, including issues arising in the context of ICT-related technological change.

These figures reflect in part the age structure of the overall population and in part the differences in employment and participation rates of different age groups. In particular, those aged 55-64 are under-represented in the EU workforce because of low activity (i.e. labour market participation) rates amongst these age groups. In 2004, the overall activity rate for this age group in the EU25 was 43.8% (45.3% in EU15) and the employment rate was 40.7% (42.2% in EU15). The activity (54.3%) and employment (50.5%) rates for men were a lot higher than the activity (33.8%) and employment (31.4%) rates for women, with considerable variations across countries (Exhibit 3-2).

Exhibit 3-2: . Activity and employment rates of those aged 55-64 in EU (2004)



Source: EU LABOUR FORCE SURVEY 2004

The EU has set a target of an employment rate of at least 50% for the 55-64 years age group by 2010 (STOCKHOLM EUROPEAN COUNCIL 2001) and to increase the average exit age by 5 years over the same timeframe (BARCELONA EUROPEAN COUNCIL 2002). If this is achieved then the proportion of older workers in the EU workforce will be even higher than the projections in Exhibit 3-2. Although considerable progress is being made (6% increase in the employment rate for the 55-64 years age group between 1996 and 2004, with particular progress in some countries, for example, Finland), achievement of the EU targets will require the mobilisation of all possible sources of encouragement as well as removal of causes of discouragement. In this effort it will be important to ensure that ICT-related technological change is harnessed and shaped in ways that maximise any positive opportunities that it presents and minimises any negative threats.

3.1.2 Risks and opportunities posed by ICT-related technological change

Work-related active ageing is occurring against a backdrop of continual technological change, the most dramatic of which in recent times has been the wide-scale introduction of ICTs into working life. This can present both new opportunities and new threats for older workers and potential workers.

If ICTs can help to make work and employment more age-friendly then they can help to promote high employment rates and good quality of work for older workers. Some of the properties of ICTs suggest that this may be a real possibility, for example, by exploiting their functionality and flexibility to design work in ways that adapts to the physical and cognitive changes that occur with increasing age. Some properties of ICTs may pose new risks, however. For example, the heavy reliance on visual displays, keyboards and mouse-type input devices might be at variance with some of the age-related changes in physical and cognitive functioning.

Apart from these inherent properties of the technologies themselves, the introduction of ICTs tends to be associated with changes in the organisation of work and in organisational structures. Again there are potential up-sides and down-sides for older workers and potential workers. More flexibility in when and where work is done can open up new opportunities for working arrangements that fit with responsibilities and restrictions that can increase with age, for example, as a result of activity-limiting illness or disability, or from caring responsibilities. On the other hand, intensification of work through tighter deadlines and turn-around times or through extensification of work through requirements for 24/7 working in some ICT-based occupations may not be compatible with the capacities or preferences of older workers. In addition, such developments may have negative implications for willingness / ability to contribute to care for others (whether children or dependent older people) as well as for wider contributions to social capital through civic work.

Another aspect to be considered is (technological) *change*, in itself, and the implications of this for older workers and potential workers. For example, there is a widely held perception that people's capacity and willingness to embrace change and to learn new skills reduces with age. If this is true then it can be expected that older workers and potential workers may be disadvantaged by the introduction of ICTs and the associated novelty[19], requirements for new skills and new ways of doing things. Even if it is not true that older workers have limited capacity for adjustment to technological change a perception that this is the case, whether

[19] It is debatable whether all ICTs, for example computers, can still be considered to be "new" technologies in those occupations where personal computers have been a central feature for more than a decade by now. However, the process of diffusion of ICTs across sectors and occupations is still ongoing and new applications and software releases require continual updating of skills and mastery of new procedures.

held by older workers themselves, by co-workers or by employers could be just as disadvantaging.

Finally, technological change affects the labour market overall in various ways. If technological change brings productivity increases then the demand for labour may decline (although evidence for this is a lot less clear for ICTs in comparison to manufacturing technologies) and it is possible that this may affect older workers and potential workers differently to younger workers. The diffusion of ICTs also brings changes to the skills and experience in demand on the labour market and hence affects opportunities for finding employment, for changing jobs and for commanding a good level of remuneration. In addition, new occupations emerge and traditional occupations may decline in importance. This may be to the advantage of younger workers and potential workers with "hot" new skills as opposed to older workers and potential workers with more traditional skills.

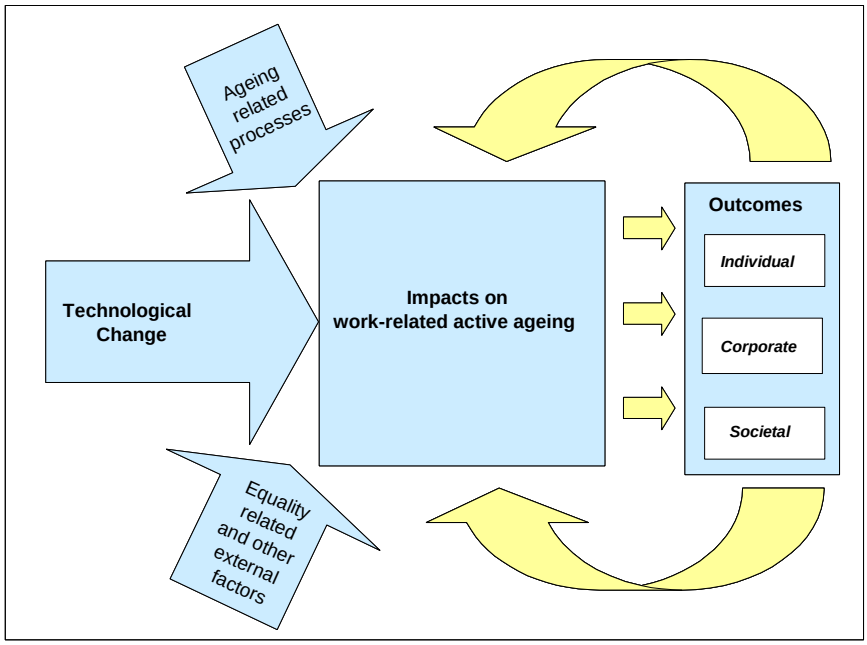
The remainder of this chapter examines available evidence on the extent to which and how ICTs are impacting on work-related active ageing in these and other ways, looks at current policy and practice in this field and identifies some key policy and research themes that warrant attention in Europe.

3.1.3 Conceptual approach

Overall it is clear that the possible interactions between ICTs and demographic ageing are complex and multi-dimensional and that simple direct effects of ICTs on employment rates and employment-related outcomes for older workers and potential workers are likely to be difficult to isolate. An added difficulty in this is that the topic of ICTs and work-related active ageing has been given relatively little focused research attention to date. Nevertheless there has been some research on aspects of the topic, ranging from age-related accessibility aspects of ICTs to impacts of ICTs on retirement decisions. In addition, there is some relevant data from labour market and other surveys.

The framework outlined in Exhibit 3-3 has been developed to help organise the current knowledge base, identify policy implications and provide a basis for an ongoing research agenda in this field.

Exhibit 3-3: Basic analytic approach



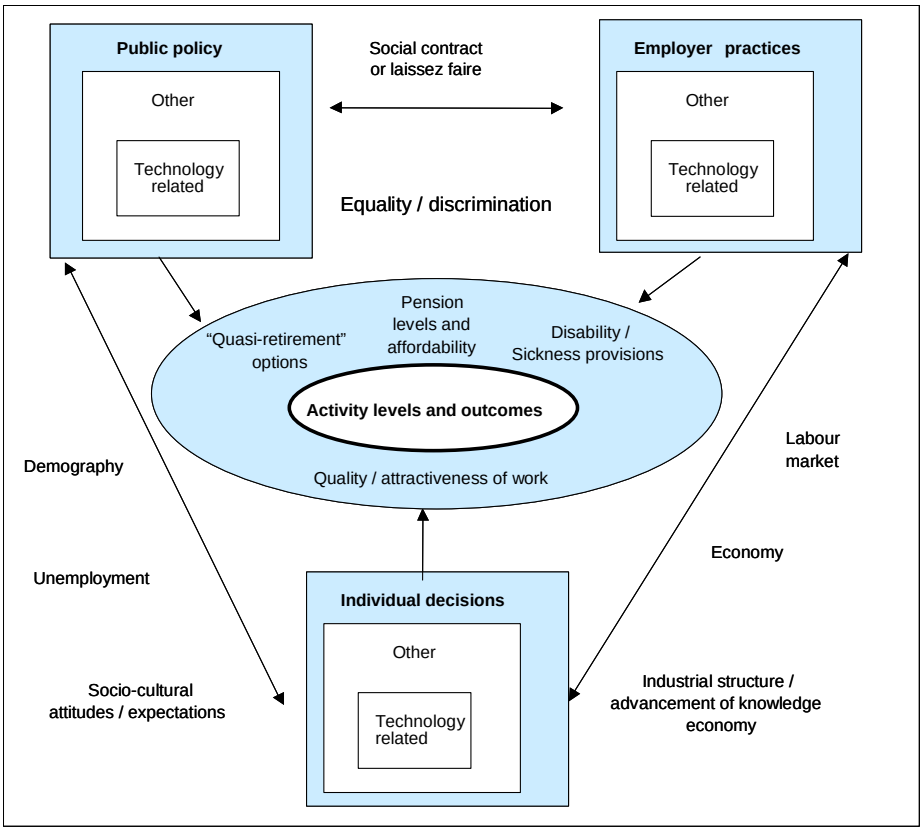
Source: the authors

The framework distinguishes four main dimensions:

- technological change,
- age related processes and age-equality and other external factors that affect the implications of technological change for older workers / potential workers,
- impacts of technological change, in conjunction with these other factors, on work-related active ageing,
- the ultimate outcomes at the individual, corporate and societal levels.

The primary focus in the remainder of this chapter is on processes and impacts that can be directly or at least closely linked to ICTs. However, it is important to recognise that ICTs, and technological change more generally, comprise just one element of a range of factors and forces that affect work-related active ageing. Just some of the dimensions of this wider picture are schematically represented in Exhibit 3-4.

Exhibit 3-4: Technological change and other factors / forces affecting work-related active ageing

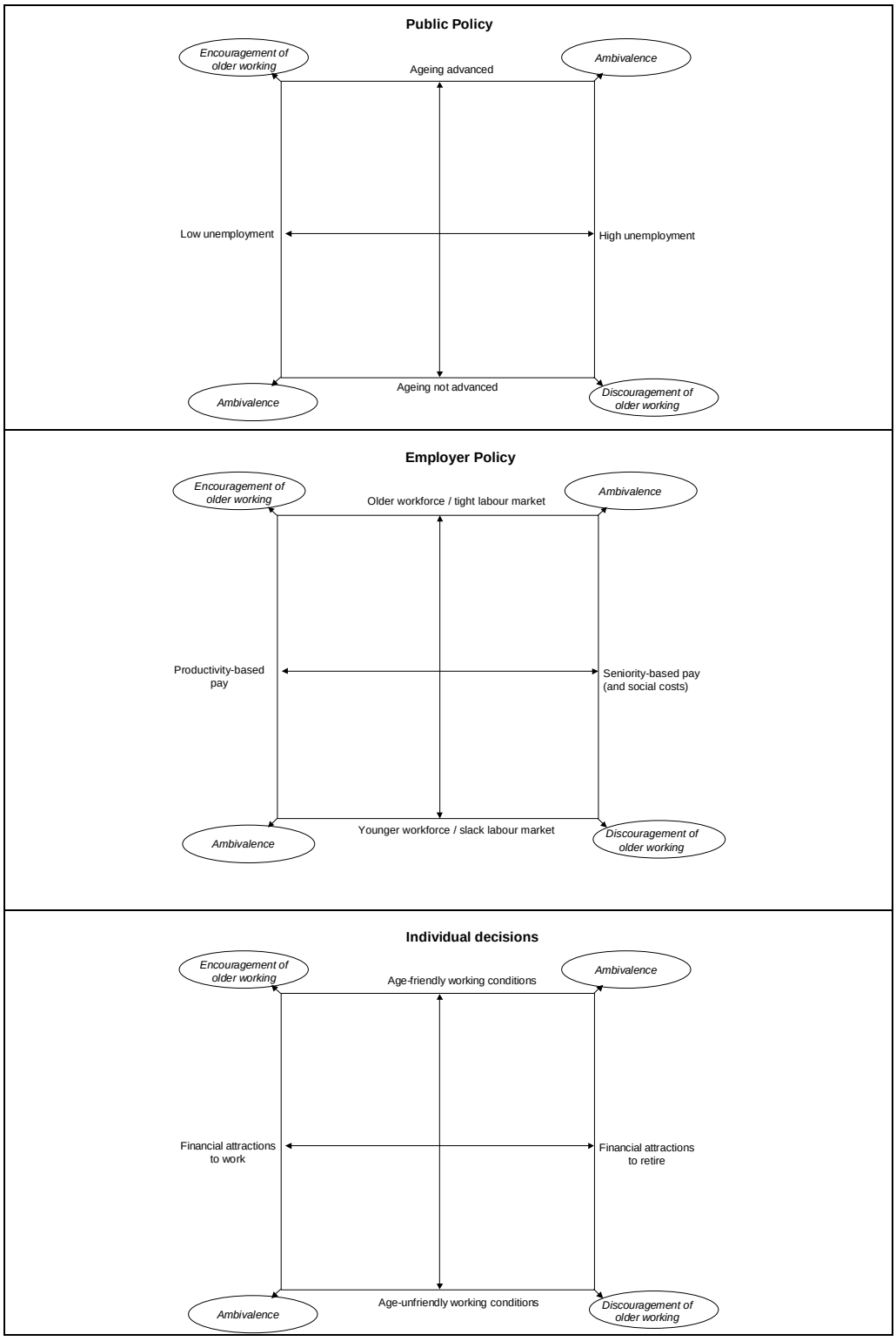


Source: the authors

The schema has at its core the (labour market) activity levels and outcomes for older people. A combination of public policy and provisions, employer practices, and individual circumstances and decisions interact to affect these. At each level, technology-related factors may play a role but typically as just one element of a wider set of factors.

The most direct influences on activity levels are financial factors, namely the relative financial attractiveness of remaining in the labour market or withdrawing from it through retirement or other means. The options available will be determined by pension levels and the affordability of (early) retirement, as well as by the availability and attractiveness of other alternatives, such as disability/sickness provisions and other quasi-retirement options. Apart from this the quality and attractiveness of available work options will also be a central consideration.

Exhibit 3-5: Ambiguity and ambivalence towards work-related active ageing



Source: the authors

The nature of such options and the priorities of public policy, employers and older workers / potential workers will vary depending on contextual factors that differ widely across countries, including the economy and labour market, the level of demographic ageing and socio-cultural attitudes and expectations. Across Europe the immediacy of the work-related active ageing issue varies considerably across countries and may sometimes conflict with other policy priorities (e.g. unemployment amongst younger workers), resulting in a considerable

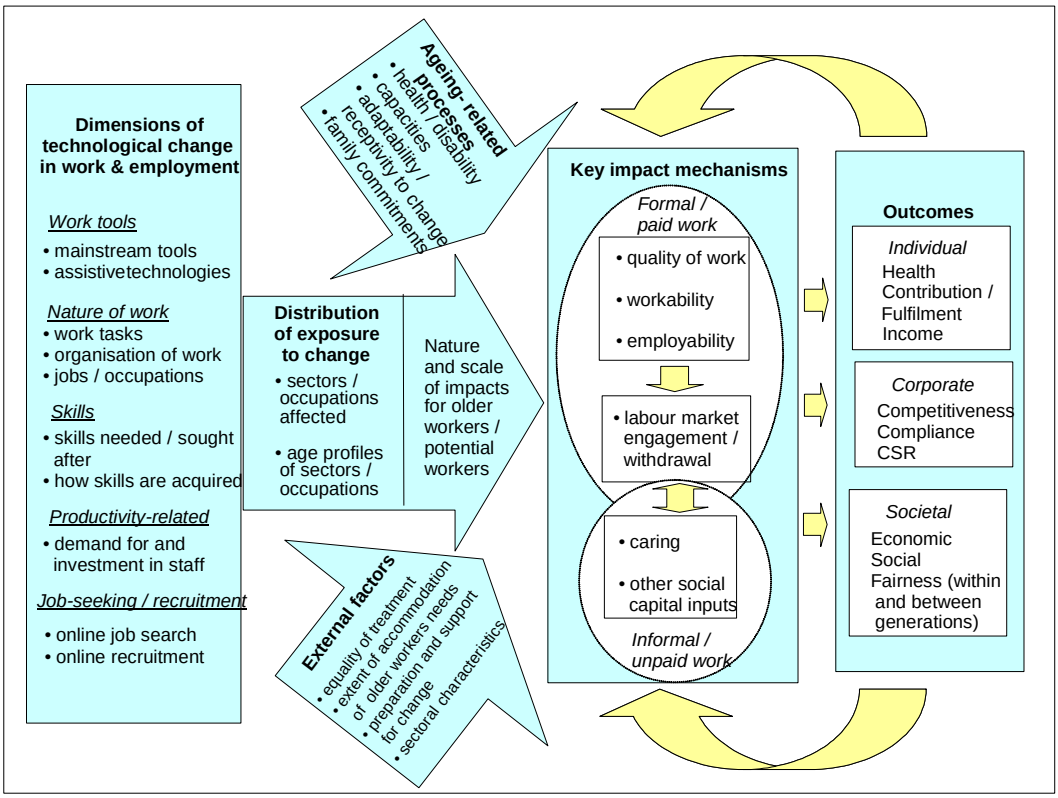
ambivalence in goals / approaches at policy and employer levels that can also be reflected in individual decision making (Exhibit 3-5).

3.2 State-of-the-art: current knowledge about the topic

This section provides an overview of what we currently know about technological change and work-related active ageing. As noted above, this is an under-researched field and there is no single, well-developed and coherent field of research that focuses on this theme. Part of the reason for this is that the main policy focus to date has been on engagement / retirement decisions and the financial factors that influence this. More generally, there has not yet been sufficient multi-disciplinary research to address simultaneously the multi-dimensional set of the factors that are involved. Nevertheless, as will be shown in this section, there is a growing body of data and research that can help to throw light on how technological change is impinging on work-related active ageing.

Exhibit 3-6 presents the analytic framework that has been developed to help understand the processes and factors that are involved in the interactions between technological change and work-related active ageing

Exhibit 3-6: Analytic framework: interactions between technological change and work-related active ageing



Source: the authors

3.2.1 Overview of key dimensions of technological change in work and employment

Technological change impacts on work and employment in many different ways. Some impacts are directly linked to ICTs in themselves (e.g. new ways of working based on

computers and other new ICT-based tools) and others are linked to the ways that ICTs enable or encourage changes in the organisation of work (e.g. the time and place of work).

ICT-related work tools and their characteristics

For purposes of the analysis it is useful to make a distinction between mainstream tools and assistive technologies.

Mainstream ICT-related tools

One dimension to technological change concerns changes in the basic tools that are used to perform work. In this study the focus is on developments in ICT-related tools in the working context. There are many different technologies, services and applications of relevance in this regard, with variations depending on sector, occupation and so on. They include the computers, computerised applications and systems, and Internet-based applications and services that are becoming a ubiquitous feature of office-based work; the computerised tools and process control technologies that are increasingly utilised in manufacturing; and the various hand-held devices that are becoming commonplace in many other service areas.

These tools share some commonalties in the types of interface (visual displays and input devices) and associated modes of interaction (various forms of information input, finding, manipulation and output). A key issue concerns the extent to which these features match the perceptual, motor and cognitive capacities of older workers.

ICT-related assistive technology

Another dimension to technological change is the potential offered by ICTs to support older workers deal with challenges that they may face in the workplace because of age-related changes in capacities and functioning. There are a large variety of such assistive technologies that have been developed for use in the workplace, in educational settings, in the home and in the wider environment. Many of these are relatively simple low-tech devices and others are based on ICTs. Two somewhat different types of application of ICT-based assistive technologies are important – those aiming to make ICT more accessible and usable, and those aiming to support wider work activities. A key issue concerns the extent to which older workers have needs for assistive technology and the extent to which these needs are being provided for in the workplace.

Nature and organisation of work

Technological change impacts on the nature of work in a number of ways. It changes work tasks and introduces entirely new ones; it facilitates or requires changes in the organisation of work; and it changes the content of jobs and occupations. Associated with this are changes in skill needs amongst the workforce and amongst those seeking to enter the workforce. In addition, changes in the organisation of work in time and place associated with or facilitated by technological change are also very significant.

Work tasks and the organisation of work

Technological change can have a variety of impacts on work tasks and the organisation of work (e.g. DUCATEL and BURGLEMAN 1999; ILO, 2001), including:

- de-materialisation (reductions / changes in physical aspects of work),
- increased information and knowledge work,
- more / less multi-tasking,
- more / less intensification of work,
- more / less social contact, team-working, etc.,
- greater flexibility in time and place,
- more working outside standard hours, including 24/7,

- blurring of boundaries between work and non-work,
- less stable / secure employment, precarious work.

One cross-cutting dimension is the increased flexibility of work organisation that is enabled by ICTs, including flexibility in time, place and types of work contract. This flexibility can be employed in worker-centric and / or company-centric ways, with quite different implications for workers. Worker-centric flexibility can allow work rhythms to be fitted to other aspects of the worker's life, such as family or personal requirements; company-centric flexibility might sometimes have the opposite impacts, through unsocial hours of work and / or job insecurity.

These types of change are relevant for the whole workforce, including older workers. Some may be more important for older workers, whether positively or negatively, because of their changing capacities and life circumstances. A key issue concerns the extent to which older workers have the opportunity to benefit from the types of flexibility that have positive impacts and are protected from those that have negative impacts.

Jobs / occupations

Technological change also brings changes in jobs and occupations. Some jobs change in their content, some become obsolete and totally new jobs emerge. Changes occur both within the ICT industry and ICT professions (e.g. new jobs such as webmasters) and in other sectors / professions (e.g. new jobs such as call centre operators). Key issues here concern the age-friendliness of the work and working conditions of different jobs and occupations, and age equality in access to the range of occupations.

Skills

Technological change brings changes in skills needs (ICT-related skills) and also in how such skills are acquired. Ongoing efforts are being made to understand and classify the ICT skills content of jobs, and a number of different levels have been distinguished (OECD 2004, 2005a; E-SKILLS FORUM 2004):

- basic digital literacy (basic computing and online skills important for everyone),
- applied ICT skills (important for jobs exposed to ICTs):
  - advanced user skills (competent users of advanced, and often sector-specific, software tools; ICTs are tools, not the main job),
  - basic user skills (competent users of generic tools, such as the main office software packages; again, ICTs are tools, not the main job),
  - E-Business skills (skills needed to exploit the business opportunities provided by ICTs),
- professional ICT skills (within the ICT sector and ICT functions in other sectors; ICTs constitute the main part of their job).

Key issues here concern whether there are age-related differences in relation to the different skills, including the composition of the current skill base, capacity to learn new skills and interest in / willingness to learn new skills.

The ways in which ICT skills are acquired (through formal training at or outside the workplace, informally learned on the job, and so on) is also important, including ICT-based methods (eLearning). A key issue here is whether there are age-related differences in access to, suitability of and preferences for different modes of learning ICT skills.

Productivity, labour costs and wages

ICTs can be expected to impact on productivity, labour costs and wages in various ways.

Impacts on productivity have proven difficult to measure, both for the ICT-sector and for ICT-induced productivity gains in other sectors. However, recent analyses have found an overall positive and significant correlation between a sector's share of ICT-skilled employment and gross value added per employee (OECD 2005a). Robust evidence of positive correlations between ICT investments and performance has also been found at the firm level (OECD 2003).

Impacts of ICTs on wages are manifested in different ways. New / scarce skills command high wages: the rapid pace of ICT-based developments means that many ICT-related tasks require higher-order skills based on tacit knowledge, which are difficult to reproduce in large quantities. On the other hand, though, ICTs have significantly increased the possibility for codification of knowledge, in the form of computer programmes which act as work tools for less qualified workers. For this reason, many ICT-based occupations are relatively low paid (e.g. data entry, call centre operator).

Key issues here include the extent to which these factors impact on employers hiring, retention and release of workers of different ages and on wage-related issues for older workers and potential workers.

Job-seeking and recruitment

Finally, ICTs are becoming important in relation to job seeking and recruitment. Increasingly employers are advertising positions on the Internet and job seekers are searching for opportunities online. In addition, there are many online recruitment agencies.

A key issue here is whether these new online opportunities are targeted towards and / or being used to the same extent by older and younger job seekers.

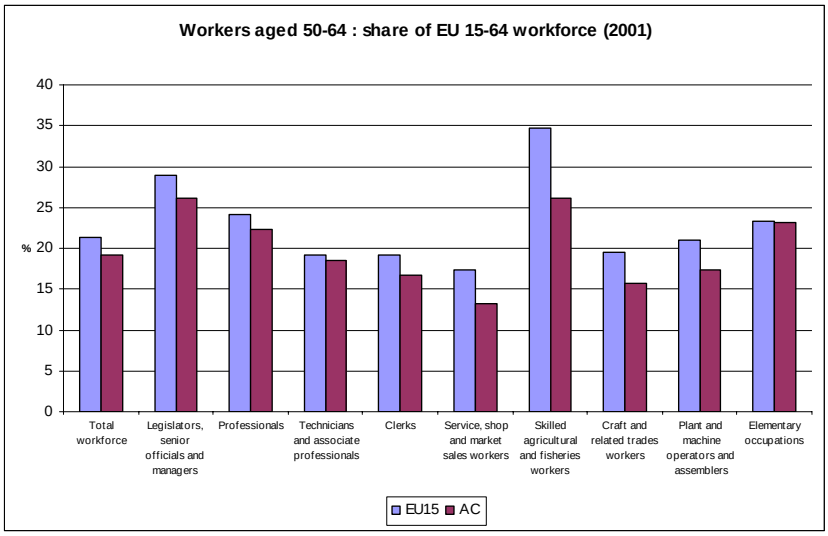
3.2.2 Distribution of exposure to the impacts of technological change

Not all workers are or will be exposed in the same way to these various dimensions of technological change. This will vary by sector/occupation and according to the age profiles across sectors/occupations. The distribution of exposure to change will determine the nature and scale of impacts for older workers / potential workers.

Age profile of the workforce

Older workers are not distributed evenly across the workforce, being under-represented in some occupations and sectors and over-represented in others. Exhibit 3-7 shows the age composition of the main occupational categories for which EU wide data is available.

Exhibit 3-7: Age composition of the main ISCO occupational categories

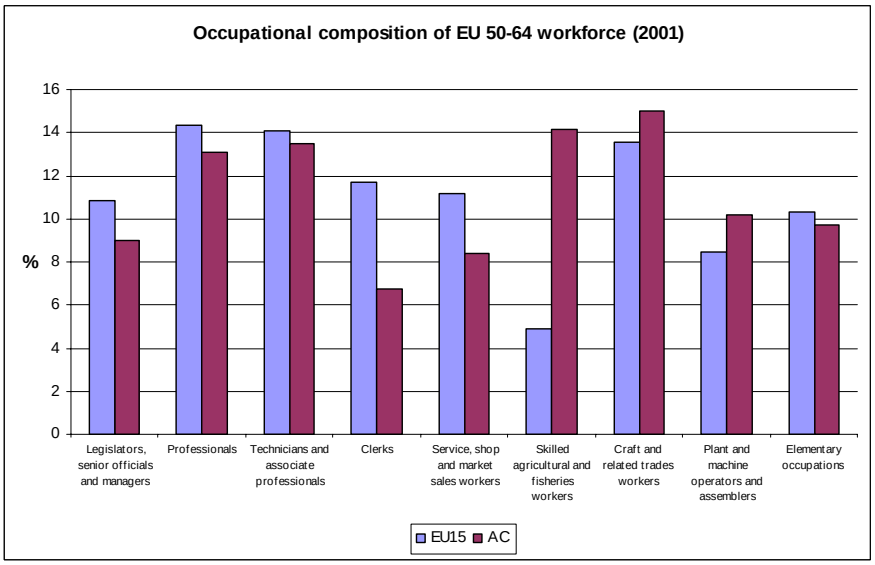


Source: LABOUR FORCE SURVEY 2001

The age profile is especially older in two categories – "legislators, senior officials and managers" and "skilled agricultural and fisheries workers" – especially in the new Member States for the latter category.

Exhibit 3-8 presents the occupational distribution amongst the older workforce. It can be seen that for both the old and new Member States, the largest occupational categories are "professionals", "technicians and associate professionals" and "craft and related trades workers". In the new Member States fewer older workers are in the "clerks" and "services, shop and market sales" categories whilst a much larger proportion are in the "skilled agricultural and fisheries category".

Exhibit 3-8: Occupational distribution of the older workforce



Source: LABOUR FORCE SURVEY 2001

Older workers in ICT-intensive occupational categories

The relevance and extent of diffusion of ICTs varies across sectors and occupational categories. Some occupations can be considered to be primarily computer-based or computer-focused, some are not computer-based as such but involve varying levels of computer usage, and others do not involve any computer usage at all. In office-based work, computers and associated applications and services are becoming ubiquitous and affect or will affect practically the entire workforce, young and old. In the manufacturing context, computer-controlled processes are increasingly being deployed but only a minority of the workforce directly engage with these. In other services, the main trend is in the area of hand-held devices, with the extent of deployment varying widely across sector and occupation.

The ISCO occupational classification system used for EU workforce statistics does not provide information on computer-based jobs, per se. However, data from the U.S. current Population Survey suggests that such jobs comprise under one-in-twenty (4.6%) of the workforce there (Exhibit 3-9).

About 2% of the U.S. workforce work in computer occupations, about 0.5% in computer-based office work (this refers only to the small proportion of office workers who are dedicated computer operators in some form), about 0.1% in computer-based work in the production sector, and perhaps up to 2% in computer-based sales and sales related work (although this is probably somewhat of an overestimate as not all of the customer service category will be in computer-based positions).

Turning to Europe, the OECD has recently developed an approach that classifies the ISCO occupations in terms of the levels of ICT-skills that are typically needed in the occupation (OECD 2004; OECD 2005a). This classification makes a distinction between “narrowly-defined” and “broadly-defined” ICT skills.

The narrow definition focuses on the skills of ICT specialists who have an ability to develop, operate and maintain ICT systems[20]. ICTs constitute the main part of their job – they develop and put in place ICT tools for others. Those within the broad definition of ICT skills include, in addition to the ICT specialist groups, advanced users (competent users of advanced, often sector-specific, software tools, for whom ICTs are not the main job but a tool) and basic users (competent users of generic tools, such as office software packages, needed for everyday tasks in the Information Society) [21].

[20] ISCO occupations included under the narrowly-defined ICT skills category are: Computing professionals (213), Computer associate professionals (232), Optical and electronic equipment operators (313) and Electrical and electronic equipment mechanics and fitters (724)

[21] ISCO occupations included under the broadly-defined ICT skills category are: Directors and chief executives (121), Production and operations managers (122), Other specialist managers (123), Physicists, chemists and related professionals (211), Mathematicians, statisticians and related professionals (212), Computing professionals (213), Architects, engineers and related professionals (214), Business professionals (241), Legal professionals (242), Archivists, librarians, and related information professionals (243), Computer associate professionals (312), Optical and electronic equipment operators (313), Finance and sales associate professionals (341), Business services agents and trade brokers (341), Administrative associate professionals (343), Secretaries and keyboard-operating clerks (411), Numerical clerks (412), Electrical and electronic equipment mechanics and fitters (714).

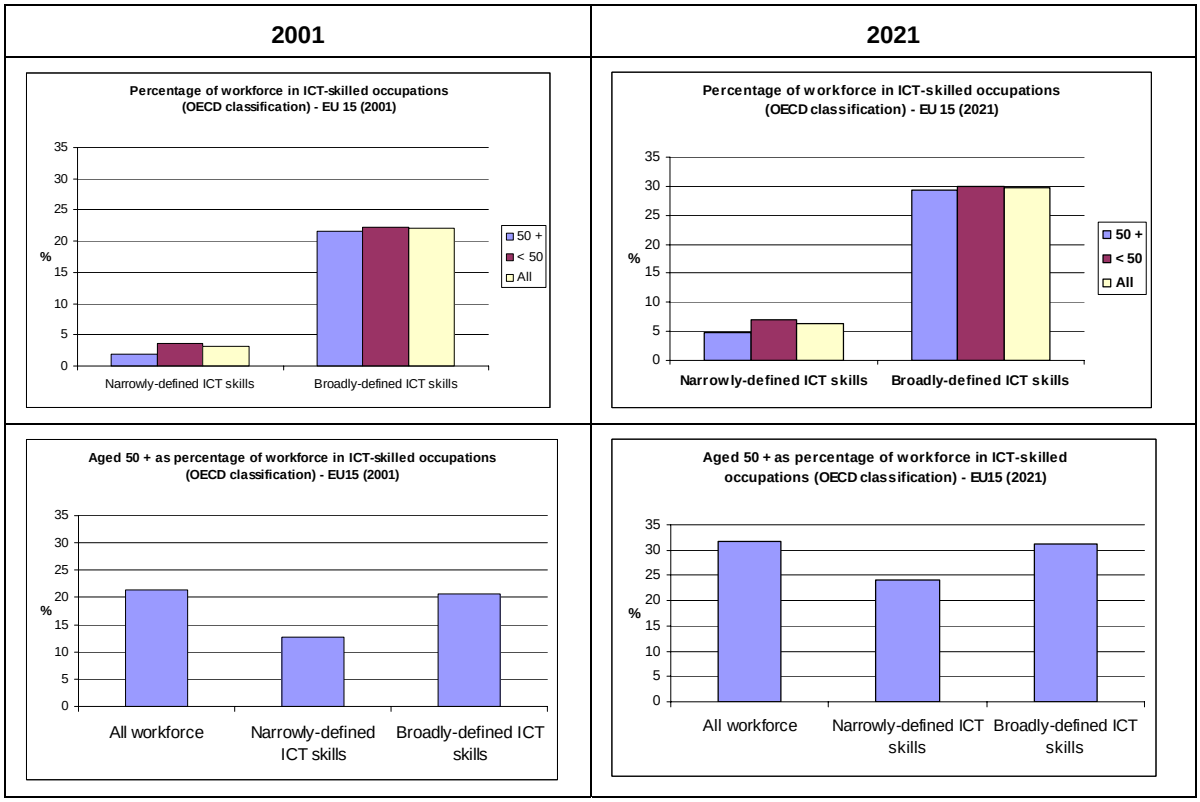
Exhibit 3-10 shows the current and projected representation of the older workforce amongst occupations with a high intensity of the narrowly defined and broadly defined ICT skills, respectively, and the overall importance of the different occupational categories for the workforce overall and for younger and older workers.

Exhibit 3-9: Computer-based jobs as percentage of overall workforce – (U.S., 2004)

Category	Occupation	% of workforce
Computer	Computer and Information Scientists	0.02
Occupations	Computer programmers	0.32
	Computer software engineers, applications	0.33
	Computer software engineers, systems software	0.25
	Computer support specialists	0.38
	Computer systems analysts	0.38
	Database administrators	0.08
	Network and computer systems administrators	0.20
	Computer specialists, all other	0.10
	All computer occupations	2.06
Computer-based	Computer operators	0.11
office and	Data entry keyers	0.24
administrative support	Word processors and typists	0.13
	Desktop publishers	0.03
	All computer-based office and administrative support	0.51
Computer-based work	Computer controlled machine tool operators	0.10
in production	Numerical tool and process control programmers	0.01
occupations	All computer-based work in production occupations	0.11
Computer –related	Telemarketers	0.33
sales and sales	Customer service	1.48
related	Computer, ATM and office machine repair	0.12
	All computer-related sales and sales related	1.93
All computer-related		4.61

Source: BLS 2004

Exhibit 3-10: Older workers in ICT-skilled occupations



Source: LABOUR FORCE SURVEY 2001; COOMANS 2004

In 2001 just over one-in-five (22.1%) of the workforce overall worked in occupations in the broadly defined ICT skills category and just under one-in-thirty (3.2%) worked in occupations in the narrowly defined categories. By 2021 the share of the workforce working in the broadly defined category is projected to increase to nearly one-in-three (29.7%) and in the narrowly defined category to about one-in-15 (6.4%), the latter being a doubling of the share of employment over the period.

For the broad category, the profile for older workers is very similar to that for younger workers and for the workforce as a whole, both in 2001 and in the projected situation in 2021. In the case of the narrowly defined skills category, however, older workers were considerably under-represented in 2001 but the gap is projected to reduce somewhat by 2021.

Overall it can be seen that older workers working in occupations requiring ICTs skills according to the OECD definition comprise a minority of the older workforce at present and will continue to do so over the next twenty years even though their share will increase during the period. Although this gives a useful yardstick on the current situation of the older workforce and on likely overall developments, these figures based on the OECD skills classification are very coarse-grained. They are based on the numbers employed in occupational areas with a likelihood of high requirements for ICT skills and not all workers in these occupational groupings necessarily work with ICTs themselves. In addition, many workers in other occupational categories are likely to use ICTs to some degree as part of their work.

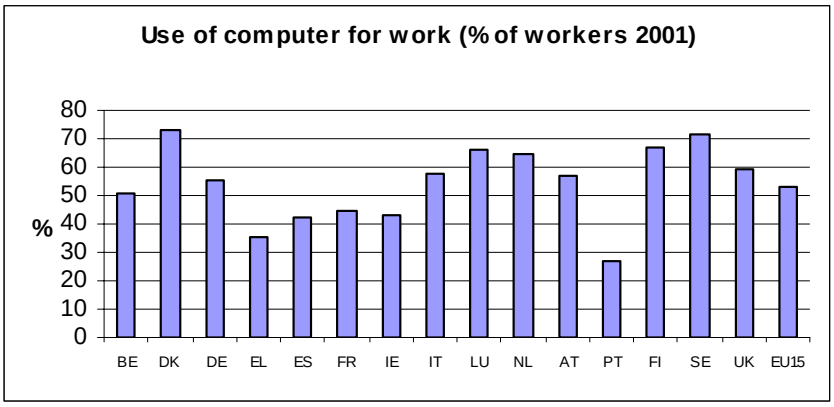
Use of ICT at work

Overall workforce

A Eurobarometer survey in 2001, for example, found that more than half (53%) of the workforce in the EU 15 used ICT for their work (CEC 2002), an increase of one fifth over

2000 (Exhibit 3-11). However, there remain significant differences across the Member States, with computer use for work in 2001 ranging from just 27.2% in Portugal to 73.0% in Denmark.

Exhibit 3-11: Use of computer for work (EU15, 2001)



Source: EUROBAROMETER 2001

In some occupational groups computer usage is becoming ubiquitous. For example, in 2001 87.0% of managers and 77.1% of other white-collar workers used a computer in their work (CEC 2002). This was in contrast to less than one quarter of manual workers (although this in itself is a surprisingly high number). Computer use also varies by company size, ranging from 45% of workers in micro enterprises to more than 70% in large companies (CEC 2002).

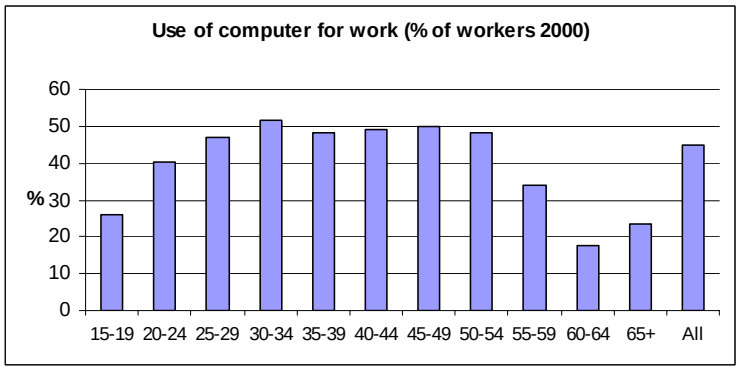
Gender patterns

Women workers (54.4%) were just a little more likely to use computers for their work than were men workers (52.4%). This relates to computer usage, in all forms, across the workforce. Other research (WWW-ICT 2003) has found that women are under-represented in higher level as well as more technical ICT occupations such as IT professionals (in EU15 in 2001, just 17% were women) and computer technicians (just 22% were women).

Older workers

As regards age and computer usage for work, available data for 2000 suggest that computer usage is lower amongst the younger age groups and then starts to fall off again amongst workers aged 55 and over (Exhibit 3-12).

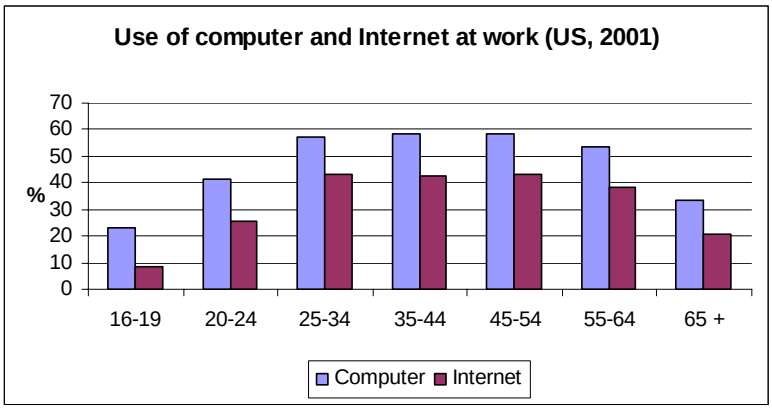
Exhibit 3-12: Use of computer for work by age (EU15, 2000)



Source: EUROBAROMETER 2000

As shown in Exhibit 3-13, U.S. data presents a similar picture to that in the EU15 (BLS 2002), although the fall off amongst the older age groups is not as fast or as steep.

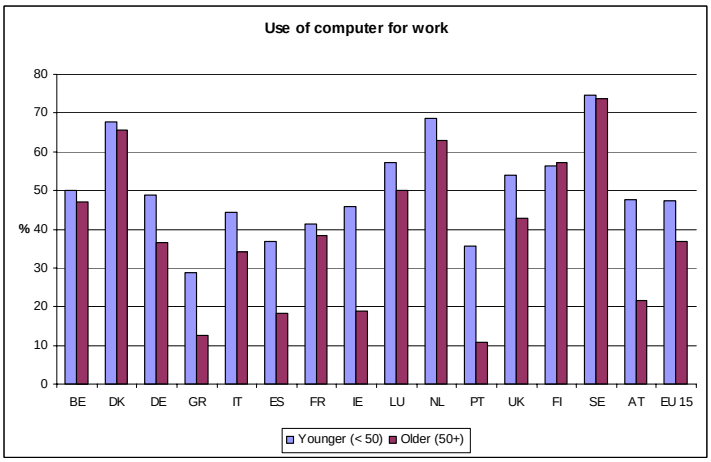
Exhibit 3-13: Use of computers and the Internet at work (U.S., 2001)



Source: BLS 2002

The overall European picture hides considerable differences across countries (Exhibit 3-14). Usage of computers for work by older workers is almost at the same level as usage by younger workers in Finland, Sweden, Denmark, France and Belgium, but a lot lower in Portugal, Greece, Spain and Ireland.

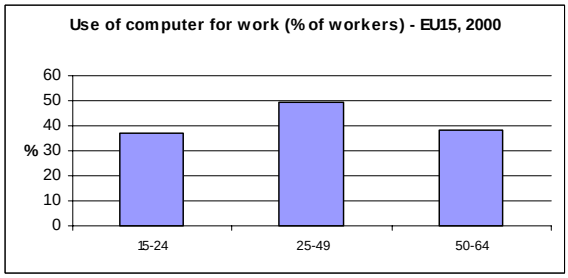
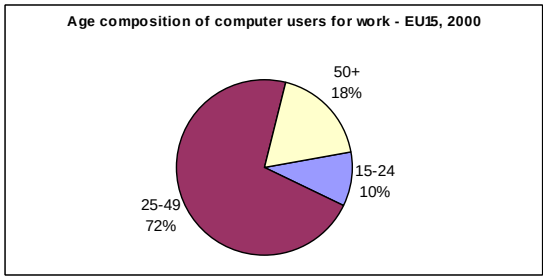
Exhibit 3-14: Use of computer for work by age in the EU 15 Member States (EU15, 2000)



Source: EUROBAROMETER 2000

In terms of the main age blocks in the workforce there is a clear pattern of higher rates of computer usage amongst those in the 25-49 years age group (Exhibit 3-15).

Exhibit 3-15: Computer usage for work for the core age groups (EU15, 2000)

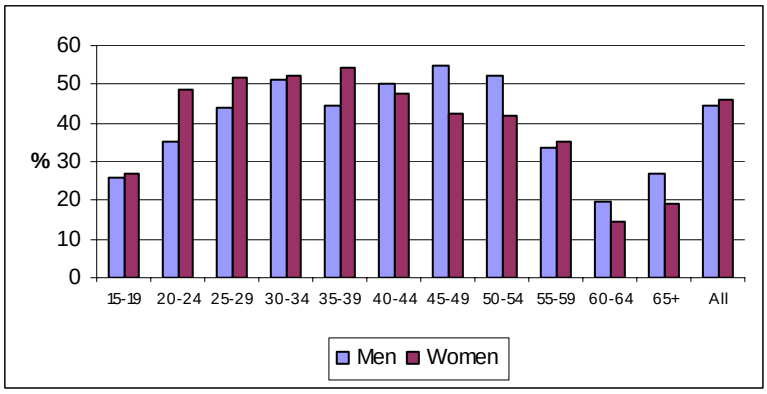
Extent of computer usage for work	Composition of computer using population
	

Source: EUROBAROMETER 2000

As regards the overall composition of the computer-using workforce, the prime age (25-49) group make up the majority (72%), with older workers comprising just under one-in-five (18%).

Available data for the EU15 suggests that gender patterns in computer usage vary with age (Exhibit 3-16). The overall tendency amongst younger workers is for women to use computers more often than men but this pattern reverses amongst older workers overall.

Exhibit 3-16: Computer usage for work by age and gender (EU15, 2000)

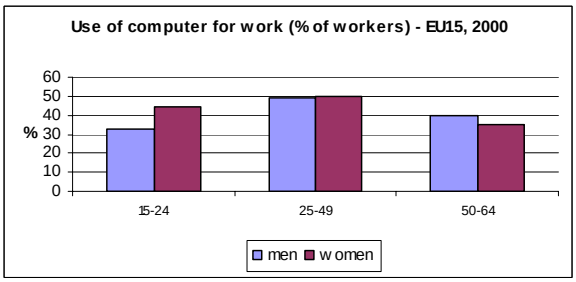


Source: EUROBAROMETER 2000

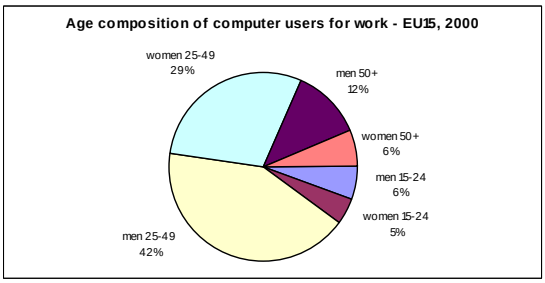
Exhibit 3-17 presents the picture for the three main age groups in the workforce.

Exhibit 3-17: Computer usage at work for the core age groups by gender (EU15, 2000)

Extent of computer usage for work



Composition of computer using population



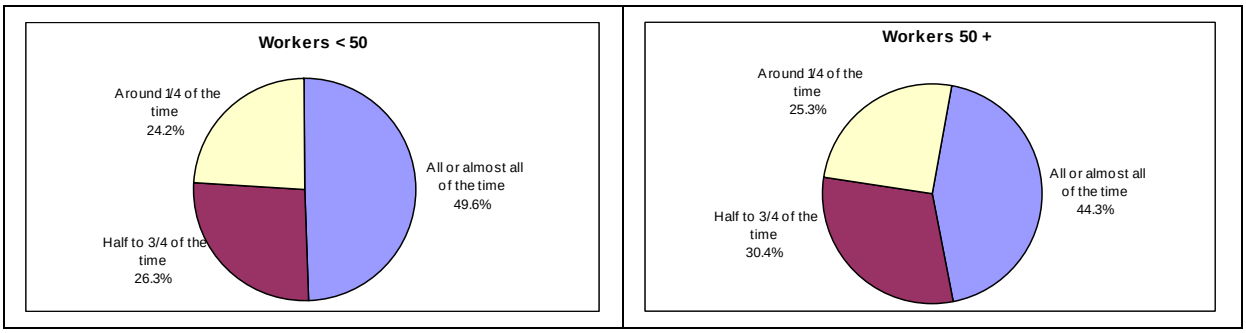
Source: EUROBAROMETER 2000

It can be seen that amongst younger workers women are more likely to use computers, for the 25-49 years age group men and women workers are equally likely to use computers for work and for the older group men are more likely to use computers.

These patterns, together with the age and gender composition of the workforce mean that men (42%) and women (30%) aged 25-49 together comprise almost three-quarters of computer users for work. Older men workers comprise about two-thirds of the older workers using computers.

EU data from the European Foundation's surveys on working conditions provides information on the amount of time spent using a computer by those who use computers at work (Exhibit 3-18). The overall picture as regards computer usage was fairly similar to that found in the Eurobarometer survey, with a similar tendency for computer usage at work to drop off amongst older workers.

Exhibit 3-18: Extent of usage of computers by those who use computers at work (EU, 2000)

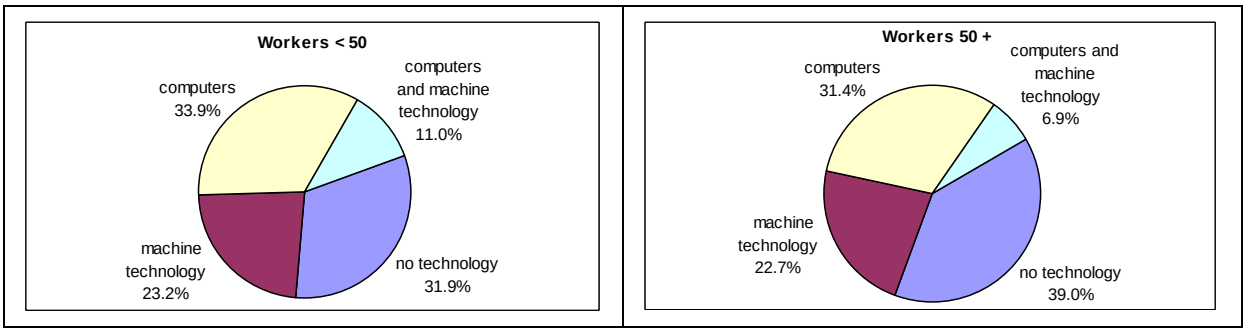


Source: EUROPEAN FOUNDATION WORKING CONDITIONS SURVEY 2000

Older workers who used computers were somewhat less likely to use computers all or most of the time, although more than two-in-five of the older workers who used computers did so.

The European Foundation's surveys also provide information on working with machine technologies and those who work both with computers and machine technologies (Exhibit 3-19). Older and younger workers were equally likely to be working with machine technology, but older worker were less likely to be working with both machine technology and computers.

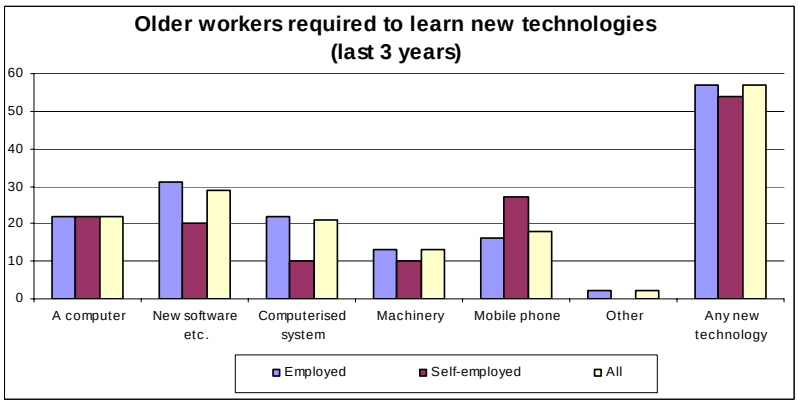
Exhibit 3-19: Usage of computer and machine technologies (EU, 2000)



Source: EUROPEAN FOUNDATION WORKING CONDITIONS SURVEY 2000

Finally, data from the UK suggests that a considerable proportion of older workers are directly experiencing recent technological change, with more than half of the older workforce being required to learn new technologies in the previous 3 years (Exhibit 3-20). The most common requirement was to learn about new software (29%), followed by a computer (22%) or a computerised system (21%), a mobile phone (18%) and then machinery (13%).

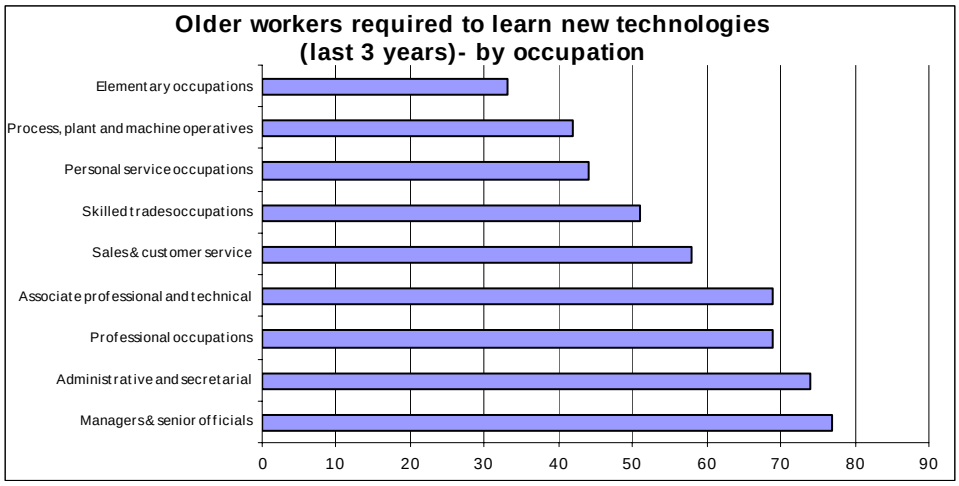
Exhibit 3-20: Older workers (50+) required to learn new technologies (UK, 2003)



Source; DEPARTMENT FOR WORK AND PENSIONS 2003

These figures are for the overall older workforce. More differentiated data shows the even greater exposure to change for older workers amongst particular occupational groups, especially the higher occupational categories, although as many as two-in-five in manufacturing and one-in-three in elementary occupations reported having had to learn new technologies (Exhibit 3-21).

Exhibit 3-21: Older workers (50+) required to learn new technologies (UK, 2003)



Source; DEPARTMENT FOR WORK AND PENSIONS 2003

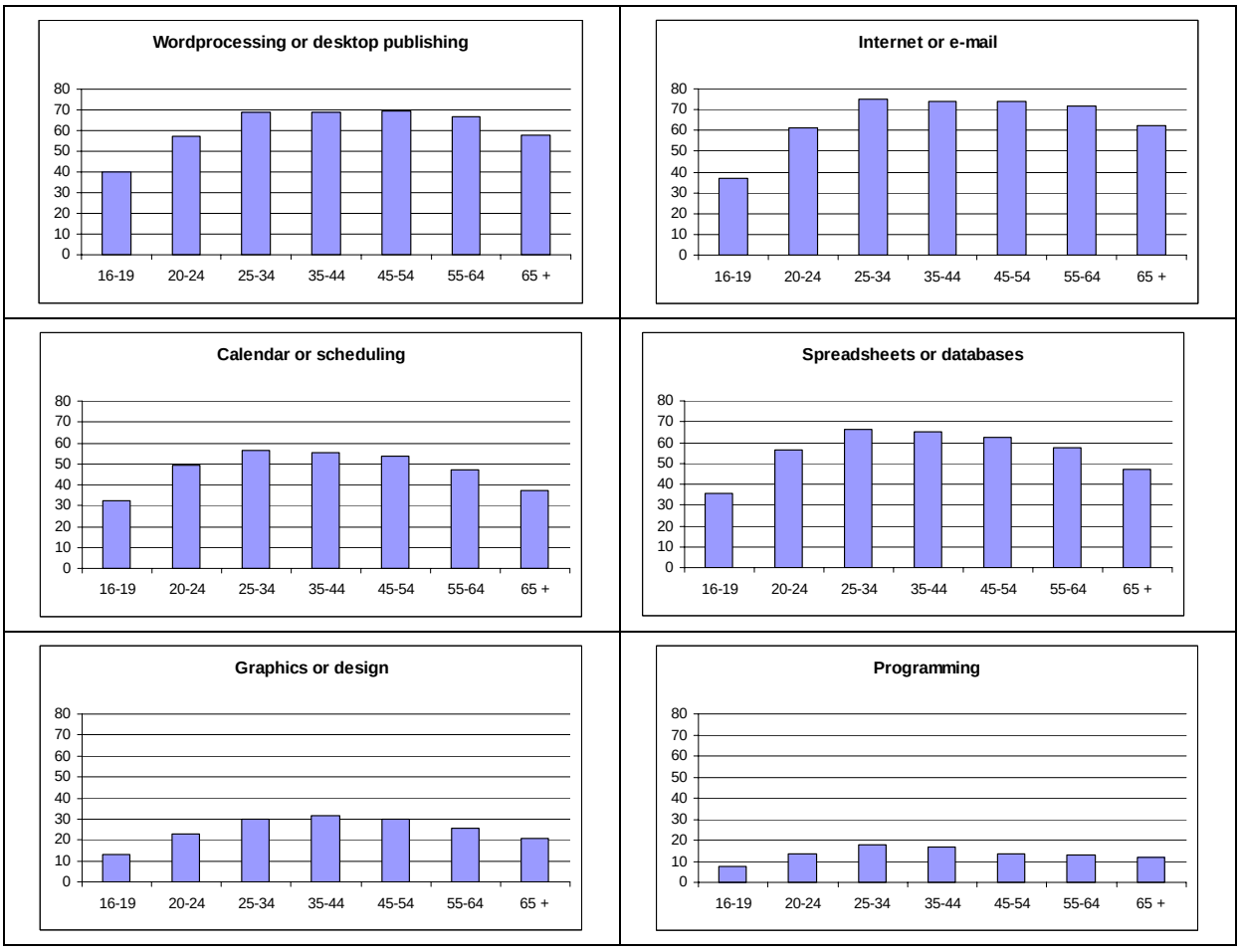
As regards type of ICT applications used at work, U.S. data show relatively little decline amongst older workers (50-64) for most applications, although workers in the 25-44 years range were more likely to do programming (Exhibit 3-22).

Conclusions

Overall, older workers seem to be proportionately represented amongst occupations where ICTs has a high relevance, although they are significantly under-represented amongst the specialist ICT areas. Projections suggest that, without any specific policy interventions, they are likely to maintain a proportionate share of the occupations where ICTs have relevance, increasing in line with the ageing of the workforce from under one-in-four today to perhaps one-in-three by 2021.

In 2000, younger and older workers were less likely to use ICTs at work than prime age workers. For the older workers a fall off in usage could be detected amongst those aged 55 years and above, especially amongst those aged 60 and above. Nevertheless, substantial numbers of older workers worked with ICTs to at least some degree. Almost half of workers aged 50 to 54 years used computers in their work, as did more than one-third of workers aged 55 to 59, and nearly one-in-five workers aged 60 years and older. Overall they comprised nearly one-in-five of all computer users at work. Therefore, even if older workers were to remain under-represented amongst the computer-using workforce they nevertheless would still comprise a substantial group whose needs require a commensurate level of attention.

Exhibit 3-22: Applications used by computer users at work (U.S., 2001)



Source: BLS 2002

Looking forward to 2010, on the basis of the levels of usage of computers amongst the 40-44, 45-49, and 50-54 age groups in 2000 it would be expected that, if nothing else changed and computer users showed the same pattern of remaining in or exiting from the workforce, then older workers in each of the 50-54, 55-59 and 60-64 age bands would have the same level of computer usage as the prime age workers at that time. Other factors might influence this of course, for example, the quality of computer-related work and the extent to which it is conducive to the needs and preferences of older workers. This aspect is examined in some detail in section 3.2.4. Apart from this, age-related occupational mobility might also have an influence and, of course, in the context of a more general increase in the penetration of computers into the workplace, the percentage of prime age workers working with computers might increase faster than that for the future 50 plus cohort. Either way, however, it can be expected that there will be a substantially higher percentage of older workers using computers at work in 2010.

Finally, although overall women workers were a little more likely to use computers at work than men, this was accounted for by the higher levels of usage amongst younger women workers. Amongst the older workers men were more likely than women to use computers in their work and, overall, men comprised about two-thirds of the older workers using computers.

3.2.3 Age-related factors affecting the implications of technological change

Having identified an increasing exposure of older workers to ICTs in the workplace, the next step in the analysis focuses on age-related factors that affect the implications of technological change for older workers and potential workers. These are factors that have a key role to play in determining whether technological change in the workplace has positive or negative consequences for work-related active ageing.

Two sets of age-related factors are important in this regard:

- ageing-related processes,
- equality related and other external processes.

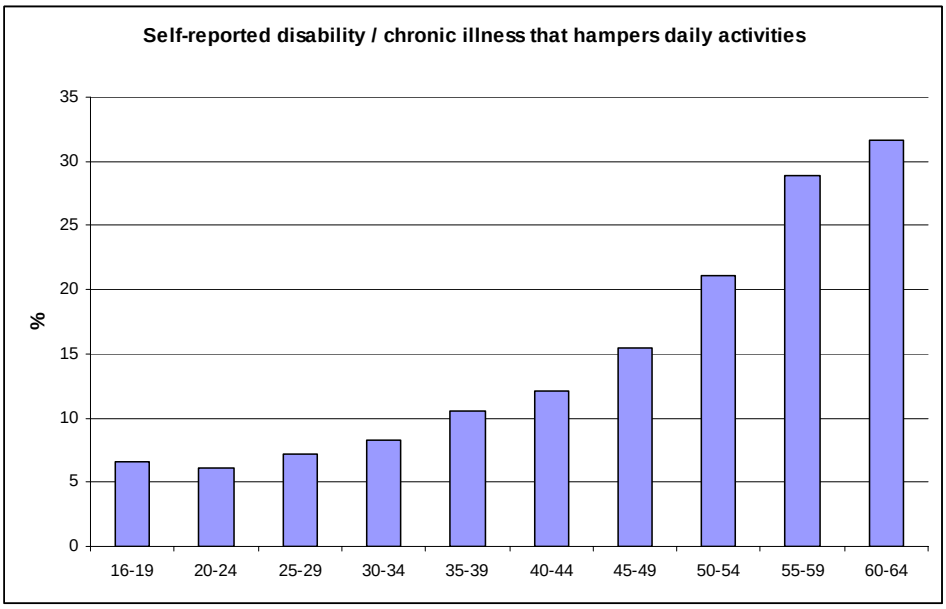
Separately and in combination these sets of factors play a major part in determining the implications of technological change for work-related active ageing and its outcomes, and these are the areas where policy must focus its efforts if technological change is to contribute to desired outcomes.

Ageing-related processes

Health and disabilities

The prevalence of chronic illness and disability increases with age (Exhibit 3-23). About one quarter of people in the 50-64 years age range has such problem.

Exhibit 3-23: Estimated disability rates by age in the EU15



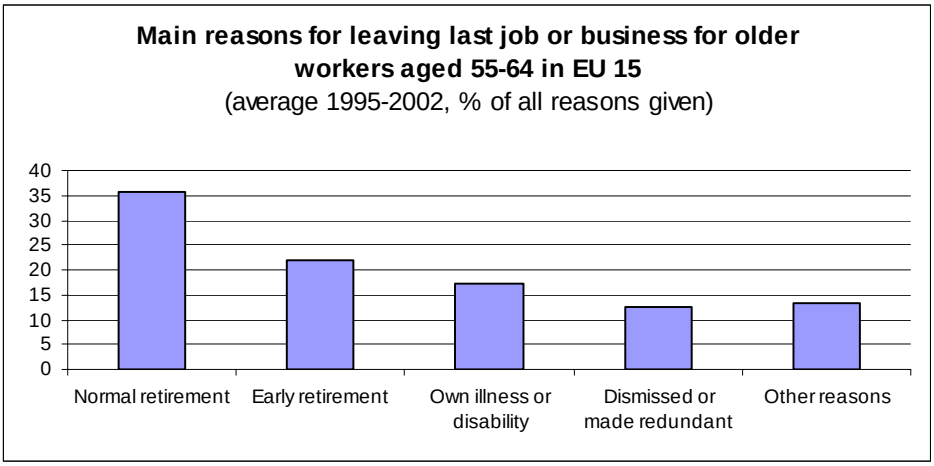
Source: EUROSTAT 2001

The ageing process is associated with an increasing likelihood of ill-health and disability, and also with various physical and cognitive changes that can have a bearing on performance. Ill-health and disability amongst older workers has multiple causations, including factors both outside and inside the workplace, and their interactions.

However, these general patterns mask enormous heterogeneity as regards health and capacities amongst the population in any given age range and this heterogeneity tends to increase with age. It is therefore important to beware of inaccurate stereotyping of older workers / potential workers in terms of their work capacities.

Nevertheless, ill-health and disability are important reasons for exiting the workforce (Exhibit 3-24). Data for the EU over the 1995 to 2002 period suggest that, apart from normal retirement, this was the second most important reason for leaving work amongst those in the 55 to 64 years are range.

Exhibit 3-24: Main reasons for leaving work amongst workers aged 55-64 (EU15, 1995-2002)



Source: CEC 2004 – based on LFS data

Age-friendly accommodations in the workplace have a central role to play in addressing these challenges posed by the ageing of the workforce. Assistive technologies have an important role in this.

In addition, there is the more general question of what role does or could ICTs play in these processes. If ICTs are associated with improved working conditions then they can be expected to reduce the incidence of work-related ill-health and disability in the first place, as well as offering the potential to make work more conducive to the needs of older workers who do have problems with ill-health or disability. On the other hand, if ICTs are associated with dis-improved working conditions and, in particular, with working conditions that are not conducive to the needs of older workers then they may have negative implications for the incidence of ill-health and disability amongst older workers and on the suitability of the work for older workers with ill-health or disability.

Finally, and importantly, ageing is associated with increased prevalence of some specific changes in vision, hearing and dexterity, capacities that are especially relevant for working with ICTs. The implications of these age-related changes for older workers and ICTs are examined in more detail in section 3.2.4.

Work capacity, performance and ability to learn

There has been a great deal of research on the issue of the relative decline of human performance with age (see for example, GRIFFITHS 1997). Topics that have been addressed include both physical performance indicators such as strength, speed, stamina and accuracy, and cognitive performance indicators such as memory, information processing, and ability to learn.

Despite this, there is little empirical data on the practical implications of ageing for work-related activities in general, and even less for working with ICTs. What evidence is available indicates that the relationship between age and performance is dependent on the type of performance measure, the nature of the job and other factors such as experience, and that there are wide individual differences at any given age. Importantly, many changes in functional capacity due to age can be accommodated within the workplace through redesign of jobs, and many are preventable and some are reversible. Much of performance at work is

influenced by factors outside of the individual, such as how work is designed, training and supports, and quality of teamwork.

Ageing typically only becomes a problem when workers have remained a long time in stressful jobs and when the specific resilience demanded for this has been used up to such a degree that the individual's performance ability is less able to satisfy the demands of the job (EWON 2001). This applies not only to jobs where considerable physical effort is required but also where mental stress prevails. Lean management practices, sometimes associated with ICTs, can also result in poorer working conditions, intensification of work and reduction of niche workplaces for older workers.

Recent work suggests that many types of work performance, especially in relation to more complex cognitive tasks and tasks that require complex social skills, may improve with age. These aspects have been given considerable attention in Finland and research there indicates that many positive aspects of ageing are relatively unknown and therefore unappreciated (EUROPEAN FOUNDATION FOR THE IMPROVEMENT OF LIVING AND WORKING CONDITIONS 2004). Older people may experience declining short-term memory and a slower pace but, in the right work environment and with a flexible workload, they can maintain high productivity. They possess many strengths, including good cumulative long-term memory, long working experience, good ability to perform accurate control tasks, a high level of dedication, low levels of absenteeism and well-developed abilities to evaluate issues and problems.

As regards capacity to learn, the available evidence suggests that older workers are well capable of learning new skills, including ICT skills, but they tend to learn differently and prefer different types of training and learning context to younger workers. In addition, they may sometimes be slower to learn but this may be compensated by ultimately learning better and making fewer mistakes (CZAJA and MOEN 2004).

Adaptability and receptivity to change

There is a commonly held view that workers become less adaptable and receptive to change as they get older and that this influences their attitudes to technological change and ICTs. In fact, the available evidence suggests that such generalised stereotypes are unwarranted and that, when properly supported, older workers are willing and able to work with computers (CZAJA and MOEN 2004). Given appropriate supports older workers seem just as flexible and open to change, including technological change, as younger workers (RIZUTTO 2005).

On the other hand, however, adaptability and receptivity to change require appropriate skills. Older workers either need to have the necessary skills already or have access to the opportunity to acquire them. The available evidence suggest that older workers have the capacity to acquire the necessary skills. However, their prior educational and occupational experiences may not have equipped them with the new skills that are required nor may they always be afforded equal opportunities to acquire them within the workplace when the need arises.

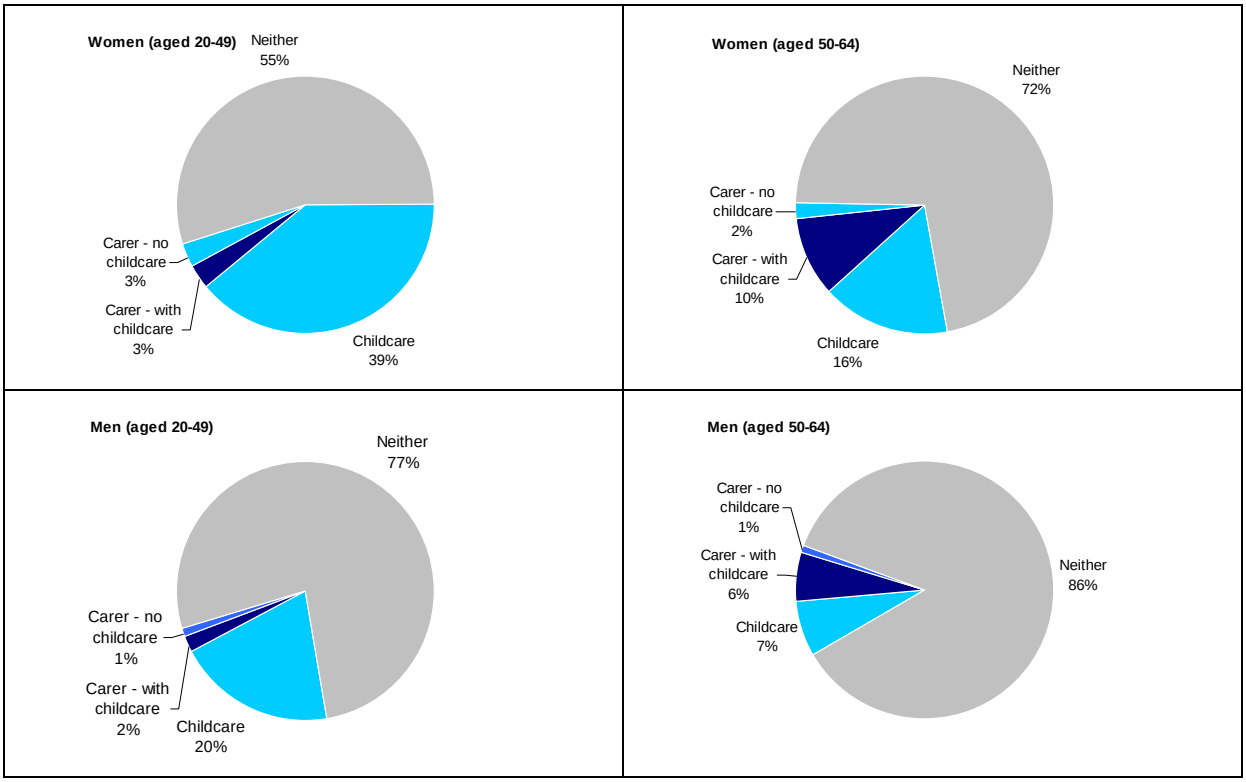
Family commitments and work-life balance requirements

The extent and nature of family commitments and, consequently, of work-life balance requirements change through the life-course. Both childcare and caring for other dependants (such as a spouse or parent with a long-term illness, disability or dependency due to old age) need to be considered here. In particular, the latter type of caring responsibilities tend to increase with age, with estimates from different EU15 surveys suggesting that twelve percent or more of women in the 50-64 years age range may have such responsibilities at any point in time (CULLEN at al. 2004, based on data from European Foundation survey on working time preferences 1998; EUROPEAN COMMUNITY HOUSEHOLD PANEL SURVEY 1998).

Data from the ECHP shows how childcare responsibilities decline with age whilst other caring responsibilities increase with age, although childcare is still more important overall for

both age groups (Exhibit 3-25). Overall, more than a quarter of women in the 50 to 64 years age group reported childcare or caring responsibilities. Work-life balance provisions catering both for childcare and other caring needs are likely to be especially important for this age group.

Exhibit 3-25: Childcare and other caring responsibilities (EU15, 1998)



Source: CULLEN et al. 2004, based on European Community Household Panel, 1998

More generally, older workers may find their working conditions and long hours of work to be no longer compatible with their needs and lifestyle (EWON 2001; UK DEPARTMENT FOR WORK AND PENSIONS 2003).

External factors

In parallel with ageing processes, per se, there are various external factors that can have a more significant and even determining influence on the implications of technological change and ICTs for older workers and potential workers. These include the:

- extent to which older workers receive equality of treatment at work and in the labour market,
- degree to which the needs of older workers are accommodated in the workplace and in labour market supports,
- opportunities and supports for older workers to prepare for change,
- characteristics of the sector that they work in or have worked in.

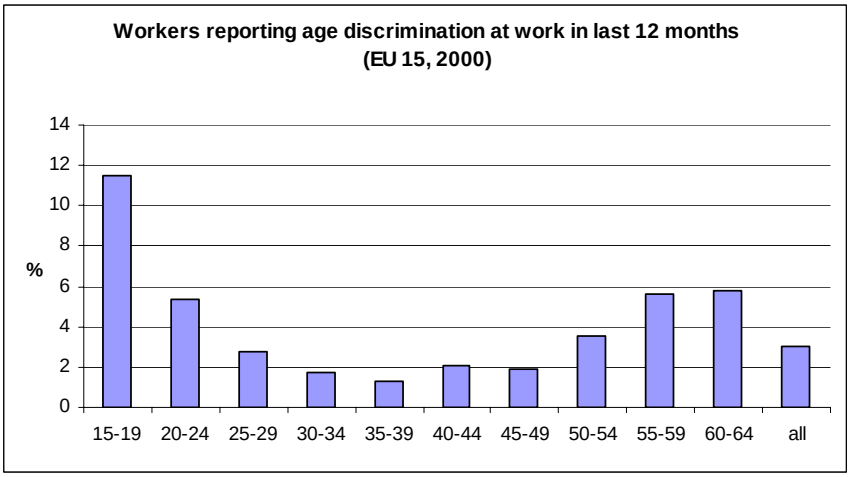
Equality of treatment in the workplace

Despite the lack of evidence of any dramatic or insurmountable age-related declines in many aspects of work performance or of any inherent inability to learn or unwillingness to adapt to change, there is evidence of persistent stereotypical images of older workers amongst employers and co-workers (CZAJA and MOEN 2004). Human resource practitioners tend to share the view that older workers are less willing to adapt to new circumstances and to learn

new things (BÖHNE and WAGNER 2002). Such stereotypes can result in unfavourable treatment or even discrimination against older workers in many aspects of working life and also against older people who are seeking work.

Exhibit 3-26 presents data on the experience of age discrimination amongst the workforce.

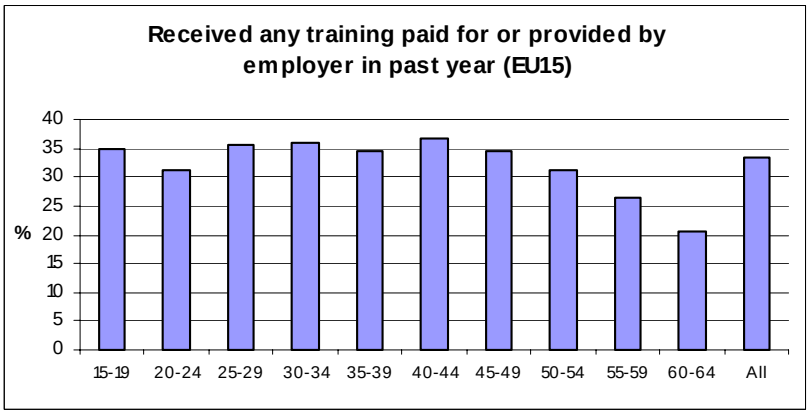
Exhibit 3-26: Experience of age discrimination at work (EU15, 2000)



Source: EUROPEAN FOUNDATION WORKING CONDITION SURVEY 2001

Although overt discrimination on the basis of age was reported by fewer than one-in-sixteen older workers, there is a lot of other evidence to suggest that older workers are often treated less favourably than younger workers, for example in access to training (Exhibit 3-27).

Exhibit 3-27: Employer-provided training by age (EU15, 2000)



Source: EUROPEAN FOUNDATION WORKING CONDITIONS SURVEY 2001, the author's own calculation

Discrimination may also be less active in nature, especially where age related stereotypes are held by fellow workers. It may also take more subtle forms such as social exclusion by superiors and peers.

Unfavourable treatment of older workers can also take place in relation to access to promotion, new jobs, overtime, or various other workplace benefits. There may often be preferences towards younger employees equipped with the latest know-how, flexible in terms of time and place, and offering less resistance towards intensive workloads, including weekend working, to the neglect of the experience of older employees (EWON 2001).

There are also other factors that may make older workers more vulnerable to discrimination or unfavourable treatment. For example, given that older workers are more likely to

experience chronic health problems or a disability, and that they are more likely to have redundant skills, the grounds on which discrimination might occur are wider.

Discrimination and unfavourable treatment may also operate at the level of the labour market, both in recruitment practices and in the public supports provided for older workers. This applies not just to job-seeking for older unemployed but also return-to-work by those who have been out of work because of illness or disability.

Accommodation of older workers needs

Linked to the more general issue of equality is the extent to which employers and other relevant stakeholders make accommodations for the changing needs of older workers in the design and organisation of work and in the ergonomic and other characteristics of the tools used for work. Actions by both employers and by the manufacturers and suppliers of the tools used in work are of central relevance to this.

A particularly important issue in relation to technological change is the extent to which the ICTs used in the workplace are designed in ways that take into account the changes in vision, hearing, dexterity and cognition that occur with ageing. Both employers and the manufacturers and suppliers of workplace ICTs have key roles to play in this. These aspects are addressed in more detail in section 3.2.4 and section 3.3.

More generally, available evidence (Exhibit 3-28) suggests that to date there has been insufficient attention given to the particular needs of older workers in relation to work design and organisation (MOLINIÉ 2003).

Exhibit 3-28: Working conditions and older people

Aspect of working conditions	Situation and provisions for older workers
Physical demands of work	• Overall prevalence of physical demands as prevalent in 2000 as in 1995; older workers still relatively shielded compared to other age groups • For those who are exposed the effects are worse, especially osteoarticular pain but this has not lead to measures to protect them from this
Irregular working hours	• Older workers typically do not find shift working and night work suitable and are less likely to engage in these • For those who do, the effects are often more negative than for younger workers
Speed demands of work	• Time pressures on work performance have increased • This seem to be less suitable for older workers, with age selection arising for such work • For those who do, the effects are often more negative than for younger workers

Source: Molinié (2003) based on EUROPEAN FOUNDATION WORKING CONDITIONS SURVEY

Preparation and support for change

The extent to which older workers and potential workers are prepared for and supported in meeting the challenges of change is also a central issue and this is affected by prior occupational experiences. This includes not just occupation-specific skills (which can easily become obsolescent) but also a willingness and capacity to adjust to changes in one's job, change to a new job (within the organisation or with another employer) or find a job when seeking to return-to-work. The mix of professional and social skills needed for this is not a biological gift of younger age groups but rather a product of company structures and processes that are restrictive or conducive to innovative behaviour. A culture of developing human resources through participation in decision-making and comprehensible work tasks,

transparent internal procedures, trust and co-operation avoids the dead end of 'social ageing' in organisations (EWON 2001).

Mobility within employing organisations is a central issue here. The opportunities available for older workers who are already in the workforce to change jobs if desired or necessary, for example to accommodate changes in health and work capacity or changing work-life balance or personal lifestyle requirements are a significant factor in the retention of older workers (EWON 2001). The implications of technological change for these dimensions of (re)employability are examined in more detail in later sections.

Sectoral characteristics

Finally, there are broader characteristics of different sectors of industry and employment that affect the likelihood of workers experiencing change and the challenges that this may pose for older workers within the sector. Recent work in the Netherlands on this theme has prepared profiles of different sectors (GRIP et al 2004). The results are quite instructive, showing that there are significant variations across sectors in the nature and extent of a need to be ready for change and in the degree of readiness for change. However, the key conclusion is that older workers in virtually every sector of industry are at a disadvantage in their readiness for and level of support for dealing with the challenges of change. Technological change is one factor in this but many other factors are also involved.

Conclusions

Age-related changes interact with external factors to determine work-related outcomes for older workers. In the main the evidence indicates that, if treated fairly and if their needs and preferences are accommodated, then older workers can maintain their work capacity and can bring unique age-related skills and experience to the workplace. A critical factor in this is the lifetime accumulation of strengths and deficits in working life. A proactive approach that focuses on the entire working life and therefore on all age groups in the workforce is needed. This would help to reduce the accumulation of work-related disadvantages and to ensure that all of the workforce is prepared for and has the capacity to deal with technological or other changes in working life and the labour market.

3.2.4 Key impact mechanisms

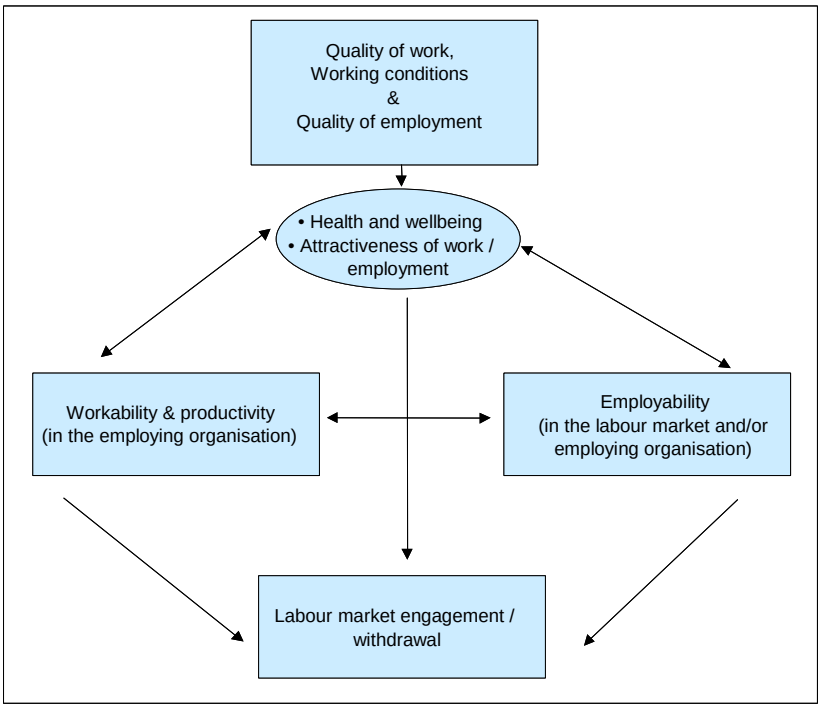
This core component of the analysis focuses on four key mechanisms through which technological change, ageing-related and age-equality related factors exert their influence on age-related active ageing and its outcomes for older workers, enterprises and society. A final section returns to the issue of informal and unpaid work that was raised in the introduction to this chapter.

Figure Exhibit 3-29 depicts the four key impact mechanisms – work quality, workability, employability and labour market engagement / withdrawal decisions – and their various interactions. The first three, in particular, must be key targets for policy intervention in order to support the achievement of the ultimate goals of high employment rates, high job quality and equality in work-related active ageing for older workers and potential workers.

The interactions between the dimensions are not purely one-way. Quality of work and working conditions are closely linked with workability and productivity - poor quality of work and organisation of work can cause problems with work performance and problems with work performance impose stresses and strains on the worker. Limitations on employability will restrict the worker's opportunities to find a better situation in the workplace. Decisions to withdraw or not from the labour market can affect health and well-being, for better or worse.

The following sections provide an overview of what is currently known about the implications of technological change and ICTs in these areas.

Exhibit 3-29: Four key impacts mechanisms



Source: the authors

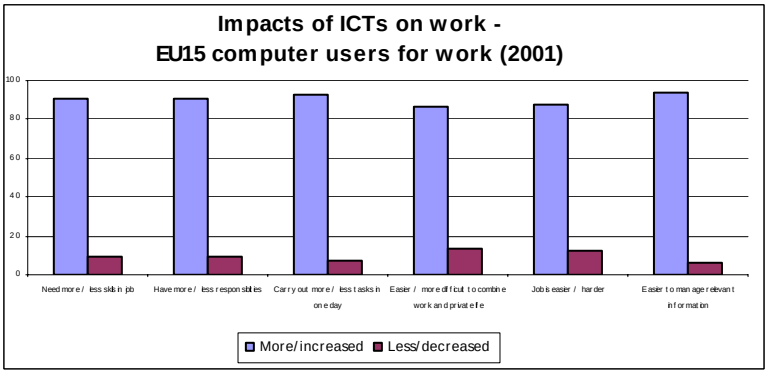
Quality of work, working conditions and quality of employment

One key mechanism of impact of technological change is through the effects it has on quality of work, working conditions and quality of employment. These are separable yet closely interlinked areas. Quality of work concerns focus on the work itself and how it is organised. Working conditions focus on aspects such as hours of work, time of work, place of work, remuneration systems and so on. Quality of employment concerns the nature of the contractual relationship, the amount of security provided, provision of training, fringe benefits and so on. Separately and in combination these aspects of work affect the attractiveness of work and employment and the health and well-being of the worker.

Impacts of ICTs on work quality

There were a number of earlier Finnish studies in the late 1980s on the impacts of ICTs on work (HUUHTANEN 1987; HUUHTANEN 1992). In general, computers were found to have more often increased rather than decreased the quality of work along various dimensions, such as job complexity, autonomy, social interaction and job satisfaction.

Exhibit 3-30: Impact of ICTs on various aspects of work (EU 15, 2001)



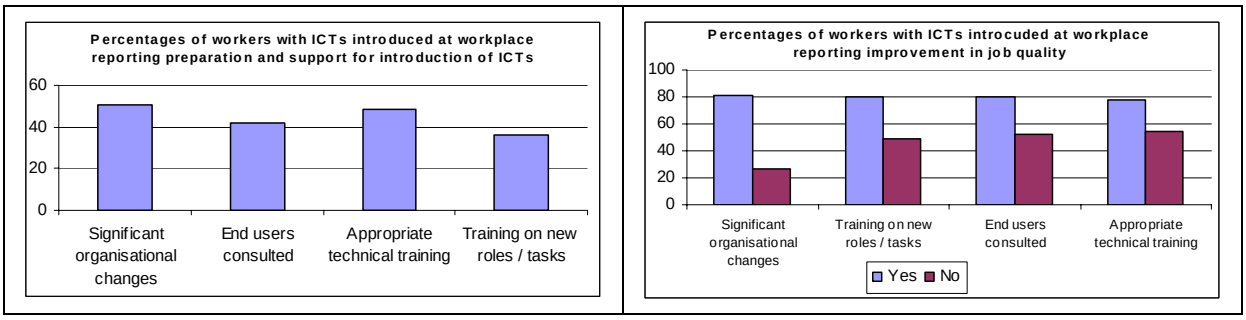
Source: EUROBAROMETER 2001 (CEC 2002)

More recently this aspect has been examined in a series of Eurobarometer surveys carried out in the early 2000s. The results of the survey in 2001 indicate that ICTs impact on many aspects of work (Exhibit 3-30).

Overall, just over three-in-five workers (60.6%) reported that ICTs had improved their job quality. This suggests that ICT-related technological change can be a positive force for better quality of work in Europe and, as such, has the potential to make work more attractive to older workers.

On the other hand, the survey found considerable variation in the levels of preparation and support for ICT introduction that were experienced and that improvements in job quality were linked to this (Exhibit 3-31). Therefore, if positive benefits for older workers are to be achieved the process of preparation and support for technological change must be given sufficient attention.

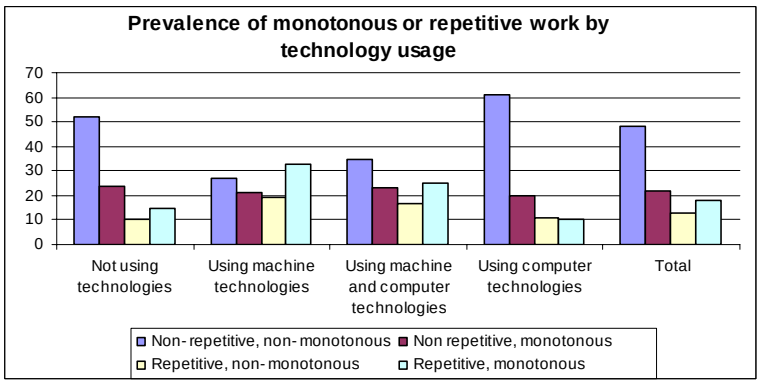
Exhibit 3-31: Importance of preparation and support for the introduction of ICTs (EU15, 2001)



Source: EUROBAROMETER 2001 (CEC 2002)

The finding that the introduction of computers can be positive for the quality of work for many but not all workers is also borne out by the results from the European Foundation surveys on working conditions (DHONDT et al 2002). For example, those who work with computers were least likely to report that their jobs were repetitive or monotonous, although nevertheless about ten percent of those working with computers had jobs that were both monotonous and repetitive (Exhibit 3-32).

Exhibit 3-32: Levels of monotony and repetitiveness in working with and without technology (EU15, 2000)

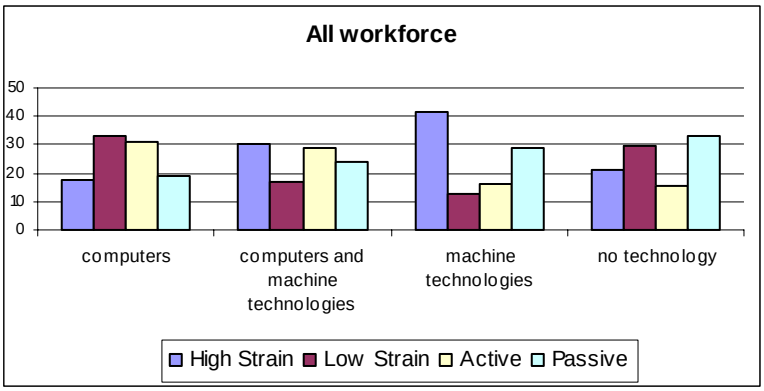


Source: EUROPEAN FOUNDATION SURVEY OF WORKING CONDITIONS (DHONT et al. 2002)

More generally, the results of that survey suggest that the proportion of jobs that are of good quality is higher amongst computer users than amongst other groups in the workforce. (Exhibit 3-33). Those working with computers were more likely to be in active (demanding

work but within control of the worker) or low strain (undemanding work well within the control of the worker).

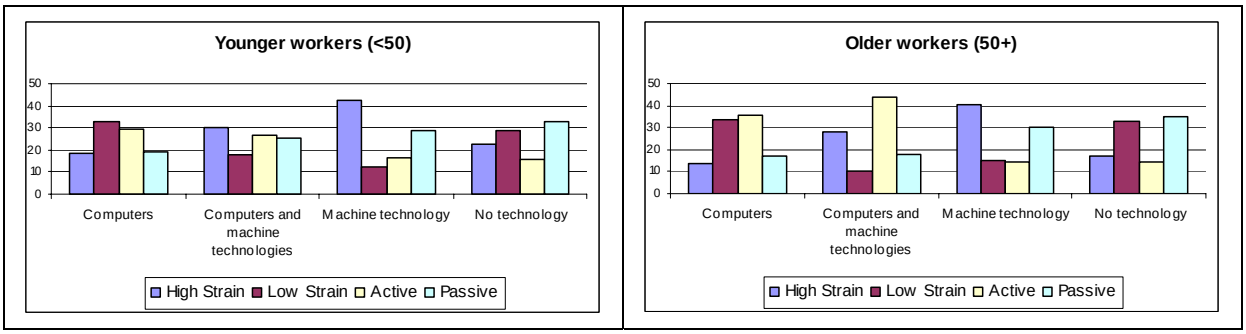
Exhibit 3-33: Distribution of jobs of different quality across the workforce (EU15, 2000)



Source: Own analysis based on data from European Foundation survey of working conditions

This tendency for better quality jobs for computer users was found amongst both younger and older workers (Exhibit 3-34). Older workers working with computers and machine technologies were especially likely to have active jobs.

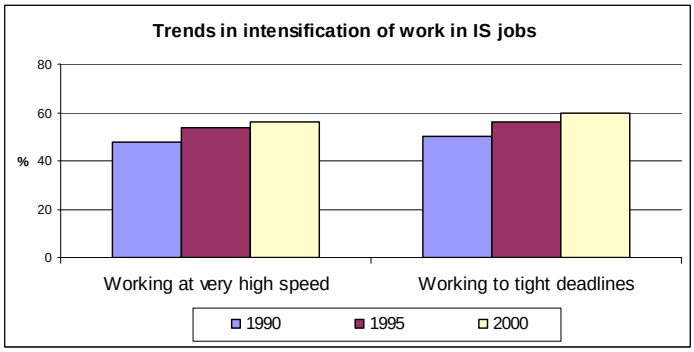
Exhibit 3-34: Job quality amongst older and younger workers (EU15, 2000)



Source: Own analysis based on data from European Foundation survey of working conditions

Apart from the upsides suggested by the Eurobarometer and European Foundation data there are also indications of some potential downsides. For example, the Eurobarometer survey found an intensification of work in terms of more tasks being carried out in one day as a result of the introduction of ICTs.

Exhibit 3-35: Trends in the intensification of work



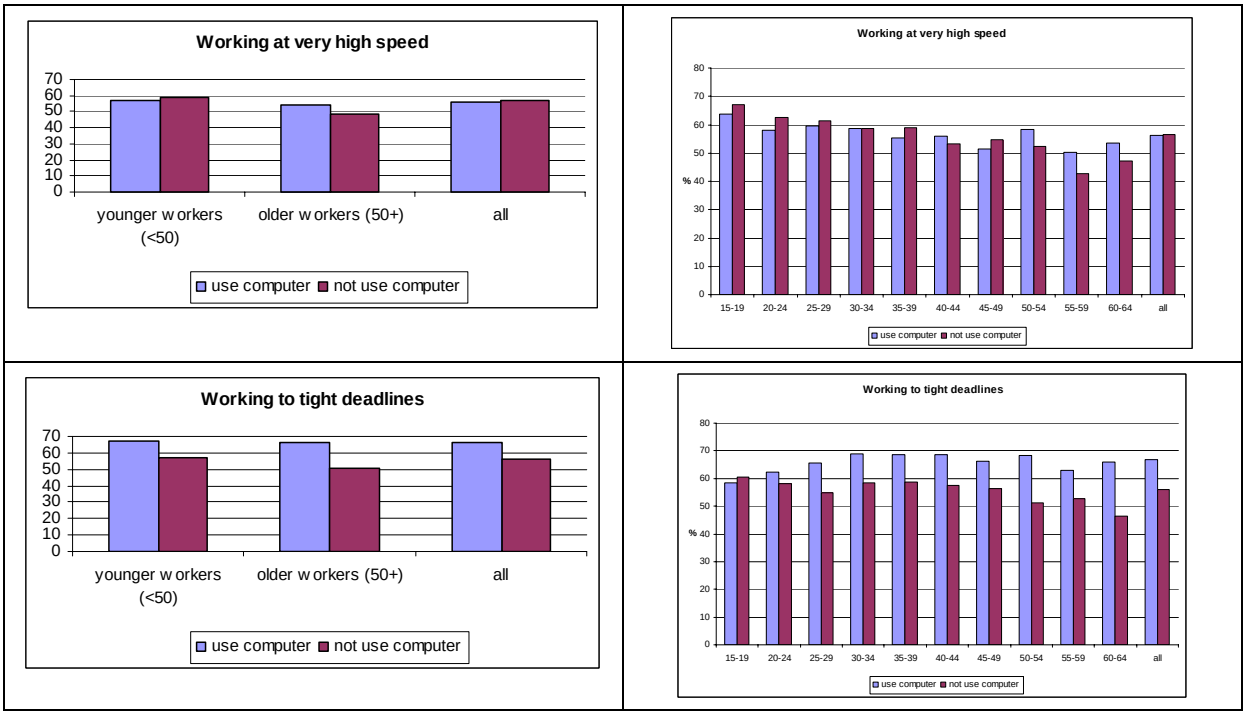
Source: cited in CEC (2002c) based on European Foundation working conditions surveys

Evidence of increasing intensification of work over the last decade is apparent in time series data from the European Foundation surveys of working conditions (Exhibit 3-35).

Amongst the workforce overall those who work with computers for at least one-quarter of their time are considerably more likely to report working to tight deadlines but have the same likelihood of reporting working a very high speed as other workers (Exhibit 3-36).

For older workers, the increased likelihood of computer users working to tight deadlines is even more marked than for younger workers. Older computer users are also more likely to report working at very high speed in comparison to older non-computer users. It seems that workers not using computers may gain some reduction in these types of work pressures as they get older but this is not happening as much for older workers working with computers.

Exhibit 3-36: Intensity of work by computer usage and age (EU15, 2000)



Source: Own analysis based on European Foundation conditions of work survey

Other possible downsides have also been identified (ILO 2001; CEC 2002b,c) including:

- stress arising from excessive working hours, workload and increasing complexity of tasks;
- negative side-effects in the form of information overload through e-mail, difficulty in distinguishing significant and insignificant information, and being accessible all the time;
- stress of having constantly to upgrade skills;
- decrease in human relationships replaced by virtual contacts;
- physical impairments such as repetitive strain injuries and musculo-skeletal illnesses due to inadequate or ergonomically unadapted equipment or to forced postures, and the combined effects of both.

The issue of repetitive strain injuries from working intensively with computers has received a lot of publicity. However there seems to be an absence of good quality data on prevalence rates across occupations or on whether the risks increase with age and, if so, under what circumstances. This is an area that warrants a lot more attention in the future.

More generally, some ICT-based jobs may be more at risk of negative impacts that others, for example, data entry and call centre jobs which are typically repetitive and require high speed, monitored working. Therefore, whilst such work may be well suited to flexible schedules they are unlikely to be suitable for or attractive to many older workers. In addition, these types of jobs can often be precarious ones, with poor job security and career progression opportunities.

More generally, although most workers in ICT-based jobs work in relatively comfortable office environments some do not. Call centre environments vary a lot and can sometimes be crowded and noisy. Service workers using handheld devices work in many different environments. Computer-controlled tool operators work in machine shops.

In some instances ICTs can have impacts on working time. Call centre working is often organised in round-the-clock shifts; computer support specialists and systems administrators may be required to be on call via pager or telephone for rotating evening or weekend work; many computer programmers work long hours or weekends to meet deadlines or fix problems; computer-controlled tool operators are increasingly required to do evening and weekend work as companies justify investment in expensive machinery by extending hours of operation. Shift-working and in particular night shifts are generally unsuitable for older workers as they are at a higher risk of negative health and other effects.

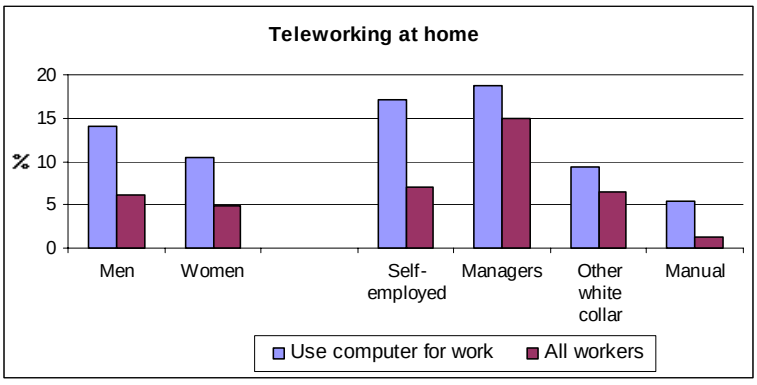
In general, however, these types of ICT-based jobs represent only a small proportion of jobs that involve working with ICTs. The majority of jobs where ICTs are used may not be radically re-organised because of ICTs and the key to making them age-friendly is adequate attention to good work design, ergonomics and so on.

Teleworking

The diffusion of ICTs has been associated with increased working from home. For some this may take the form of a formally organised teleworking arrangement, operating during normal working hours. For others it may represent a spill-over of work into the domestic sphere through taking work home.

Overall, between 5 and 6 percent of the EU15 workforce reported at least some teleworking from home in 2000 (Exhibit 3-37).

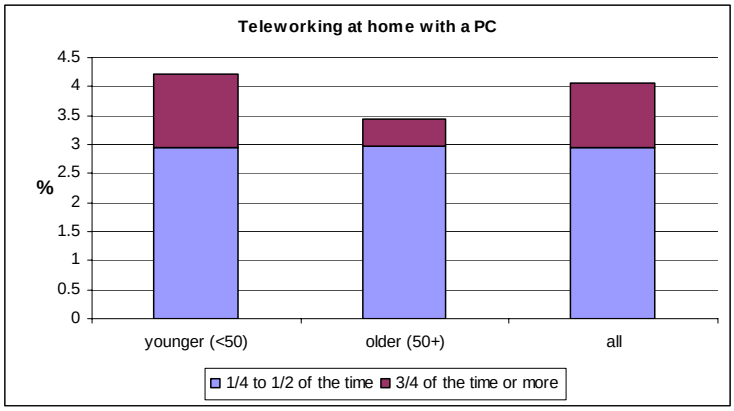
Exhibit 3-37: Extent of teleworking at home (EU15, 2000)



Source: EUROBAROMETER (CEC 2001)

Older workers seem a little less likely to telework at home, but only in the case of teleworking for three-quarters or more of the time (Exhibit 3-38).

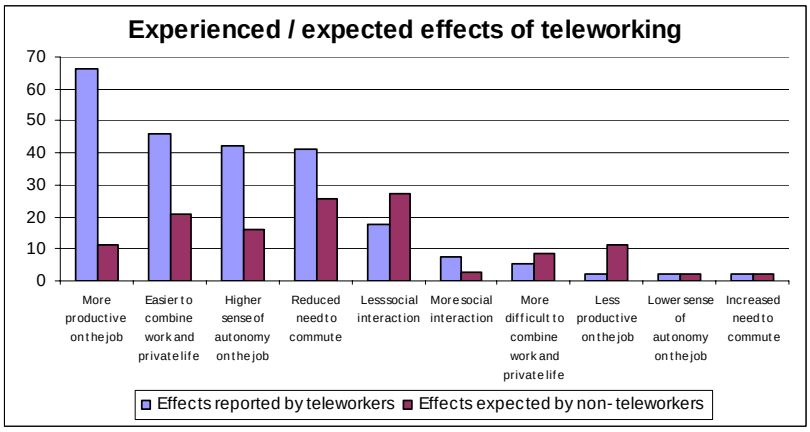
Exhibit 3-38: Extent of teleworking at home by age (EU15, 2000)



Source: Own analysis based on European Foundation working conditions survey

The main benefits experienced by teleworkers were increased productivity, easier combination of work and private life, higher sense of autonomy and reduced need to commute (Exhibit 3-39). The main negative effect was reduced social interaction.

Exhibit 3-39: Experienced and expected effects of teleworking



Source: EUROBAROMETER (CEC 2001)

The experiences of those who have actually done teleworking were a lot more positive than were the expectations of those who have not. Part of the reason for this may be that those who have opted for teleworking were in circumstances that were particularly suitable and conducive to positive outcomes, and that those who have not teleworked are in less suitable circumstances. It may also reflect inaccurate perceptions of teleworking and its potential benefits.

As regards older workers, teleworking might be seen as an attractive option where more flexible hours and, possibly, reduced hours of work are desired and also as a possible solution to work-life balance requirements. Available evidence from a European Foundation survey of working time preferences in Europe suggests that those in the workforce who are caring for an elderly or disabled person have a higher likelihood of working part-time (CULLEN et al. 2004). Of those who desired to remain working part-time, almost two-in-three cited wanting or needing enough time to care as being a reason for this preference, although caring was usually just one of a number of reasons (typically including childcare needs) for the part-time preference.

Carers were also a lot more likely to be working mainly from home than non-carers. They were also more likely to express an interest in working partially or fully from home but were

only very slightly more likely to give combining work and family as a reason for such a preference. Women carers were considerably more likely to cite work family balance as a reason than were men carers.

More generally, however, a lot of research suggests that working from home is often not compatible with caring responsibilities in situations where the children or other dependants are in the home at the same time (CULLEN et al. 2004). In addition, there is evidence that people caring for adult dependants value getting out of the home to go to work as a respite from their caring.

Conclusions

Overall, from the point of view of work quality and age-friendly work organisation it seems that jobs involving computer usage are more likely to be of good quality than are jobs that do not. One reason for this is that computers tend to be used in jobs that were of better quality in the first place. Older workers using computers have a higher likelihood of being in better quality jobs than younger workers, although a significant minority are in low quality jobs that may either be under-stimulating or involve excessive demands. It also seems that there has been an intensification of work during the 1990-2000 decade that is associated with increasing usage of ICTs, with a growth in the number of workers being required to work at high speeds and meet tight deadlines. For some workers these aspects may be seen as positive qualities of their jobs but for others may not. In fact, it seems that older workers working with computers are overall more likely to have to work at high speeds and meet tight deadlines than older workers in other jobs, although there is substantial variety within both groups. This may be an indication that the introduction of ICTs has yet to give sufficient consideration to the likelihood that the majority of those working in ICT-related jobs will be unwilling or unable to maintain a frantic pace of work throughout their working lives.

The issue of “calming” of ICTs and of ICT-related work warrants a lot more research attention both with regard to its implications for older workers health and well-being and its implications for age of exit from the workforce. To put this in an employment policy context it is useful to consider the EU target of 50% employment rates for the 55-64 years age group by 2010. This would require that about one-quarter of the 45-54 year olds in 2000 who, on the basis of past trends would be expected to leave the workforce early, are persuaded to remain. A very simplified calculation based on the exposure to work intensification of older computer users at work indicates that ICTs may be linked in some way to an increased risk in this area for perhaps 5% of the 45-54 years age cohort in 2000.

Teleworking opens up opportunities for more flexibility that can be used to facilitate work-life balance. However, we still know relatively little about how attractive or practically useful teleworking partially or completely from home might be for older workers in different circumstances, for example, with and without care responsibilities. This is another aspect that warrants a lot more research attention both with regard to its implications for older workers health and well-being and its implications for age of exit from the workforce.

Workability and productivity

The implications of technological change for workability and productivity constitute another key mechanism of impact on work-related active ageing. Changes associated with the ageing process, and how work is organised to accommodate these, may have implications for workability (the ability of the worker to carry out particular work tasks) and for productivity (the amount and value of the output that can be achieved). Overall, as indicated in section 3.2.2, the available evidence indicates that productive capacity is not inherently reduced by ageing processes, per se, but rather by skills obsolescence and lack of attention to age-friendly organisation of work.

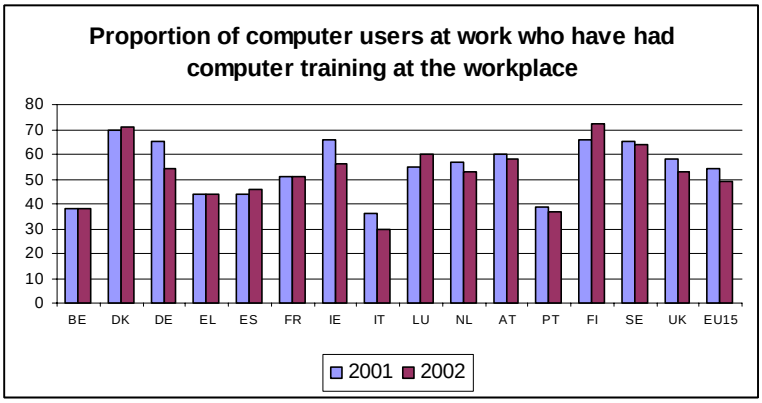
In relation to ICTs a number of aspects need to be considered, including:

- adequate skills to effectively perform ICT-related work,
- age-friendly design of ICT-related work,
- accessibility and usability of ICTs for older workers,
- ICT-based assistive technologies to support workability of older workers.

Adequate skills to perform ICT-related work

Adequate ICT skills are a key requirement for workability in the context of ICTs. However, overall only about one-half of the EU15 workforce working with computers has ever received computer training at the workplace (Exhibit 3-40).

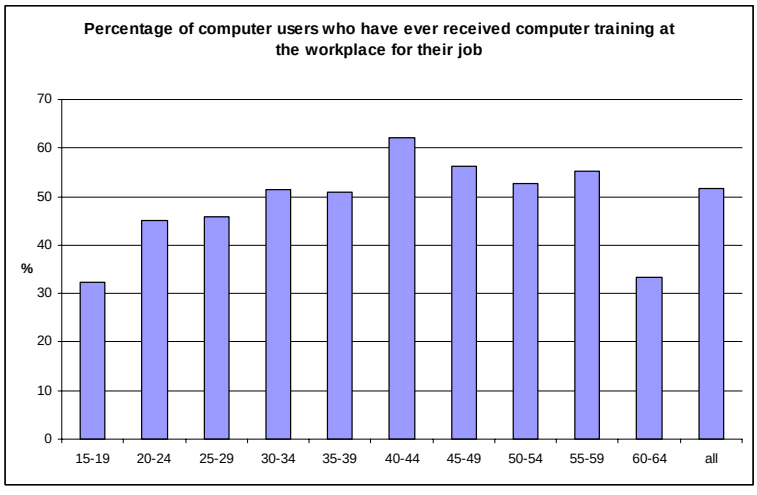
Exhibit 3-40: Computer users who have had computer training at the workplace (EU15)



Source: EUROSTAT statistics on the information society, based on Eurobarometer surveys

Computer users aged 60 and over and those aged under 30 were less likely to have received computer training at the workplace than other age groups (Exhibit 3-41).

Exhibit 3-41: Age patterns in workplace computer training for computer users (EU15)

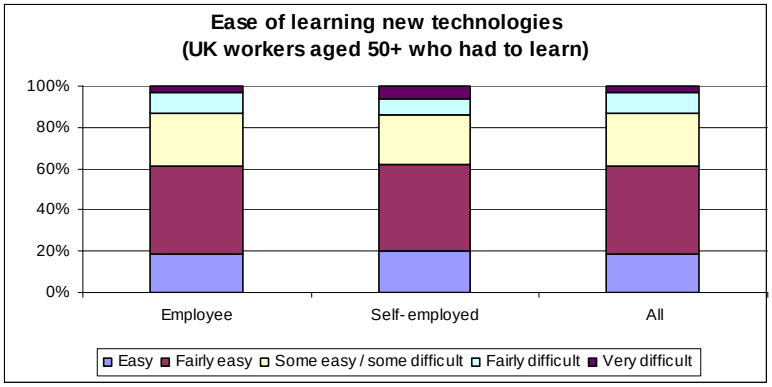


Source: EUROBAROMETER 2000

The likelihood that many computer users at work have learned their computer skills informally is borne out by other surveys. Many users have acquired their skills through self-learning and / or help from friends / colleagues at work or at home. This raises the issue of whether such self-acquired skills result in the same levels of productivity as skills gained in formal training, and whether there are age-related aspects to this.

Data from a UK survey of older workers who reported having to learn new technologies in the previous 3 years indicates that although many workers found that this did not pose difficulties for them, almost two-in-five had some degree of difficulty in learning the technology (Exhibit 3-42).

Exhibit 3-42: Ease of learning new technologies for older workers (UK, 2003)

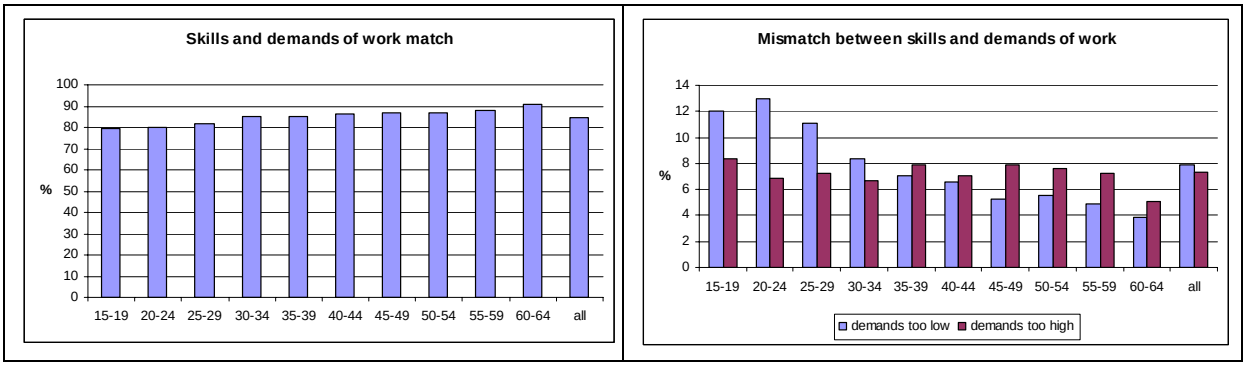


Source: UK DEPARTMENT OF WORK AND PENSIONS 2003

This fits with findings from other research (CZAJA and MOEN 2004) indicating that older workers are able to learn and apply new technologies but are generally slower than younger adults to acquire new skills and require more help and hands-on practice. The research points to the importance of matching training strategies with the preferences and characteristics of older workers.

More generally, the European Foundation survey of working conditions provides some information on age patterns in the degree to which the skills of workers match the demands of their work (Exhibit 3-43). In fact, the majority of older workers (about 85%) report that their skills match the demands of their work, a figure equal to or higher than that for other age groups. On the other hand, amongst the minority of older workers who do report a mismatch there is a greater likelihood of demands being too high than too low, a pattern contrary to that for younger workers.

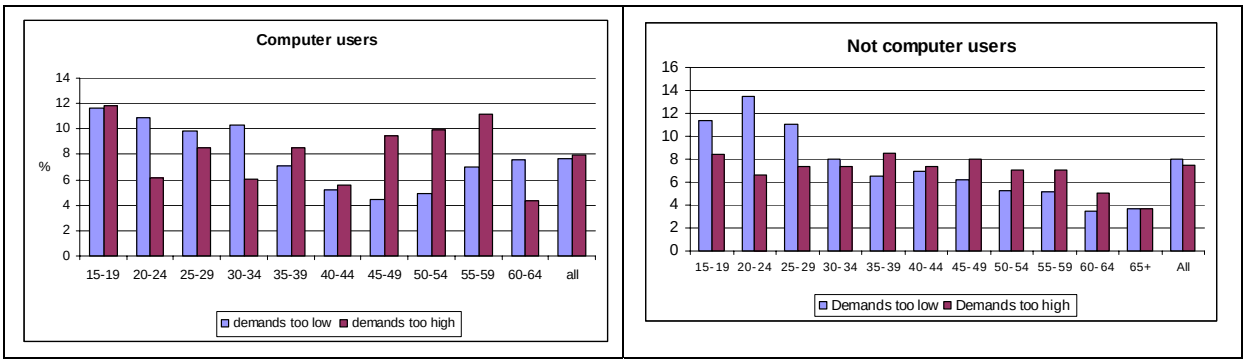
Exhibit 3-43: Workers perceptions of the match between their skills and work demands (EU15, 2000)



Source: own analysis based on European Foundation working conditions survey

This pattern was apparent both for computer users and non-computer users, with a tendency for it to be a bit more pronounced amongst the computer users, although the differences are quite marginal from a statistical point of view (Exhibit 3-44). Overall levels of mismatch were low for both older workers who were computer groups and those who were not, affecting just a small proportion of the older workforce.

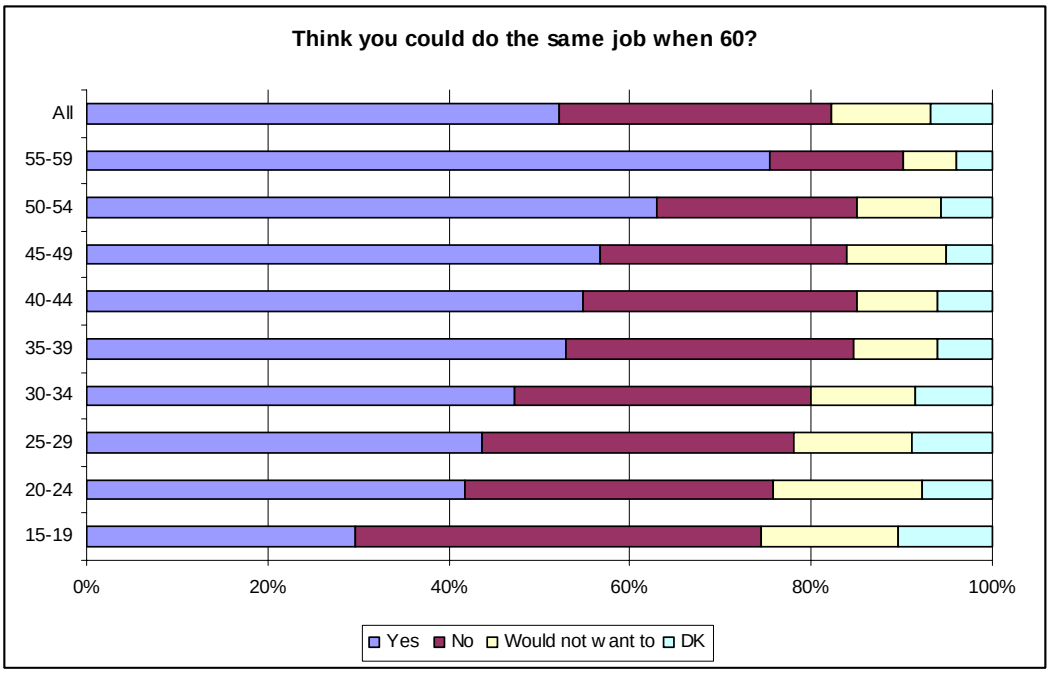
Exhibit 3-44: Perceptions of demand-skills mismatch by computer users and non computer users (EU15, 2000)



Source: own analysis based on European Foundation working conditions survey

Also of interest in relation to workability are workers views on whether they would be able to continue in the same kind of work as they get older. One main trend in this is that the older a worker gets the more likely he or she is to feel that he or she can continue to do the same job when aged 60 (Exhibit 3-45). This could be because older workers experience lesser decline in capacity than younger workers expect or because older workers have selected into more age-friendly jobs or, indeed, because of a "survivor" effect where those who remain in the workforce are those with higher capacities.

Exhibit 3-45: Workers expectancies about changing capacities with age (EU15, 2000)



Source: own analysis based on European Foundation working conditions survey

The other interesting aspect is that although about three-quarters of workers in the 50-59 years age range feel that they can continue in their current jobs at age 60, one-quarter do not. Clearly there is a need for opportunities to move to more age-friendly jobs if these workers are to be encouraged to remain in the workforce.

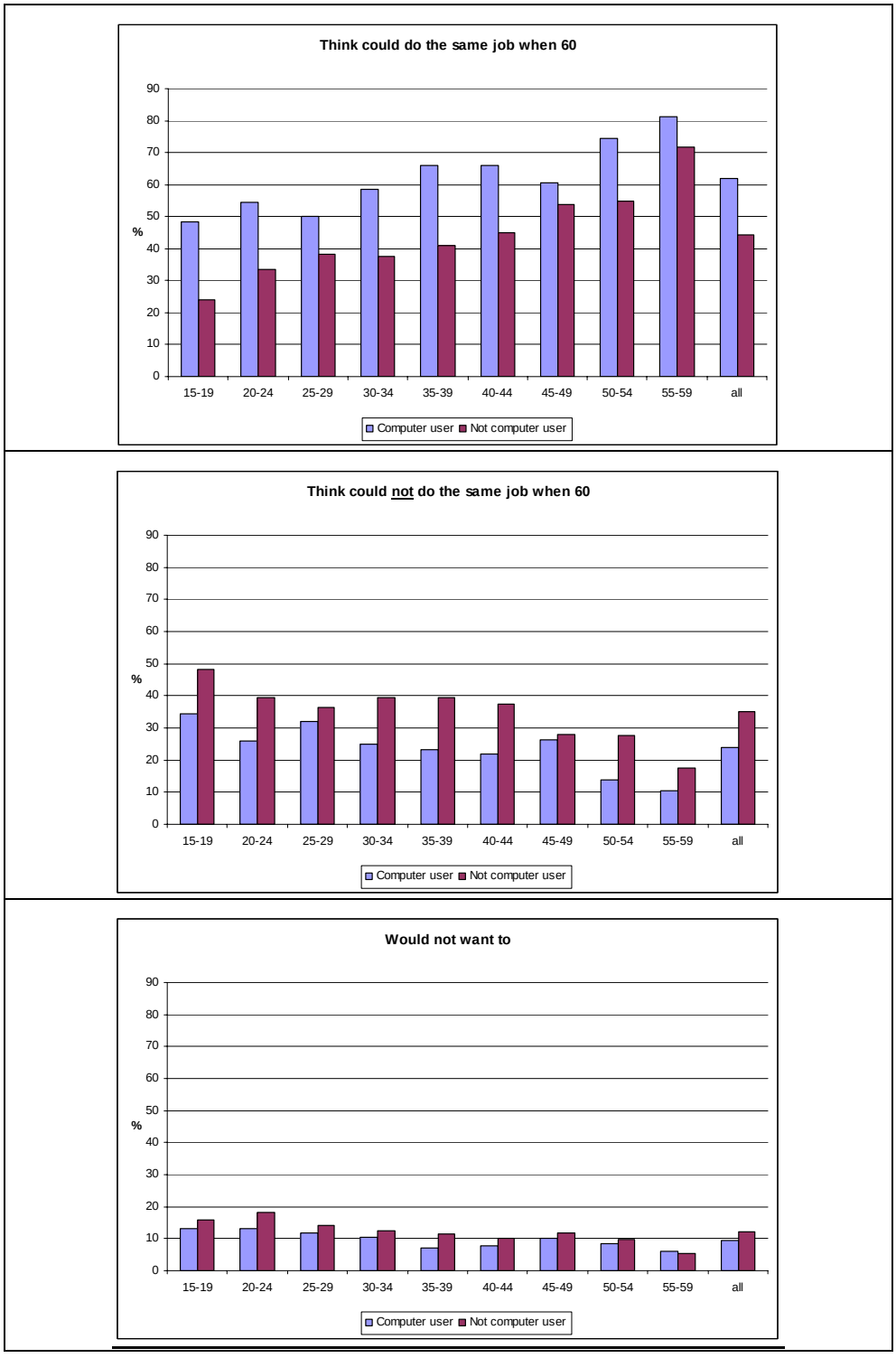
Computer users at all ages had a somewhat more positive view on their capacity to do the same job when 60 than had those not using computers (Exhibit 3-46).

Age-friendliness of ICT-related work

The extent to which ICT-related work is designed and organised to meet the changing needs of older workers has not received much direct research and is an area that warrants a lot more attention for the future. More generally, the aspects of work quality in ICT-related work that have already been addressed earlier have a central importance for the maintenance of workability of older workers. The available evidence suggests that ICT-related work can often be good quality work, but this is not always the case. Trends such as intensification in terms of a high pace of work and tight deadlines are likely to have negative implications for workability of older workers.

Another issue that warrants more attention is the prevalence of repetitive strain injuries amongst those working with ICTs. There is a lack of good quality data on this topic for the European workforce and research is needed on whether the risks and requirements (for ergonomic adjustments) are different for older workers.

Exhibit 3-46: Computer usage and expectancies about changing capacities with age (EU15, 2000)



Source: own analysis based on European Foundation working conditions survey

Accessibility and usability of ICTs for older workers

The interactions between age-related changes in physical and cognitive function and more specific characteristics of ICTs and ICT-based work are a central issue for the maintenance of the workability of older workers. Again this is an under-researched area and one that warrants a lot more attention for the future.

ICTs and ICT-based work have some specific ergonomic characteristics, including the use of visual displays and particular types of input device (keyboard, mouse, stylus and so on). Comfortable and effective usage of ICTs therefore requires adequate vision and dexterity as well as hearing for applications where audio input or output is important. Exhibit 3-47 identifies a range of potential implications of changes / impairments associated with ageing.

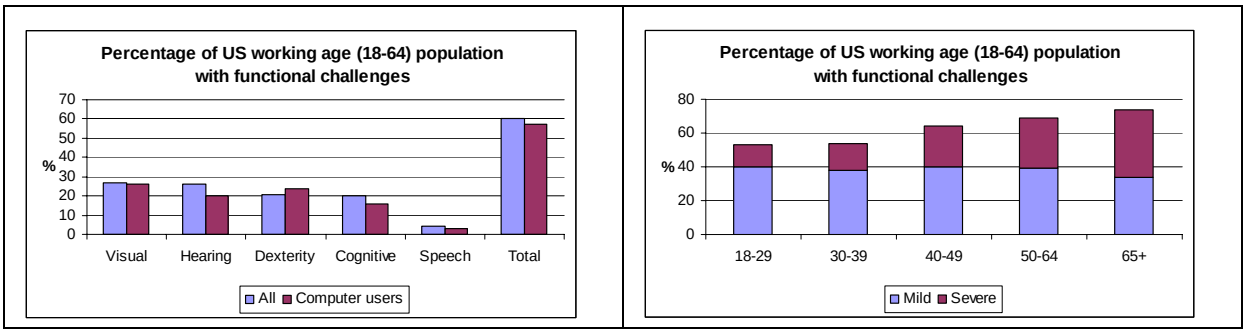
Exhibit 3-47: Potential implications of age-related changes

Change / Impairment	Activity that may be impacted
Visual impairment	Reading of text, instructional manuals, computer screens
	Locate information on complex displays
	Perform tasks that involve fine visual discrimination
	Lighting requirements
Auditory impairment	Comprehension of synthetic speech
	Detection of auditory signals or alerting sounds
	Speech communication (telephone or face to face)
Changes in motor skills	Tasks that require small manipulations (e.g. fine assembly work)
	Use of computer input devices (mouse, keyboard, etc.)
Changes in cognitive abilities	Learning new skills or procedures
	Recall of complex operating procedures or instructions
	Time-sharing; performance of concurrent activities
	Locating information on complex displays
	Performance of paced tasks

Source: CZAJA and MOEN 2004

Available evidence on the prevalence of physical and cognitive difficulties amongst the overall population of working age and especially amongst the population aged 50-64 years underlines the importance of this issue (Exhibit 3-48).

Exhibit 3-48: Prevalence of difficulties with accessibility and usability implications (U.S.)

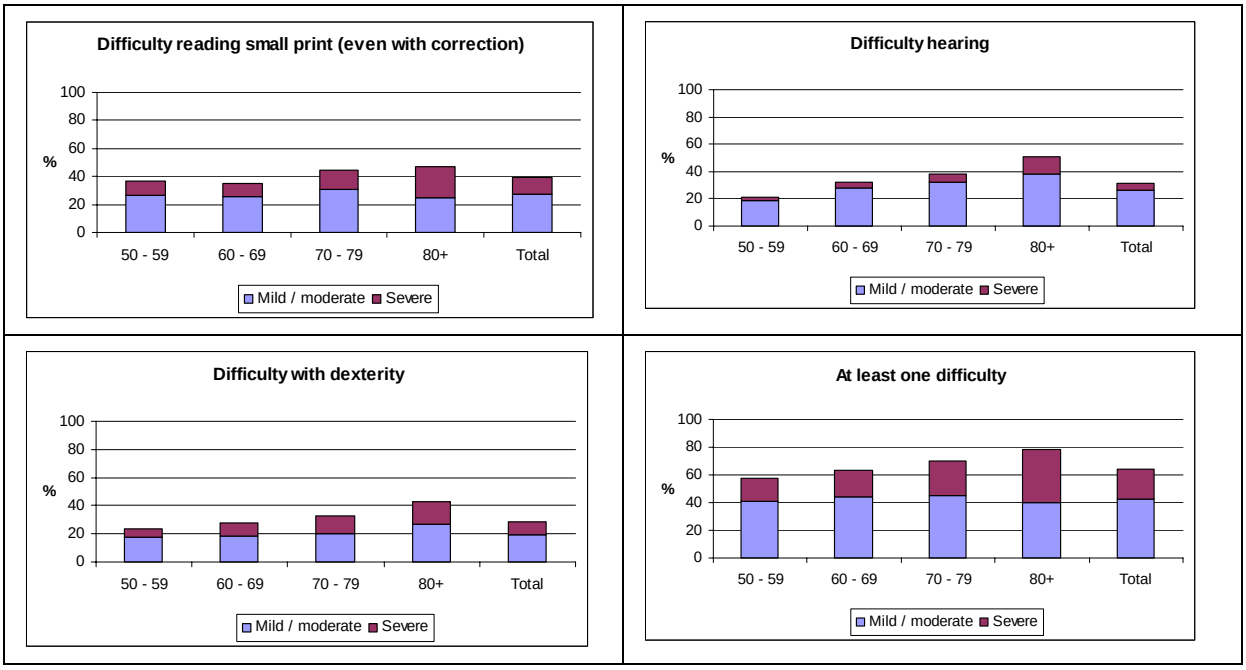


Source: FORRESTER RESEARCH / MICROSOFT CORPORATION 2003

The age pattern in functional difficulties is instructive. The prevalence of severe challenges increases significantly amongst older workers but many workers of all ages have less severe difficulties and they also stand to benefit from more accessible and usable ICT designs. This indicates the benefits that can be gained through a Design for All approach aiming to ensure that ICTs are as accessible and usable as possible for the widest possible range of users in the widest possible range for contexts.

The importance of giving focused attention to accessibility needs of older workers is also indicated by data from an EU survey of the population aged 50 plus (Exhibit 3-49). That study found a prevalence rate of 60% for physical functional difficulties amongst those in the 50-64 years age range.

Exhibit 3-49: Prevalence of difficulties with accessibility and usability implications (EU15)



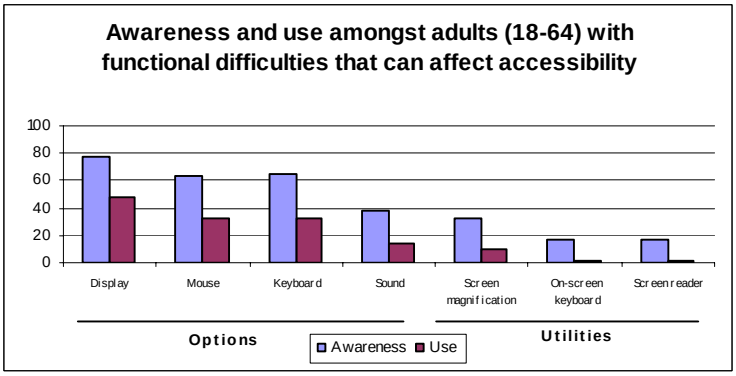
Source: SENIORWATCH 2002

The general lack of attention to this area has been quite eloquently put by others (RIGGS 2004):

> *„Interfaces for accommodation of disability have been added on to computer technologies, for sure, but they do not promote facile use in most workplaces. Arthritic fingers struggle to keep up with those of acrobatic Xers. Bifocaled eyes squint at screens that are too dim and low-resolution to read in one's 50s. Youth can speed down the Information Superhighway. This is one highway on which lack of speed kills."*

Although standard personal computers and operating systems typically now have a number of built-in accessibility features, U.S. data suggests that levels of awareness and usage of these vary considerably amongst those who could benefit from them (Exhibit 3-50).

Exhibit 3-50: Awareness and used of built-in computer accessibility features (U.S.)



Source: FORRESTER RESEARCH / MICROSOFT CORPORATION 2003

Assistive technology

Finally, in addition to new accessibility challenges, technology also presents new opportunities. Assistive technologies, ranging from low- to high-tech devices and systems can both help to make ICTs more accessible and provide supports for workers with physical or cognitive challenges in the wider aspects of their jobs. This is another area that has not yet received sufficient attention in research, policy or practice.

Exhibit 3-51: Awareness and work use of assistive technologies by people with functional difficulties likely to affect accessibility (U.S. adults, 18-64)

	Awareness %	Work use %
Alternative keyboards	31	1
Augmentative communication devices	14	<1
Braille embosser / printer	13	<1
Electronic pointing devices	32	1
On-screen keyboards	21	1
Reading tools	17	<1
Refreshable Braille display	8	<1
Screen magnifier	36	3
Screen readers	16	1
Sip-and-puff switches	10	<1
Speech-training software	16	1
Talking word processor	24	1
Touch screen/monitor	64	4
Trackball	46	4
Text telephone	24	<1
Voice recognition products	56	1
Word prediction programs	11	1

Source: FORRESTER RESEARCH / MICROSOFT CORPORATION 2003

Data from the U.S. suggests that between one-quarter and one-third of workers with a disability need or would benefit from assistive technology in the workplace (Stoddard et al., 1998). However, amongst those with functional difficulties that increase the likelihood of accessibility problems, levels of awareness and usage of assistive technology solutions seem to be generally low (Exhibit 3-51).

Employability

The term employability has been used in a number of different ways (GAZIER 1999; GRIP et al. 2004). For present purposes it is intended to capture those characteristics of a person that affect their likelihood of getting a job in the labour market and the type of job they get (for those trying to enter the workforce), as well as opportunities to change jobs (for those already in the workforce). Key factors here include skills and experience, but also issues such as flexibility with regard to hours of work and mobility, so that family responsibilities and geographical location can also impact on employability. In addition, the concept can be broadened to include health and disability, as well as age in itself, to the extent that these are visible to or taken into account by (prospective) employers. Put another way, employability refers to the attractiveness of a person to (potential) employers.

Another dimension of this, of course, includes wage expectations and associated additional costs of employment (social insurance, pension and health contributions, and so on). Seniority bonuses, which are a common feature on many European labour markets, play an important role here.

Technological change may have implications for employability, for example through changes in skills and the cost: productivity ratios of workers of different ages, skill profiles and so on. For the future it can be expected that electronic labour markets (GAREIS and MENTRUP 2001) will be of increasing importance for access to job vacancies as well as for self-employed persons seeking business opportunities.

This section looks at a number of dimensions of the links between ICTs and employability of older workers:

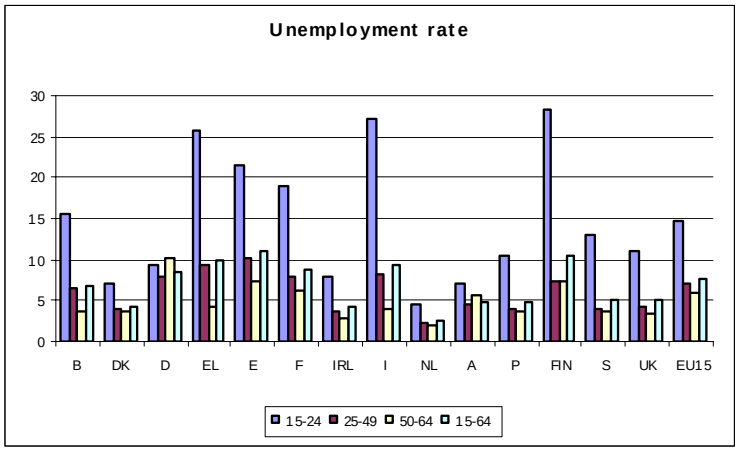
- evidence that ICT skills are important for employability of older workers,
- age-related aspects of employability in specialist ICT jobs,
- usage of ICTs by older workers to acquire other skills,
- age patterns in usage of online job search and recruitment services.

Evidence that ICT skills are important for employability of older workers

It makes intuitive sense that ICT skills will be a factor in employability for at least a proportion of older workers. However, despite the widespread penetration of ICTs in occupations in which older workers work or have worked in (for those who are unemployed or inactive), there has not so far been much research attention given to the role that ICT skills play in employability. In fact, one study based on UK data for 1997 found that there were no specific labour market returns for older workers from having computer skills and that older workers' wages were unlikely to be affected by lower ICT skill levels (BORGHANS and TER WEEL 2002).

Of course the penetration of ICTs has increased considerably in the intervening eight years and it is possible that benefits of ICT skills might be found if the research was repeated today. More generally, it is apparent that employers are increasingly requiring ICT skills in their recruitment practices, even to some degree in occupations where such skills may not be especially relevant. In addition, data from a survey in 28 EU regions (BISER 2003) found that about one person in three (30%) thought they could have a better job with more advanced computer skills. A similar proportion (33.3%) thought that they would have a worse job with less computer skills. Among the unemployed and other persons temporarily out of work, nearly every second person (48.6%) felt that it would be easier to find a satisfactory job with more advanced computer skills.

Exhibit 3-52: Unemployment rates by age group (EU15, 2001)



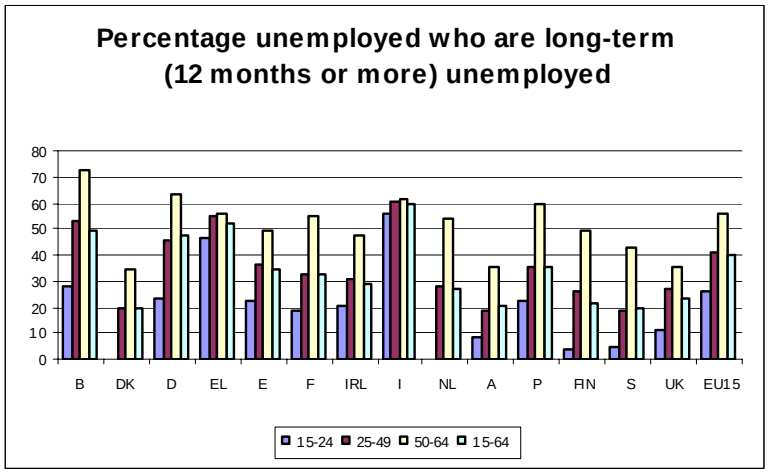
Source: EU LABOUR FORCE SURVEY 2001

One factor in the lack of research attention to date has been a broader lack of attention to job-seeking or job change amongst older workers. This is partly explained by the age patterns of unemployment across Europe (Exhibit 3-52).

It can be seen that for most countries unemployment amongst the 50-64 years age group is of a lower order than for other age groups. In addition, of course, there has up to now been a certain ambivalence about encouraging older workers back to the labour force. This is changing with the Stockholm targets for a 50% employment rate for this age group.

On the other hand, it is clear that older workers who are unemployed have serious employability problems; in many countries they are at a very high risk of long-term unemployment (Exhibit 3-53).

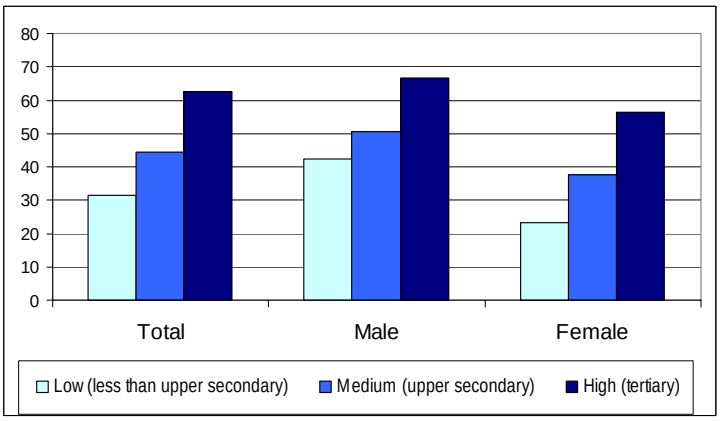
Exhibit 3-53: Proportion of long-term unemployed amongst the unemployed (EU15, 2001)



Source: EU LABOUR FORCE SURVEY 2001

In addition, it is important to remember that employability is not just an issue for those who are unemployed (that is, those who are not in employment but are actively seeking work). It is also an issue for those who are currently at work, especially for older workers who are at a high risk of early exit and for whom the possibility to change to a more attractive job might be a deciding factor. Employability may also come to be an issue for those older workers who are currently inactive, especially in the light of an active encouragement of return to work of those who are currently inactive.

Exhibit 3-54: Employment rates amongst those aged 55-64 by educational attainment (EU25, 2004)



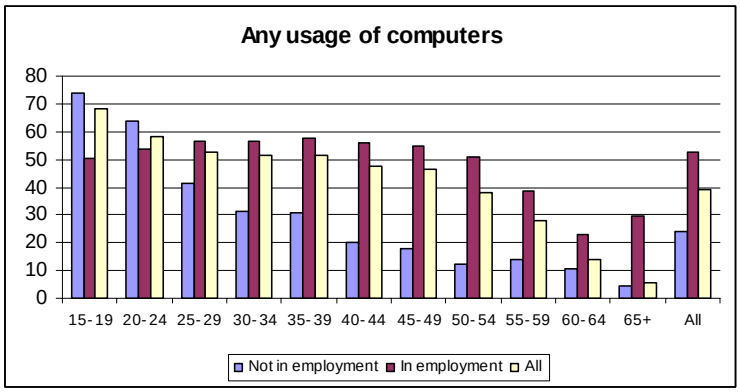
Source: EU LABOUR FORCE SURVEY 2004

One factor to be borne in mind in relation to this is the key role that educational attainment plays in activity and employment rates of older workers in Europe at present (Exhibit 3-54).

In 2003 almost half of the population aged 55-64 had a low educational attainment, although there has been a strong decline in this, from 61% in 1996 to 49% in 2003 (COOMANS 2004). In addition to the trend towards reducing numbers with low education there is also a trend towards increasing numbers with higher levels of education amongst this age group (12% in 1996, 16% in 2003 and projected to be close to 25% in 2030). This will have implications for many aspects of labour market orientation and engagement, including ICT-related aspects.

Overall, patterns of usage of ICTs and the possession of ICT skills by older workers and potential workers is strongly linked to employment status (Exhibit 3-55).

Exhibit 3-55: Computer usage by employment status (EU15, 2000)



Source: own analysis based on Eurobarometer data

Clearly lack of ICT experience and skills is a significant issue for all who are outside the workforce, with the exception of the younger age groups. The pattern for the 45-54 years age group in 2010 is perhaps especially significant as regards the achievement of the EU targets for employment rates of the 55-64 year olds by 2010 and there is a need for an immediate focus on the development of ICT skills amongst this cohort, both inside and outside the workforce, as well as a longer-term focus on the ICT skills of all the working age cohorts.

Levels of interest in developing ICT skills will be an important factor affecting the improvement of the ICT skills base of the population. One positive indication is that levels of interest are apparently quite high amongst the 50-59 years age group (Exhibit 3-56), although variations by current computer usage, gender, educational attainment and other socio-economic indicators are likely to be even more manifest amongst this age group.

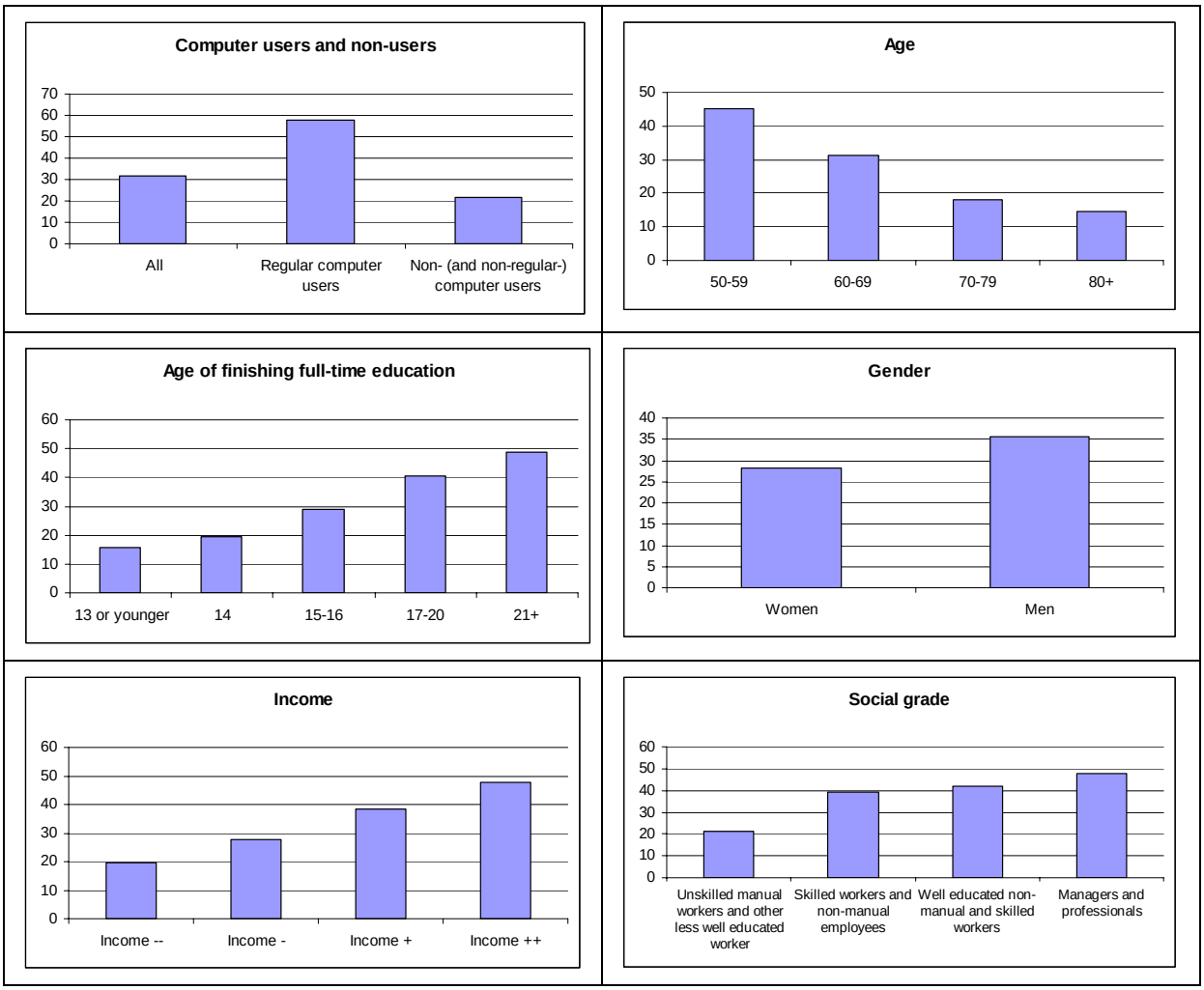
The European Computer Driving Licence (EDCL) has emerged as a key element of harmonisation of the ICT skills field, providing a standardised and recognised way to acquire and demonstrate ICT competencies. A requirement for ECDL or equivalent is increasingly included in recruitment specifications. It is now held by more than 4 million people world-wide, most of them in Europe. However, there appears to be no ongoing collation of age patterns of those taking ECDL courses and having ECDL qualifications.

Age-related aspects of employability in specialist ICT jobs

U.S. research has looked at the employability experiences of older workers in the specialist IT workforce (NATIONAL ACADEMY PRESS 2001). The main findings were:

- The IT workforce is younger than that in other occupations with workers of comparable educational attainment (58% are under 40 in the IT occupations compared with 46% in the other occupations).

Exhibit 3-56: Interest in improving computer skills



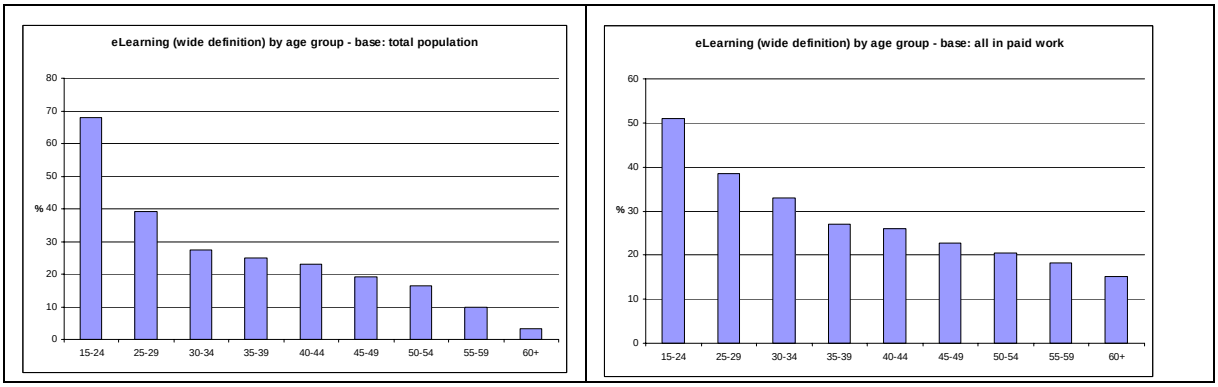
Source: SENIORWATCH 2002

- Older IT workers (aged 40 and over) are more likely to lose their jobs than younger workers; this difference becomes more pronounced when compared to the fact that in the rest of the economy older workers are less likely to lose their jobs than younger workers; this could be an indication of age discrimination, the ending of projects or product lines that rely on older technologies and skills (e.g. FORTRAN or COBOL), employers motivated to reduce labour costs because younger workers are cheaper, or some combination of the three.
- Older IT workers are just as likely to find new jobs as younger IT workers and the length of time it takes is similar to that for younger workers; also, older IT workers fare better than comparable older workers in non-IT occupations.
- However, there is some evidence that older displaced IT workers may find new jobs relatively quickly by being willing to take new jobs that do not pay as well as their previous jobs; younger displaced IT workers gained a 6.6% increase on average whereas older workers experienced a 13.7% decrease on average; this pattern is not found in other occupations; without further data it is not possible to determine whether this is due to discrimination or to the fact that older workers do not have up-to-date skills.
- Finally, as regards implications for a tight IT labour market, the data suggest that elimination of all potential age discrimination likely would not have a significant effect in the long-term although it could have a small, but important, one-time effect.

Usage of ICTs by older workers to acquire (other) skills

ICTs can also play a role in the acquisition of skills for older workers and older job-seekers through the flexibility offered by eLearning. However, available evidence indicates that older persons are much less likely to make use of the Internet for preparation of, or in the course of purposeful learning activities (Exhibit 3-57).

Exhibit 3-57: Usage of eLearning by age (EU15)



Source: EUSER 2005, the author's own calculation

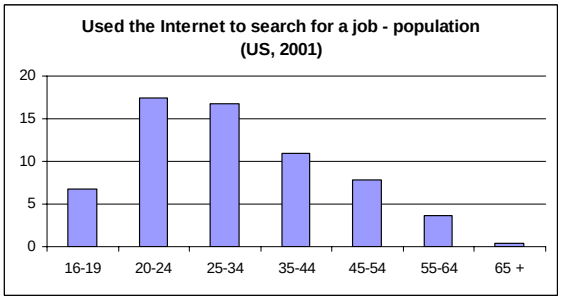
Usage of online job search and recruitment services

As regards usage of the Internet to support job-seeking, available evidence for the U.S. and for the UK suggest that older workers and potential workers are a lot less likely to do this than are those in the younger age groups (Exhibit 3-58).

Amongst those who do use online support to look for a job in the U.S., the types of usage are fairly similar for both younger and older users. The most frequent uses are reading online ads or searching online job listings, followed by researching information on potential employers, submitting a resume or application, and posting a resume on a job listing site or with a service. Likewise, in the UK reasons for using online recruitment services were similar for older and younger users. Most were out of work and actively looking for a new job, with smaller numbers being currently in work and looking at other opportunities.

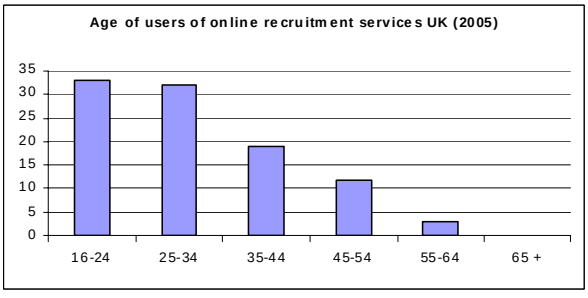
Exhibit 3-58: Online job search (U.S. and UK)

U.S.



Source: BLS 2002

UK



Source: NORAS 2005

Disengagement from the labour market

This is by far the most visible theme on the work-related active ageing policy agenda at the moment, prompted by low employment rates amongst the older age groups of the working age population in most European countries. In fact, basic figures on employment rates hide a

much more complex picture as regards the composition of the group of older people of working age who are outside the workforce. Some are "retired" in various ways, sometimes through choice and sometimes through necessity, some are unemployed, and many are on sickness or disability benefits. The profile of this population varies widely across Europe, depending on pension and other benefit structures and other factors. In addition, the other three key dimensions of impact – work quality, workability and employability - can also influence engagement or disengagement.

Technological change can influence engagement / disengagement decisions through its impacts on these other three dimensions, as well as through more direct impacts on the decisions of older workers / potential workers and employers, for example, whether to invest in training in new skills.

The extent to which early retirement is directly affected by technological change has been the subject of some empirical studies. Based on human capital theories, it can be hypothesised that technological change could contribute to early retirement because older workers are less likely (or their employers are less likely) to make the training investments needed because of the likely lower likelihood of return on the investment.

The results of studies in this field have been somewhat contradictory. FRIEDBERG (2001) found evidence in the U.S. that lower levels of computer usage amongst older workers in the 60-64 years is linked to lower investment in skills due to impending retirement and that computer use may reduce the retirement probability of older workers, especially those in the 55-59 year age group. However, SCHLEIFE (2004) found that for Germany factors other than computer use determine whether workers voluntarily or involuntarily change their employment status and become part-time workers, retired or unemployed.

Overall, it seems likely that ICTs have so far had only a relatively small direct impact on retirement decisions. This is borne out by the results of a representative survey of older workers in the UK (Exhibit 3-59).

However, in considering the current situation of older workers it needs to be remembered that the older workforce represents something of a "survivor population", given that only about forty-three percent of the EU population in the 55-64 years age range are in employment. It could be the case, for example, that computers and technological change play a role in decisions to exit the workforce, even if this is not a determining one in most cases. In addition, it could also be the case that those workers who remain in the workforce are more receptive and capable in the face of technological change than are those who have left.

In relation to this, there is emerging evidence that job quality can be important in the retention or attraction of older people and people with care responsibilities into the labour market (CEC 2002b; CEC 2004a). Patterns vary across countries but withdrawal from the labour market of older workers in low quality jobs can be up to four times higher than that of older workers in jobs of higher quality, but also more than twice as high as that of younger people in low quality jobs (CEC 2004).

Overall, taking together all of the evidence that has been collated and analysed in this Chapter so far it can be concluded that if technological change in the workplace is suitably shaped and managed to support the needs of older workers and potential workers then it can make an important contribution to the achievement of the EU employment rate targets for older workers. Technology on its own may not be a "killer application", but exploitation of the age-friendliness potential of technological change will be an important element of the overall set of supports that are needed.

Exhibit 3-59: Reasons for expected and actual early retirement amongst 50+ workers (UK)

Reasons for expected early retirement	Men %	Women %	Total %	Reasons for actual early retirement	Men %	Women %	Total %
Enjoy life while still young and fit enough	80	92	83	Ill-health	53	44	49
Spend more time with partner/family	46	65	50	Enjoy life while still young and fit enough	26	19	23
Could/can afford to retire	45	46	45	Financial offer to retire early / take voluntary redundancy	27	8	18
Financial offer to retire early / take voluntary redundancy	32	10	27	Could/can afford to retire	21	14	18
Retire at same time as husband/wife/partner	20	32	22	Made redundant/ dismissed/had no choice	22	14	18
Job is too stressful	15	26	17	Spend more time with partner/family	13	19	16
Work is too demanding in other ways	9	20	12	Work is too physically demanding	11	16	14
Fed up with job and want a change	10	12	11	Ill-health of relative or friend	4	13	8
Ill-health	8	17	10	Job is too stressful	8	8	8
Spend more time doing voluntary work	8	15	10	Retire at same time as husband/wife/partner	3	10	6
Work is too physically demanding	9	10	9	Care for an adult	3	7	5
Skills are not valued	7	8	7	Work is too demanding in other ways	5	3	4
Dislike job	8	3	7	Provide childcare	1	6	3
Made redundant/ dismissed/have no choice	8	4	7	Fed up with job and want a change	2	4	3
Want to work part-time and could not in career	3	6	4	Couldn't find another job	3	2	3
Care for an adult	1	9	3	Skills are not valued	2	2	2
Ill-health of relative or friend	1	6	2	Dislike job	1	2	2
Couldn't find another job	3	0	2	Spend more time doing voluntary work	1	2	1
No opportunities for promotion or progress	3	0	2	*New technology / machinery being used at work*	1	1	1
Provide childcare	-	2	1	No opportunities for promotion or progress	1	1	1
Retire at different time to husband/wife/partner	0	4	1	Want to work part-time and could not in career	0	1	-
New technology / machinery being used at work	1	2	1	Retire at different time to husband/wife/partner	0	1	-
Other reason	8	10	9	Other reason	9	11	10

Source: DEPARTMENT FOR WORK AND PENSIONS 2003

Although it is difficult to specify precisely what that contribution might be in quantitative terms, a basic modelling provides an indicative yardstick of the potential scale of the impacts that age-friendly ICT developments might make (Exhibit 3-60). Potential impacts of this order

against the baseline employment rate in 2004 of 40.7% for EU25 and 42.2% for EU15 warrant commensurate attention in policy.

Exhibit 3-60: Indicative modelling of the potential quantitative contribution of age-friendly ICT to employment rates of older workers in Europe[22]

Indicative estimate of percentage of population aged 55-64 inactive linked to…		How ICTs could help	Indicative potential increase in employment rates of 55-64 year olds		
			Percentage that might be helped by ICTs		
			10%	20%	30%
Illness / disability	10	Assistive technologies, accessible ICTs and exploitation of the flexibilities of ICTs	1.0	2.0	3.0
Carer	6	ICTs to support flexible working, work-life balance and caring	0.6	1.2	1.8
Early retirement (job not attractive enough)	12	Better quality / more attractive work through ICT-related jobs	1.2	2.4	3.6
Unemployed	6	Increased chances of finding work through ICT skills	0.6	1.2	1.8
Total	35		3.4	6.8	10.2

Source: the authors

Equality of opportunity in access to the potential benefits of ICTs, across the active and inactive older working age group, will be a key factor that will influence whether such potential gains will be realised in practice.

Informal / unpaid work

As already noted in the introduction, a complete analysis of the intersections between work-related active ageing and technological change also needs to give consideration to informal / unpaid work. Important dimensions of this include caring for older or disabled dependants and childcare, as well as other forms of civic activity that contribute to the overall social capital of society.

Of particular interest in the context of work-related active ageing are the interactions between paid work and caring work, and how technological change can impact on outcomes in this regard.

In most EU countries at present families provide the bulk of care for older people when they become dependent. The likelihood of such responsibilities arising is especially high for people in the older worker age range as their parents and, sometimes, their partners / spouses come to need care. This work clearly has enormous social and economic value, and some have even argued that it should be formally recognised and recompensed for its monetary value.

[22] Estimates are based on reasons for leaving work by older workers in Europe (see Exhibit 3-24) and prevalence of caring amongst those aged 50-64 (see Exhibit 3-25)

As individually and collectively there are only a finite number of hours available to be shared between formal and informal work, it is clear that full employment (in the sense of everyone of working age being in full-time employment) is unlikely to be achievable nor is it desirable. Again, this is a theme where technological change opens up new opportunities and also some potentially new risks. If ICTs can help to increase the flexibility of formal working arrangements then it provides positive potential; likewise, if technologies can help in the caring process (as examined in some detail in chapter 4) then they may also provide part of the solution in some cases. One the other hand, if technology results in intensification and extensification of work, then the time and space for care may be diminished.

This is an area that has so far received relatively little research attention (see Cullen and Clarkin, 1994 for an earlier overview of this field). Aspects that warrant more examination at this point in time include the opportunities and risks posed by teleworking for carers and the possibilities for technology to help working carers to provide care from the workplace (e.g. by remote monitoring of the well-being of the person being cared for).

Apart from caring for older or disabled dependants, childcare is another important domain of informal work for the many people for whom grandparenthood begins in the older worker age range. With increasing female employment rates amongst women with children the childcare contribution of grandparents is becoming more visible. This is another aspect where technological change can have impacts, although more so in its impacts on work flexibility (for parents and / or grandparents) than in the use of technology in childcare. Whilst web cam links to provide reassurance of one's child's happiness in the créche are already available for some working parents, it is unlikely, at least for the foreseeable future, that parents, grandparents or society will come to consider remote, technology-supported childcare to be acceptable.

3.2.5 Outcomes

Finally, it is important to move beyond a narrow focus on employment rates alone and consider wider aspects of the work-related active ageing issue. Employment must be seen as a means to an end rather than an end in itself. Impacts and outcomes at three levels – individual, corporate and societal – need to be considered.

Individual

At the individual level, health is a fundamental consideration for older workers / potential workers. For some older workers, working has positive implications for health and well-being but for others it can have negative impacts. This will depend on the quality of the work and its degree of age-friendliness. For those who are outside the workforce, there is evidence that being involuntarily inactive can have negative impacts on health and well-being. Therefore, the extent to which ICT can improve the quality and age-friendliness of work and the impacts that technological change has on choices of older workers in regard to whether or not to remain in or return to work will influence outcomes in this area.

Linked to this is the issue of the overall balance that people experience between making a contribution to society and the economy, on the one hand, and fulfilling their personal and family aspirations. This will become an increasingly important issue as the population of Europe ages and pressures to deal with the challenges of this increase. Here the extent to which ICTs can contribute to better work-life balance will be crucial.

Level of income is of course a central factor of influence on activity rates for older workers. Whatever solutions are introduced to encourage employment rates will have to include the financial attractiveness of work. The issue of income extends beyond retirement, of course, and equitable access to an income after retirement is also a central issue in relation to activity rate patterns over the working lifetime. The extent to which access to ICT-related jobs

affects employment earnings and the relative financial attractiveness of employment in comparison to various forms of inactivity is therefore also an important issue.

Corporate

At the corporate or employer level, relevant outcomes include competitiveness, compliance and corporate social responsibility (CSR).

The interactions between technological change and work-related active ageing for competitiveness (including efficiency and effectiveness in public sector organisations) is clearly an outcome of central importance for employing organisations. This will become an increasingly important aspect of organisational competitiveness as the workforce and labour market ages. The importance of ensuring that technological change enhances rather than hampers the contribution and productive capacities of older workers will grow accordingly.

There are emerging legislative and regulatory forces that will place requirements on employers in relation to work-related active ageing (e.g. equality / anti-discrimination legislation, accessibility requirements and so on). Compliance with these requirements will become increasingly important for employing organisations. Many of these are linked directly or indirectly to technological change, such as accessibility of ICTs (an issue both for employers and for manufacturers and suppliers of ICTs), reasonable accommodations in the workplace and ensuring equality in access to ICT training.

Apart from a formal requirement to address these matters, work-related active ageing issues (and the implications of technological change for these) also fall within the realm of corporate social responsibility. Age-friendliness will become an increasingly important and visible aspect of this, both internal to the organisation (age-friendly employers) and in customer service and products (age-friendly design).

Societal

From an overall societal point of view both economic and social outcomes are of central importance. Also very relevant are issues of fairness and equality, including fairness of outcome within the older age group (e.g. as regards income, access to rewarding opportunities, health and so on) and between the younger and older generations (in their contributions to the workforce, caring and so on). Although many forces other than technological change influence this aspect, the evidence-base presented in earlier sections indicates the pervasive implications that ICTs are having in many areas of working life. The overall policy focus must be on harnessing and shaping these developments to enhance equality of opportunity and outcome for workers of all ages.

3.2.6 Conclusions

The available evidence indicates the increasing significance of ICTs for work-related active ageing in Europe. Both opportunities and risks for older workers and for the achievement of European policy goals can be detected. Key aspects to be addressed to maximise the opportunities and minimise the risks are:

- design of ICTs to cater for age-related changes in perception, dexterity and cognition;
- organisation of ICT-related work to suit the needs of older workers (“calmer” technologies and “calmer” work);
- equality of opportunities in access to age-friendly ICT work;
- exploitation of assistive technologies to support workability of older workers;
- exploitation of ICT-supported opportunities for age-friendly flexibility in work, including facilitation of carers to continue in or return to work;

- equality of opportunities to acquire and maintain ICT-related skills and competencies.

3.3 Current policies and practice of key stakeholders

Work-related active ageing now has a high priority on the EU policy agenda. It is especially visible in employment policy and equality policy.

The Stockholm Council established a target employment rate of 50% for the EU population aged 55-64 by 2010 and the Barcelona Council set a target of increasing the average exit age by 5 years over the same timeframe. As the EU is still far short of these targets there has been a recognition of the need for much stronger efforts, with a preventative approach required as the overarching principle of policy measures based on mobilising the full potential of people of all ages in a life-cycle perspective (CEC 2004).

Specific measures to be promoted include:

- financial incentives to discourage early retirement and to make sure that work pays;
- access to training and lifelong learning, and effective active labour market strategies;
- good working conditions conducive to job retention, in particular in relation to health and safety, flexible working arrangements, and care services.

In line with this, active ageing has been included in the Employment Guidelines for the Member States. However, an examination of the actual Employment NAPs for the Member States for 2004 that was carried out in the course of the research for this study suggests that these themes have not yet been very widely or fully addressed.

The work and employment related concerns of older workers are also directly addressed in EU equality policy, specifically in the context of the Framework Directive on Equal Treatment in Employment and Occupation (2000). This outlaws direct and indirect discrimination on the grounds of religion or belief, disability, age or sexual orientation.

These two policy lines provide an important contextual backdrop to policy formulation on ICTs and work-related active ageing.

3.3.1 EU policy and activity addressing ICTs and work-related active aging

The issue of ICTs, per se, in work-related active ageing is currently not very visible as a single, focused theme in EU policy or practice. However various dimensions are being addressed to a certain degree at the EU level, in particular under the Knowledge Society (DG Employment and Social Affairs) and eInclusion (DG Information Society and Media) themes, and in the practical activities being supported under the EQUAL programme. Some of the provisions of the Framework Directive on Employment Equality also have relevance.

Employment and social dimension of the knowledge society

EU activity in relation to the knowledge society theme has been supported by the High Level group on the Employment and Social Dimensions of the Information Society (ESDIS). Aspects that have been addressed include eInclusion, quality of work in the Information Society, and implications of the Information Society for Human and Social Capital. These all have relevance and importance for the theme of ICTs and work-related active ageing although this has not yet been given specific and detailed attention.

Socio-technical dimension of the knowledge-based society

EU activity through the eInclusion unit of DG Information Society and Media has focused on socio-technical aspects of ICTs, including management of relevant RTD under the

Framework Programmes and support for the development and implementation of wider policies and measures.

RTD

RTD activity has addressed eAccessibilty and ICT-based assistive technologies, themes with direct relevance for work-related active ageing. So far, however, relatively little of the RTD has focused directly on the work-related active ageing theme and this is an aspect that could be strengthened under the remainder of Framework Programme 6 and continued in Framework Programme 7, including attention to the usability requirements of older workers.

eAccessibility policy and other measures

A number of policy and other measures have focused on the eAccessibility theme. eAccessibility has been promoted through the establishment of the European Design for All Network and also through Council Resolutions[23]. Even before this the issue of accessibility of basic telecommunications services was included within the Universal Service Directive[24]. Although these aspects do not focus especially on work-related active ageing they have a contribution to make. In particular, the work in the Design for All area could in the future give increased attention to the design of ICTs for the workplace and for the needs of ageing workers in particular.

Accessibility in public procurement of ICTs

Of more obvious direct relevance is the recent EU activity to encourage accessibility in public procurement of ICT. The revised EU Directives on Public Procurement[25] now include clauses encouraging the inclusion of accessibility criteria in public procurement.

> *"Contracting authorities should, whenever possible, lay down technical specifications so as to take into account accessibility criteria for people with disabilities or design for all users."*
>
> *"Whenever possible [these] technical specifications should be defined so as to take into account accessibility criteria for people with disabilities or design for all users."*

It is significant that the reference includes "design for all users" and this perspective is very important for older workers who might not be classified as having a disability but nevertheless have age-related changes that pose accessibility challenges when working with ICTs. The Commission is now working with the European standards organisations on a mandate to prepare a toolkit to guide procurers in this area.

The public procurement line of action is potentially a very powerful one for ensuring that ICTs in the workplace are accessible and usable for older workers. If the needs of older workers are given sufficient attention in the toolkit and by public procurers then the initiative will make a significant contribution to the achievement of more age-friendly workplaces in public sector jobs. This will require a response from the ICT industry, of course, which would have as a consequence a more generally increased availability of age-friendly ICT. Older workers in private sector employment can also be expected to benefit in due course, if employers follow the lead of the public sector and the ICT industry mainstreams accessible and age-friendly ICT designs.

[23] Council Resolution of March 2002, "on the eEurope Action Plan 2002: accessibility of public websites and their content"; Council resolution 5165/03 e-Accessibility: improving the access of people with disabilities to the knowledge based society, OJ 14 January 2003.

[24] DIRECTIVE 2002/22/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 7 March 2002 on universal service and users' rights relating to electronic communications networks and services (Universal Service Directive).

[25] Directive 2004/18/EC and paragraph 42 of Directive 2004/17/EC)

EQUAL Programme

Age is a thematic dimension of the EQUAL programme, both in relation to age management in the workplace and labour market and to wider issues of age equality. EQUAL is a significant element of the European Union's strategy for more and better jobs and for ensuring that no one is denied access to them.

Although there are a number of EQUAL projects addressing ICTs and work-related active ageing issues, this theme is not very prominent in relation to the overall level of activity. More visibility and attention to this aspect would be beneficial in the future.

Framework Directive on Employment Equality

This directive provides no clear pointers to whether and how issues relating to ICTs might be covered under the age ground. In the absence of guidance on this, the extent to which it is addressed in practice will depend on whether the issue is taken up at the Member State level, including the national transpositions and whatever actions follow. This is an issue that warrants a more detailed examination at EU level to ascertain whether and how guidance on this theme could be provided to the Member States.

The requirement in the directive for employers to make “reasonable accommodations” to meet the needs of people with disabilities may also be very relevant for older workers with disabilities and age-related changes in functional capacities. Again, the question of whether and how this aspect covers accessible ICTs or access to assistive technology in the workplace has not yet been explicitly examined at the EU level.

3.3.2 Relevant activities in Member States and by other key stakeholders

Although the theme of ICTs and work-related active ageing does not so far have a very prominent place in the range of activities in the Member States addressing older workers there are nevertheless a variety of initiatives being undertaken. Some examples from different countries are presented in Exhibit 3-61.

The remainder of this section presents an overview of what is currently happening and what needs to be addressed in policy, research and practice for each of the specific themes for action that were identified in the conclusions of section 3.2.4.

ICT design that caters for age-related changes in perception, dexterity and cognition

There is an increasing effort in research, policy and practice across Europe to encourage the development and supply of ICTs that are accessible for people with disabilities. However, there has not yet been sufficient attention given to the age-related changes in perception, dexterity and cognition that become increasingly common amongst older workers and potential workers. This is an area that needs to be given a lot more attention by the research community, by procurers and by the ICT industry.

In the U.S. the public procurement approach is extensively used because of a legislative obligation on Federal Agencies. In addition, as already noted in chapter 2, direct legislative obligations on accessibility are also in place for manufacturers and suppliers of telecommunications equipment and services. The issue of accessibility in public procurement of ICTs is now on the policy agenda in Europe but this has yet to have much impact in practice.

Exhibit 3-61: Examples of activities addressing ICTs and work-related active ageing in the Member States

Country	Examples of initiatives
Belgium	• Encouraging older workers in the printing sector to develop ICT skills and / or redeploy to new roles where ICT skills are not so important
Finland	• National Programme on Ageing Workers – includes ICT skills-related training as an element (http://pre20031103.stm.fi/suomi/ikaohjelma1998-2002/index.html) • Forestry industry programme to increase the retention of older workers – includes ICT skills amongst others (http://pre20031103.stm.fi/suomi/ikaohjelma1998-2002/index.html)
Germany	• Institute of ergonomics is developing computer-based training to reduce the fears of older workers in using ICTs (www.med.uni-gies-sen.de/psychosomatik/forschung/ zlh/zlh_web2000.htm) • 'Fit for the Job' programme of pilot projects addressing the needs of older workers; Sela (self-organised and job-based learning for older employees) uses computer-based learning (www.bibb.de) • Research on impacts of ICTs on early retirement (ZEW) (www.zew.de/de/forschung/projeckte.php3?action=detail&nr=343) • Project 'Innovative with Older Employees' – guidelines for SMEs, including specific focus on lifelong learning and ICTs (www.rkw.de/projeckt/thema1/1demografischerwandel.html) • Support for job-seeking older unemployed through Senior-Internet Cafes (part of Seniors Online project in North Rhine-Westphalia) (www.sol-dw.de/arbeit!/ content.htm) • Online network set up by IG-Metall to support companies preparing for an ageing workforce (http//netab.de) • Federal project for online learning (www.senioren-lernen-online.de) includes courses on 'office and Internet' that encourage use of ICTs for professional purposes (www.senioren-lernen-online.de) • Online portal on promotion of a human working environment (www.mensch-arbeit.de) – includes a focus on 50+ workforce • Senior Citizens Online Editorial Project – aims to train and qualify older people as online editors www.senior-redaktion.de
Greece	• Valuing knowledge and competencies acquired through experience and their accreditation for older workers (CREDIT) (www.hit.certh.gr/english/credit.html) • eQuality – project under EQUAL Initiative focusing on older workers and their needs in relation to a changing work environment and the progression of ICTs (www.equality.ipet.gr)
Ireland	• Task force on Lifelong Learning (2002) – recommended a specific initiative for training older workers in ICT be developed, building on the experiences of more general IT training for older people (www.entemp.ie/labour/strategy/index.htm) • eInclusion report in 2003 recommended a specific strategy to address the ICT skills of late adopters in the workforce, especially the Internet skills of older workers
Lithuania	• IT courses provided for older women aged 55+ to help them prepare for increasing competition in the labour market (www.pmvc.ktu.lt) • WWW-GOLDEN-Age – focuses on ICTs for older people in general, including opportunities to earn a living (www.pmvc.ktu.lt)
Netherlands	• 'Midlife' web site with job vacancies – targeted to the 50+ age group (www.midlife.nl) • Talentmanagement 50+ Rabobank – involves older / retired people in doing ad-hoc work for the bank (e.g. transfer of banking service skills to older customers) (www.rabobankgroep.nl) • Teleworking Interpolis – insurance company provides extensive opportunities for teleworking / flexible working; used by many older employees who have mobility restrictions (www.interpolic.nl) • Research programme on use of ICTs by older workers, stress impacts and so on (www.tno.nl/arbeid)
Poland	• Idea for Success – EQUAL project addressing the risk of employees over 50 posed by ICTs and other changes at work • MAYDAY – support system for SMEs and older workers in maritime industry focusing on introduction of new technologies • EQUAL Programme – vocational training for older people including ICT
UK	• Directgov Over 50's web portal – targets 50+ age group, includes information on employment issues – staying longer in employment, continuing work after state retirement age, options for boosting retirement income • Scottish work life adaptability network – addresses age-related HR issues, including ICTs

Source: own analysis of information collated by eInclusion@EU project

Quality and organisation of ICT-related work to suit the needs of older workers

It is now well recognised at the European policy level that the quality and organisation of work are crucial factors for increased employment rates amongst older workers. Despite this, there is little evidence of widespread attention to this issue across Europe as of yet, whether in national policy, in the social partnership arena or in the practices of individual employers. At European level, the main efforts to date have been promoted by the European Foundation for the Improvement of Living and Working Conditions and the European Work Organisation Network (WALKER et al 1997; WALKER 1998; EWON 2001; EMCC 2005a,b), with initiatives to collate examples of good practice in action, develop principles of good practice and spread awareness in this field.

At the national level, prominent examples of initiatives in this area include the Maintenance of Workability (MWA) programme in Finland and the New Quality of Work Initiative (INQA) in Germany (INQA 2005).

Although activity to improve the quality of work for older workers are now emerging there has so far been very little attention given to the potential of ICTs in this context. This is reflected in the very limited visibility of ICTs and work quality in the Employment NAPs as well in the range of initiatives outlined in Exhibit 3-61.

ICTs and equality of opportunities in access to age-friendly work

Related to this is the wider issue of how equality of access to good quality ICT-related jobs can be supported. On balance it seems that ICTs more often are associated with better quality rather than poorer quality jobs. If this is the case then occupational mobility of older workers towards such jobs is an issue of importance both for older workers' health and for their employment rates (through retention of existing older workers and making work more attractive for older workers currently outside the workforce). This is an issue that has received little attention to date, whether in policy, the social partnership arrangements or the human resource management practices of employers.

Exploitation of assistive technologies to support workability of older workers

The report for DG Employment and Social Affairs on assistive technology (AT) in Europe included some attention to assistive technology in the workplace, although the focus was on people with existing disabilities rather than ageing workers (CEC 2003b).

Although most countries have regulations that enable the costs of workplace adaptations for people with disabilities to be partially (and sometimes fully) publicly financed, in general little use seems to be being made of these possibilities. Factors affecting this include lack of knowledge of what is available, administrative burdens and a general underestimation of the real capabilities of disabled people to perform jobs in regular enterprises. There is a lot of knowledge, expertise and good practice around but it tends to be dispersed and localised.

In addition to this under-development of the use of workplace assistive technology in support of people with disabilities there appears to have been very little direct attention given to the requirements and opportunities in this area in relation to older workers.

Exploitation of ICT-supported opportunities for age-friendly flexibility in work

So far there appears to have been very little direct attention given to the potential offered by ICTs to support age-friendly flexibility in work. In addition, although teleworking now has an established place within the work-life balance arena, there has not yet been a focused

examination of the opportunities and risks that this may present under different circumstances.

Equality of opportunities to acquire and maintain ICT-related skills and competencies

Finally, of course, provision of equality of opportunities to acquire and maintain ICT-related skills and competencies throughout the lifetime is a central issue. There is increasing attention to this across the Member States (through the Employment Action Plans, the Human Resource component of the Structural Funds and Community programmes such as EQUAL). However, the range of approaches and the degree of attention given to this aspect varies widely and there has not yet been any co-ordinated effort to document the nature and level of activity targeting ICT skills of older workers and potential workers across Europe.

3.4 Conclusive summary and policy implications

This section summarises the main overall conclusions from the analysis of the work-related active ageing theme and the key policy implications for Europe.

3.4.1 Challenges and opportunities

There are four main aspects of work-related active ageing where ICTs and technological change pose challenges and opportunities for Europe. These are:

- quality of work and employment,
- workability and productivity,
- employability,
- decision to engage in or disengage from the labour market.

In addition, there are both challenges and risks posed for engagement in informal, unpaid work.

Quality of work, working conditions and quality of employment

Overall, it seems that jobs involving computer usage are more likely to be of good quality (and thus to be "age-friendly") than are jobs that do not. One reason for this is that computers tend to be used in jobs that were of better quality in the first place; in addition, there is evidence that when care is taken to prepare properly for the introduction of ICTs then they are more often associated with improvements than dis-improvements in the quality of work.

Amongst computer users, older workers have a higher likelihood of being in better quality jobs than younger workers, although a significant minority are in low quality jobs that may either be under-stimulating or involve excessive demands. More generally, there has been an intensification of work associated with increasing usage of ICTs over the last 10 to 15 years, with a growth in the number of workers being required to work at high speeds and meet tight deadlines; some workers may view this as a positive quality of their jobs but others (especially older workers) may not. In fact, it seems that older workers working with computers are overall more likely to have to work at high speeds and meet tight deadlines than older workers in other jobs, although there is substantial variability within both groups.

Teleworking and other applications of ICTs open up opportunities for more flexibility that can be used to facilitate work-life balance; however, we still know relatively little about how attractive or practically useful teleworking from home might be for older workers in particular circumstances, for example, those with care responsibilities.

Workability and productivity

The implications of technological change for workability (the ability of the worker to carry out particular work tasks) and productivity (the amount and value of the output that can be achieved) constitute another key mechanism of impact on work-related active ageing. The available evidence indicates that productive capacity is not inherently reduced by ageing processes, per se, but rather is affected by the extent to which the workplace accommodates the needs of older workers.

Skills

Overall, only about one-half of the EU15 workforce working with computers has ever received computer training at the workplace; computer users aged 60 and over and those aged under 30 are less likely to have received computer training at the workplace than other age groups. Research indicates that older workers are well able to learn and apply new technologies but are generally slower than younger adults to acquire new skills and require more help and hands-on practice. Most older workers working with computers say that they have sufficient skills to meet the demands of their work; about 10% say that their skills are too low.

Age-friendly design of ICT-based work

The issue of age-friendly design of work, whether ICT-based or otherwise, has received insufficient attention to date, both in research and in practice. Available evidence suggests that ICT-related work can often be good quality work, but this is not always the case; trends such as intensification in terms of a high pace of work and tight deadlines are likely to have negative implications for workability of older workers. Another issue that warrants more attention is the prevalence of repetitive strain injuries amongst those working with ICTs; there is a lack of good quality data on this topic for the European workforce and research is needed on whether the risks and requirements (for ergonomic adjustments) are different for older workers.

Accessibility and usability ICTs

About one-in-five computer users at work in the EU are aged 50 and above. There are significant age-related changes in physical and cognitive function that can affect the accessibility and usability of ICTs for older workers; European and U.S. research suggests that up to 60% of those in the 50-64 years age range may face challenges in this area. Very little attention has so far been given to this issue in Europe, whether by employers (in their purchasing of ICTs) or by the ICT industry (in the design and marketing of ICTs).

Assistive technology

Assistive technologies, ranging from low- to high-tech devices and systems can help both to make ICTs more accessible and to provide supports for workers with physical or cognitive challenges in the wider aspects of their jobs. Available evidence indicates that there are wide variations across Europe in the extent of provision of assistive technologies and this is generally a very underdeveloped area.

Employability

Employability concerns the characteristics of a person that affect their likelihood of getting a job in the labour market and the type of job they get (for those trying to enter the workforce), as well as opportunities to change jobs (for those already in the workforce). Technological change may have implications for employability, for example, through changes in skills and in the cost-productivity ratios of workers of different ages, skill profiles and so on.

ICT skills for general employability

Although ICT skills are increasingly required by employers for a wide range of jobs, there is little direct evidence on how ICT skills (or lack of same) affect the employability of older workers. ICT skill levels are dramatically lower amongst those aged 50-64 who are outside the labour market in comparison to those who are in the workforce; this is likely to increasingly affect employability as ICTs become more and more ubiquitous in the workplace and employment policy encourages substantial return-to-work.

Employability in IT occupations

The IT workforce is younger than that of other occupations comprising workers of comparable educational attainment. U.S. research indicates that older IT workers (aged 40 and over) are more likely to lose their jobs than younger workers whereas the reverse is the case in the rest of the economy.

Use of ICTs to support skill acquisition and for online job search

European research shows that those aged 50-64 are much less likely than other age groups to make use of the Internet for purposeful learning activities. Evidence from the U.S. and the UK suggests that older workers and potential workers are a lot less likely to use the Internet for job seeking than are those in the younger age groups.

Engagement / dis-engagement from the labour market

The results of studies in this field have been somewhat contradictory; overall, it seems that the introduction of ICTs has so far had only a relatively small direct impact on retirement decisions of older workers but that it may play a role in some cases, even if this is not always a determining one. On the other hand, although direct research on the issue is lacking, it is likely that a perception of low employability due to a lack of ICT skills may be a deterrent to return-to-work for at least some of the older (potential) workers outside the labour market.

More generally, there is emerging evidence that job quality can be important in the retention or attraction of older people into the labour market (patterns vary across countries but withdrawal from the labour market of older workers in low quality jobs can be up to four times higher than that of older workers in jobs of higher quality). There has not been much direct empirical research on ICT-related jobs in this regard but it can be expected that where such jobs are of good quality they can support older worker retention.

Informal / unpaid work

If ICTs can help to increase the flexibility of formal working arrangements then it provides positive potential in this area; likewise, if technologies can help in the caring process then they may also provide part of the solution in some cases. On the other hand, if technology results in intensification and extensification of work, then the time and space for care may be diminished. This is an area that has so far received relatively little research attention; aspects that warrant more examination at this point in time include the opportunities and risks posed by teleworking for carers and the possibilities for technology to help working carers to provide care from the workplace (e.g. by remote monitoring of the well-being of the person being cared for).

3.4.2 Main conclusions from the evidence

ICTs are important for work-related active ageing

Overall it can be concluded that although technology on its own may not be a “killer application” as regards the achievement of high employment rates and later exit ages for older workers, exploitation of the age-friendliness potential of technological change will be an important element of the overall set of supports that are needed to achieve European targets

in this area. If technological change in the workplace is suitably shaped and managed to support the needs of older workers and potential workers then it can make an important contribution to the achievement of the EU employment rate targets for older workers, improved quality of work and health and well-being of older workers, and a better balance between paid work and informal work.

Although technology on its own is unlikely to be the decisive factor in most cases, it can be estimated that age-friendly approaches to ICTs could have direct relevance in relation to retention in employment or attraction (back) to employment for up to 10% or more of the 55-64 years age group. Potential impacts of this order warrant commensurate attention in policy.

Equality of opportunity is a key concern

However, equality of opportunity in access to the potential benefits of ICTs, across the active and inactive older working age group, will be a key factor that will influence whether such potential gains are realised in practice. Equality objectives in their own right, including equality amongst older workers (and potential workers) and between older and younger workers, must also be a central focus of European policy in this field. This includes equality in access to good quality (and age appropriate) jobs and in the skills to compete for such jobs on the labour market.

"Market" failure and the need for policy intervention

The development of age-friendly ICTs has a central economic significance for Europe, both for the productivity of the sectors of the economy where older workers use ICTs in their daily work and for the competitiveness of the European ICT industry itself. Accessibility and age-friendliness of ICT products and services will become a competitive factor, driven initially by public procurement developments, and this is something that has already been taken note of by U.S. industry.

Three main groups of "market" stakeholders - employers, other labour market actors and the ICT industry - have key roles to play in addressing these issues. Overall it must be concluded that, in the EU at least, none have so far given sufficient attention of the role of ICTs in work-related active ageing.

Although age management is becoming an increasingly visible theme in human resource circles, so far neither employers, employer organisations nor the other social partners in the EU seem to have given much direct attention to the specific theme of ICTs and work-related active ageing. Part of the explanation for this is a lack of awareness amongst employers of the issues for older workers around ICTs and how these can be addressed; ambivalence of employers towards older workers may also be a significant factor.

Public agencies play a significant role in the labour market in most European countries, providing incentives towards labour market participation, encouragement and support for job-seekers and wider skills-oriented activities. There is little evidence of direct attention to ICTs and work-related active ageing in these contexts as of yet; again, both lack of awareness and a continuing ambivalence towards activation of older (potential) workers are likely to be factors in this.

In the U.S., there is visible attention by the ICT industry to accessibility, driven by public procurement legislation, direct legislative requirements on the telecoms industry and wider anti-discrimination legislation; we have yet to see the emergence of a similar level of visibility of attention to accessibility in the ICT industry's activities in Europe. In neither case has there yet been sufficient attention given to the specific accessibility and usability challenges associated with age-related changes.

3.4.3 Policy and research priorities

In view of the limited stakeholder response to date, there is a need for specific and reinforced policy attention at the EU and Member State levels in this area. Six key issues can be identified as warranting particular attention:

- age-friendly design of the ICTs that are used in the workplace,
- quality and organisation of ICT-related work to suit the needs of older workers,
- ICTs and equality of opportunities in access to age-friendly work,
- exploitation of assistive technologies to support workability of older workers,
- exploitation of ICT-supported opportunities for age-friendly flexibility in work,
- equality of opportunity to acquire and maintain ICT-related skills and competencies.

The main policy and research priorities emerging from the analysis in this chapter are summarised in Exhibit 3-62.

Exhibit 3-62: Policy and research priorities

Theme	Policy priorities	Research priorities
Age-friendly design of the ICTs that are used in the workplace	Examination of how direct responsibilities on the ICT industry could be implemented Strong implementation by the Member States of the accessibility provisions of the EU Public Procurement Directives; with EU driven encouragement of specific attention to age-friendly design of ICTs Strong implementation by the Member States of the Employment Equality Directive; with EU driven encouragement of specific attention to age-friendly ICTs in the workplace (under the age ground and the disability ground)	Increased attention to understanding age-related changes in perception, dexterity and cognition and the implications of this for ICT design Specific targeting of this issue in the RTD Framework Programmes
Quality and organisation of ICT-related work to suit the needs of older workers	Emphasis of this topic in Employment Guidelines and other relevant instruments guiding Member State actions Establishment of the topic as a central element of EU Health and Safety Policy (in the strategy for 2007-2010) Establishment of this as a prominent topic for the EQUAL programme and its successors	Increased research on the nature and organisation of ICT-related work and its implications for older workers Adoption of this topic as a specific theme in the European Foundation's programme of work Specific targeting of this issue in the RTD Framework Programmes
ICTs and equality of opportunities in access to age-friendly work	Within the actions to address mobility and skills, give specific attention to the issue of occupational mobility for older workers and how older workers can have better access to good quality (ICT-related) jobs Establishment of this as a prominent topic for the EQUAL programme and its successors	Socio-economic research on occupational mobility over the lifetime with a specific focus on identifying barriers and facilitators of access for older workers to good quality (ICT-related) jobs

Exhibit 3-63: Policy and research priorities (continued)

Theme	Policy priorities	Research priorities
Exploitation of assistive technologies to support workability of older workers	EU level initiative to encourage more and better attention to assistive technology in support of older workers – benchmarking and exchange of good practice, establishment of common targets	Specific targeting of this issue in the RTD Framework Programmes
Exploitation of ICT-supported opportunities for age-friendly flexibility in work	More attention to the role that ICTs can play in the context of work-life reconciliation and balance (including gender equality aspects) for older workers and carers Encouragement of the social partners to address this topic in the work-life balance arena and within the context of Framework Agreements on teleworking and other related issues Establishment of this as a prominent topic for the EQUAL programme and its successors	Specific targeting of this issue in the RTD Framework Programmes and in socio-economic research more generally, with attention both to the opportunities and the risks
Equality of opportunity to acquire and maintain ICT-related skills and competencies	Emphasis of this topic in Employment Guidelines and other relevant instruments guiding Member State actions Benchmarking (e.g. age profiles of ECDL certification), identification and exchange of good practice, establishment of common targets Establishment of this as a prominent topic for the EQUAL programme and its successors	Specific targeting of this issue in the RTD Framework Programmes and in socio-economic research more generally Learning preferences and needs of older people in relation to ICT skills

4 ICT and independent living

4.1 Introduction

This chapter focuses on the intersection of demographic ageing with the opportunities offered by ICTs to support independent living and care, with a focus on older people who need support in their everyday lives because of functional difficulties associated with the ageing process. Key features of demographic change which are relevant for this area include:

- a substantial increase in the number of older people facing difficulty in coping with daily life due to age related restrictions and health problems,
- an increase in the share of those older people who may not be able to rely upon informal forms of support due to changing family structures,
- looming shortages in the labour supply in the field of health and social care due to a shrinking work force,
- increasing economic pressure on existing health and care systems due to the fiscal and budgetary implications of demographic change,
- rising expectations on the part of citizens in respect of the quality of care.

For the purposes of this chapter we use the umbrella term “independent living domain” to denote the variety of fields of service provision relevant in the context of these processes and changes. These include medical care, municipal (social) care and family care as well as the so-called Assistive Technology (AT) sector.

Scale of care and independent living issues

As shown earlier in this report the overall population is ageing, both in absolute and relative terms. In particular the share of the older old will be steadily increasing across the Union over the coming decade, and in the longer run much sharper increases are predicted for individual Member States (Exhibit 4-1).

This has implications for the independent living domain, because the older old tend to have more needs in relation to medical interventions and personal care when compared with younger age cohorts. The SeniorWatch survey revealed for instance that restrictions relating to personal mobility rise considerably during later stages of life (Exhibit 4-2). Similar results were revealed by the SHARE study according to which both limitations in mobility and other aspects of physical functioning rise steeply at advanced ages. “Among the oldest old, the prevalence of many separate limitations is higher than 30%, sometimes even higher than 50%. This is likely to result in several factors. Among the oldest old, not only have specific health problems a higher incidence and lower recovery rate (…). Also, the oldest old are more likely to have accumulated several specific health problems in the same person, which may reduce their ability to retain functionality despite the presence of disease. Finally, because of non-specific, age-related decline of functional reserve capacity of the body , the same specific health problem will more easily produce functional limitations in the oldest old.” (MACKENBACH et al. 2005: 86)

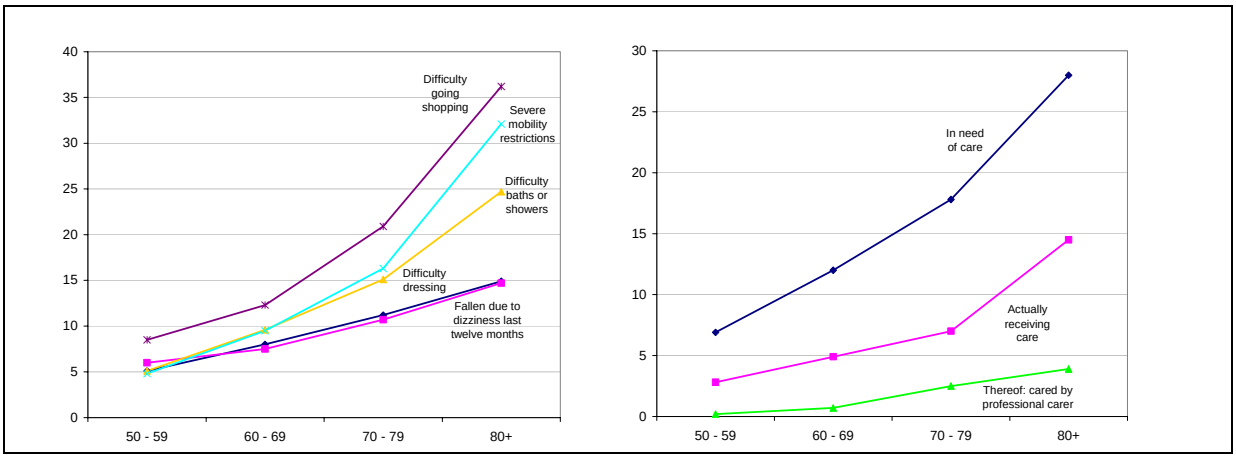
Exhibit 4-1: Projected share of the 80+ population in the overall population in the EU Member States (in %)

	2000	2005	2010	2020	2050
be	3.57	4.28	4.98	5.95	11.26
cz	2.37	3.01	3.54	3.96	8.69
dk	3.96	4.06	4.07	4.49	8.65
de	3.66	4.29	5.05	7.05	13.62
ee	2.63	3.09	3.90	4.99	7.96
gr	3.10	3.39	4.42	6.00	10.41
es	3.82	4.29	4.97	6.03	12.84
fr	3.76	4.53	5.29	6.16	11.33
ie	2.54	2.68	2.81	3.26	8.08
it	4.04	4.95	5.82	7.36	14.14
cy	2.59	2.66	2.88	3.78	8.23
lv	2.56	3.04	3.91	5.16	8.32
lt	2.36	2.97	3.81	4.96	9.21
lu	3.04	3.22	3.85	4.42	8.37
hu	2.63	3.35	3.90	4.68	8.46
mt	2.40	2.84	3.18	4.14	7.53
nl	3.21	3.49	3.68	4.13	8.28
at	3.48	4.25	4.79	5.46	12.64
pl	1.97	2.52	3.25	4.21	8.83
pt	3.34	3.79	4.35	5.59	10.66
si	2.31	3.00	3.84	5.10	10.55
sk	1.85	2.36	2.73	3.10	7.97
fi	3.37	3.85	4.45	5.37	10.29
se	5.02	5.32	5.25	5.32	8.90
uk		4.40	4.59	5.15	10.22

Source: Own presentation of data available from EUROSTAT demographic projections 2005

As suggested by data available from the SeniorWatch survey (Exhibit 4-2), such conditions tend to go along with greater need for help with personal tasks during the later stages of life. As also becomes apparent from these data, a considerable share of persons reporting such difficulties (in relation to personal hygiene, seriously restricted mobility and shopping) do not seem to receive any personal care, neither through formal care services nor through informal support networks. Similarly, the more recent SHARE study found that ".. many respondents also indicate that they do not receive adequate help with these activities." (MACKENBACH et al. 2005: 83). Together, the various processes of the demographic change outlined above bear the risks that this "care gap" may widen by the time. Counteracting these developments is one of the core issues when it comes to harnessing the potentials generally provided by technological innovation in relation to the demographic change.

Exhibit 4-2: Share of the EU 15 50+ population living at home who report difficulties in coping with activities of daily living (in %)



Source: SENIORWATCH 2002a: 123 and SENIORWATCH 2002c: 18

Clearly, the core burden of care giving is currently taken by informal carers, and the biggest group of those constitute family members. Between the ages of 50 and 65, " …individuals face a particular busy time as far as family support is concerned … " (KOHLI et. al. 2005 : 175). During that life period they tend to be involved in personal care mainly with their parents, and thereafter with their spouse. (ATTIAS-DONFUT et al. 2005a). The SENIORWATCH study (2002a) found that in 2001 some 16% of the 50+population in the EU-15 countries were providing informal care. Results from the SHARE study suggest that " … while rates of giving general forms of help and personal care to a parent decrease significantly with age, levels of giving personal care remain constant with age." (ATTIAS-DONFUT et al. 2005a: 175). Against this background, policies directed towards the care and independent living domain need to take account of the fact that older adults both receive and give care.

On the macro economic level, above-average increases of health system costs (as a percentage of GNP) have been an issue in most developed countries in recent decades, quite independent of the national health care system and its financial basis (taxes/government budget, private or public insurance, private payments), and it can be expected that the pressure to constrain these costs will continue. Three major factors driving health care costs have been identified (SENIORWATCH 2002b: 13):

- changes in real benefits,
- changes in relative prices (price of medical care relative to other goods),
- demographic change.

Up to now, evidence indicates that changes in real benefits (better services, enlarged supply account for 50% or more of the increase in health care costs, whereas demographic change has to date played a lesser role. (CAVE and PANIS 1996: II-37). However, forecasts suggest that that changes in the age distribution as measured by dependency ratios will in future indeed affect health systems' burden of cost, and, via the dramatically decreasing relative proportion of the population earning an income and paying taxes/social security contributions, may impact strongly on system income. In addition, it is expected that the extraordinary growth of the proportion of people aged 80 and over will significantly contribute to the growth of the demand for other social services. In particular, the expected sharp increase in the absolute number of disabled people will push up spending on publicly-financed long term care as a proportion of national GDP. ENGLAND (2001: 73) estimates a 102% increase in spending between 2000 and 2020 for Japan and an increase in the proportion from 0.75% to 1.54%; Canada is estimated to see a 48% increase in long-term care spending, from 0.5% to 0.81% of GDP; in the U.S. long-term care spending is supposed

to rise 21%, from 0.68% to 0.82% of GDP; in Germany, it is expected to rise 38%, from 0.71% to 1.02% of GDP; in France, it may rise 51%, from 0.60% to 0.98% of GDP.

Considering that - on the one hand - population ageing may have a negative effect on economic growth, and - on the other hand - that at least a considerable part of the remaining growth may have to be devoted to financing pension, health and social security programmes, the social explosiveness of these developments should be obvious.

Conceptual approach

The following figure (Exhibit 4-3) shows a framework for analysing the role of ICT in coping with the described impacts of demographic change. The analytic approach centres on key ICT application fields that hold the potential to benefit older people who are in need of care, or whose independence is otherwise threatened through ill health or physical/mental restrictions going along with the human ageing process. For the purposes of this study, these are subsumed under the term Independent Living Technology (ILT) domain.

Current practice in terms of actual availability of ICT based products and services in the ILT domain is influenced by specific market structures prevailing/emerging in each sub-domain, and by various factors facilitating/constraining up-take as well. More generally two key meta trends, namely the demographic change and progress in research and technology development (RTD), over time impact on the ILT domain as a whole. On the one hand, demographic developments influence the potential demand for ILT products and services. On the one hand, progress in RTD impacts on the domain through changing/emerging applications that can be taken up by markets and in service provision.

Only after uptake do ICT-based products and services have a real impact on individuals, families, care provision markets and society as a whole. These impacts can pose both risks and opportunities in relation to the policy challenges emerging from the demographic change as described in the previous section. The analysis therefore centres particularly on the take-up of ICT product and service offerings in the sub-domains, and on identifying options for policy interventions directed towards minimising the risks and maximising the opportunities that go along with wider take-up.

The four sub-domains identified as relevant to the overall ILT domain include remote social and medical care, smart homes, assistive technology (AT) and forms of ambient intelligence. These are briefly described in the following.

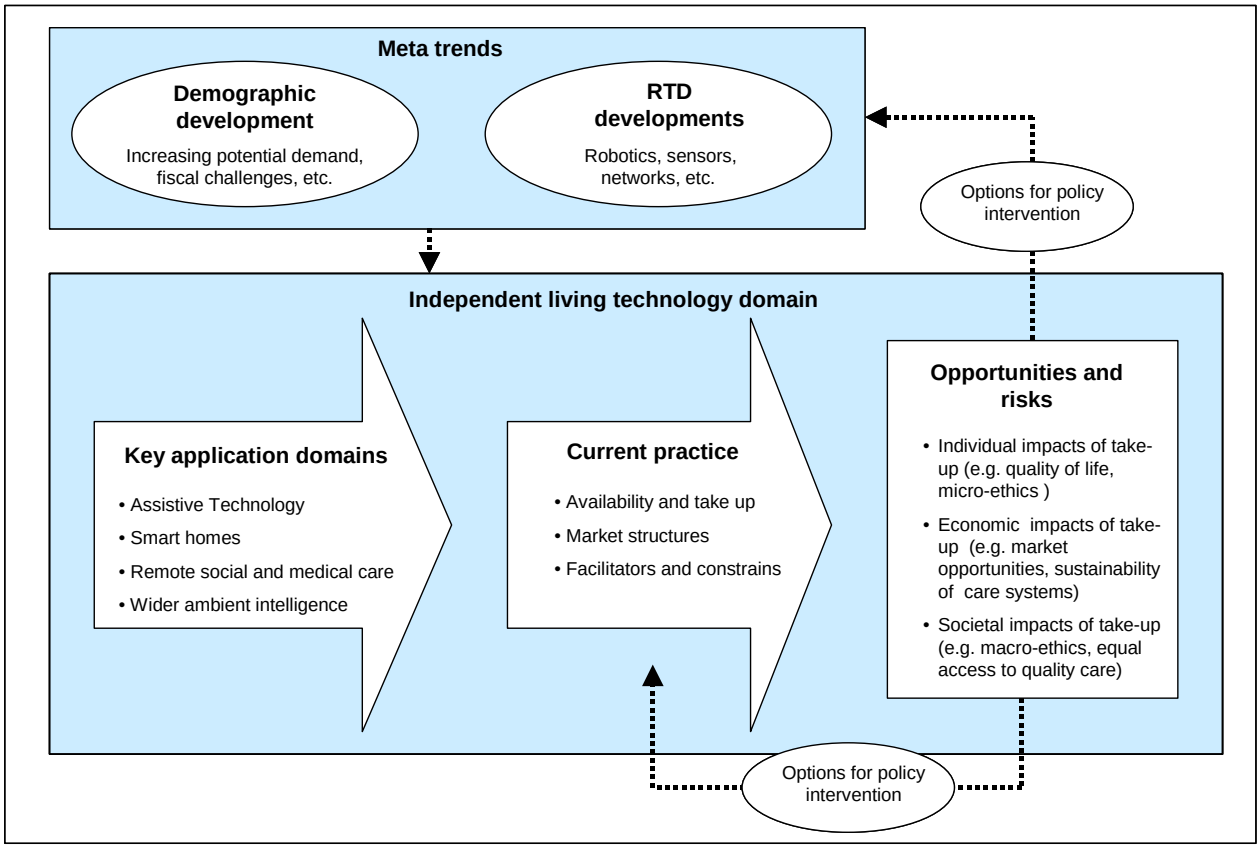
Remote social and medical care

This sub-domain encompasses solutions that allow some medical services to be provided to the home. Communication with a care centre can cover a number of media including voice and the transmission of biomedical data. Another component, linked to smart home technology, is dwelling based monitoring. Recent developments focus on extensive multi media based medical services, e.g. in the field of rehabilitation. This category also includes solutions enabling formal/informal social care provision. Also, social alarms enabling support to be provided through a service centre are included in this category.

Assistive technology (AT) devices

This sub-domain encompasses devices able to compensate in some way for motor, sensory or cognitive difficulties. This is a key contribution to enabling older people to live independently, at home and elsewhere, and in this way, for instance, to be able to remain in their familiar home environment rather than become dependent on institutional care.

Exhibit 4-3: Analytical framework for investigating the potential impacts of ICT on the independent living domain



Source: the authors

Smart homes

For the purposes of this study, smart homes are networked dwellings responding to specific needs threatening the independence of older people. Such homes provide a number of facilities ranging from simply detection and action - turning lights off or on, locking doors and providing alarms e.g. on detection of smoke - up to fully automated electrical systems and networking components within the home environment.

Wider ambient intelligence (AMI)

The term “ambient intelligence” is used to denote a new research and technology development paradigm prompted by the continuing miniaturisation of many key ICT components. A similar concept is that of “ubiquitous computing”. The vision behind these concepts includes the creation of a living environment where humans interact in a natural and non-invasive manner with computational services that help them in their everyday tasks. In addition, the realisation of ambient intelligence is expected to produce intelligent public facilities - service terminals, information kiosks and transport systems - which adapt flexibly to the specific communicational, functional and cognitive needs that tend to come with human ageing. Ambient intelligence is not yet a recognised field in the market for independent living and care services; it draws on a number of established areas of ICT, such as pervasive communications, multimodal user interfaces, artificial vision and domotics. For the purpose of this study, AMI is of importance because the independent living solutions it can be expected to deliver address the wider living environment and in this way go beyond smart home technology and telecare.

The table below (Exhibit 4-4) provides an exemplary – and necessarily selective – overview of specific ICT applications relevant in relation to the independent living theme, oriented to the four sub-domains outlined above.

Exhibit 4-4: Examples of ICT applications in the care and independent living domain

Sub-domain	Selected examples of ICT applications
Standalone AT	Communication aids/software
	Devices for locating lost things for people with cognitive restrictions (e.g. keys)
	Devices for remembering things (e.g. taking pills) and carrying out tasks
	Personal mobile robotic assistants
Smart homes	Integrating standalone AT applications described above
	Passive alarm systems
	"Intelligent" household appliances (dish washer, washing machine, freezer etc.)
	Sensors to open/close doors and windows, turn on/off lights
	Monitoring systems to prevent wandering
Remote social and medical care	Remote consultation with formal/informal care staff (e.g. reassurance services)
	Remote medical services (e.g. tele-rehabilitation, diagnosis, SMS service for diabetes management)
	Active alarm services (e.g. through mobile phone, wrist alarm)
	Care planning applications (videoconfercing, "virtual team" bringing together home-care etc.)
	Monitoring of patient's health status from a remote site (e.g. wearable health monitoring systems for people with cardiac problems or diabetes)
Wider ambient intelligence	Navigation and orientation support (e.g. a mobile device with GPS function, including possibility to call a call centre)
	Use of sensors in public buildings to assist people with handicaps
	Public transport information systems taking into account the needs of older and frail people

Source: The authors

4.2 Meta trends

The analytical framework presented above identified two meta trends that are supposed to drive developments in the ILT domain, namely the demographic development and continues progress in research and technology development (RTD). In the following section 4.2.1, it is therefore assessed at what level of magnitude demand is likely to be driven by the demographic change. The subsequent 4.2.2, outlines RTD trends that are likely to influence the ILT domain.

4.2.1 The potential demand for independent living solutions

As shown elsewhere in this report, population ageing will result in increasing demand for medical interventions and care. The market dynamics of demand and supply are however quite complex and seem to be determined not at least by structural peculiarities of national

health care systems, and care provision schemes as well. For instance, there is a close correlation between the structure of the health care system, the organisation of the services provided and the ability of the citizen to approach health care providers. Structural aspects of health care supply would thus seem to determine actual demand, at least in part (COUNCIL FOR PUBLIC HEALTH AND HEALTH CARE 2004). As the care and independent living domain – in particular health care systems – are currently undergoing significant changes in many countries, exact predictions about future demand are difficult to make. Also, medical progress may help to abate particular symptoms and manifestations of age-related restrictions and thus lower the need for medical intervention or care provision.

Nevertheless, extrapolation of current demand potential for care and independent living solutions according to demographic projections provides a useful indication about the level of magnitude at which population ageing is likely to drive demand over the time. Therefore, a quantitative estimate of demand likely to emerge over time – with the caveats mentioned above - is provided below. The estimate reported here refers to "potential" demand rather than actual demand. This is because the independent living domain is still an emerging one. It is currently not possible to assess actual levels of demand for most of the applications that have been enclosed in our analysis because these are hardly available on the market yet. Many exist only in experimental settings and levels of awareness what is possible tends to be low among potential target groups. The demand potential for individual sub-domains therefore refer to the number of people for which the individual sub-domains are judged to be especially beneficial due to specific needs they have.

For the purposes of assessing potential demand, telecare and telemedicine applications are assumed to be of particular interest for older adults in need of regularly being in contact with external care providers and/ore medical staff. Further, they are judged as being relevant for persons who are at risk of facing an emergency situation due to certain conditions they may have, or who at least fear such a situation. Not at least, they are of interest for older adults who have care responsibilities themselves while having other commitments, e.g., in the family or due to their occupation. Smart homes and assistive technology devices are assumed being of relevance for older persons who experience difficulties in coping with daily living due to restricted cognitive or physical functions. These restrictions may stem from an age-related loss/reduction of functionalities, long standing illness/disability or acute health condition such as a stroke. Wider ambient intelligence applications are assumed to be of particular interest for older persons who are restricted in using facilities that are common in the wider environment.

Despite limitations in the availability of demographic data for these population segments it is possible to put at least some boundaries on likely demand and to put some estimates for the absolute levels of demand for the independent living domain. Potential beneficiary groupings for which demographic data are available include:

- older people already using an alarm service. For the purpose of demand assessment we assume that the penetration level observed in the most matured market of alarm service, i.e. in the UK market, reasonably reflects potential demand in other countries;
- older people who suffer from chronic diseases or other forms of long standing illness requiring regular monitoring and/or interactions with medical staff. For the purposes of demand assessment we assume that not all persons affected would benefit from independent living/care solutions. Expert estimation suggest a higher probability for older age cohorts to potentially benefit from such solutions mainly for two reasons. Typically, the severity of manifestation of experienced diseases increases with growing age, as outlined earlier in this chapter. Further, the older a person gets the higher is the probability to live alone, and capabilities potentially provided by ICT systems and devices may help to substitute family support. The estimated demand potential presented here therefore relies on the assumptions that 25% of those concerned in the age range between 50 and 80 years would benefit from

care/independent living solutions while in the age group of the 80+ this would be the case for 60%;

- older people with personal care responsibilities who are in employment. For the purposes of demand assessment we assume that all of these would potentially benefit from telecare/telemedicine applications through a reduction of their care burden;
- older people having difficulties with activities of daily living such as dressing, hygiene and moving around. For the purposes of demand assessment we assume that all of these people can potentially benefit from independent living solutions;
- older people who are severely restricted in using common technology in the wider environment. For the purposes of demand assessment we assume that all of these people can potentially benefit from independent living solutions.

The estimated figures given in Exhibit 4-5 to Exhibit 4-7 indicate a potential demand in a two digit million range for every sub-domain. It needs however to be considered that the figures given for individual groups can not simply be aggregated in order to arrive at an estimated overall demand for a particular sub-domain. This is because the prevalence given for the individual beneficiary groupings are not necessarily independent and mutually distinct. This problem is unavoidable in view of the rather coarse grained data base available in relation to potential beneficiary groups. Nevertheless, the estimate suggests a significant demand potential today among the 50+ population that seems to slightly increasing over the coming decade. In the longer run, the potential demand can however be expected to increase considerably. In the light of the hitherto presented analysis, it will not come as a surprise that the increase is however much steeper when only considering the oldest old. For instance, while in the age range between 50 and 79 years the number of people having difficulties to move around is estimated to increase from 12.1 Mio to 15.9 Mio, i.e. by 31%, between 2005 and 2050 the increase in the 80+ age segment will amount to 154% during the same period, i.e. from 5.7 Mio to 14.5 Mio.

Exhibit 4-5: Estimated market potential for remote social and medical care applications among the 50+ population in the EU25

Indicator for potantial demand		Extrapolation of absolute no of potential beneficiaries in the EU25 (in Mio)			
		2005	2010	2020	2050
Proportion of 50+ population using community alarms in most mature EU market (UK) according to SeniorWatch		21.3	22.9	26.3	29.2
25% / 60% of those 50+ having joint/bone/muscle disease according to SeniorWatch	50-59 years (25%)	2.8	3.0	3.2	2.6
	60-69 years (25%)	3.1	3.4	3.9	3.9
	70-79 years (25%)	2.7	2.8	3.2	4.1
	80+ years (60%)	4.0	4.6	5.8	10.8
25% / 60% of those 50+ having dementia according to Eurodem	50-59 years (25%)	-	-	-	-
	60-69 years (25%)	0.1	0.1	0.2	0.1
	70-79 years (25%)	0.4	0.5	0.5	0.7
	80+ years (60%)	2.8	3.3	4.1	7.7
25% / 60% of those 50+ having chronic respiratory disease according to SeniorWatch	50-59 years (25%)	0.8	0.8	0.9	0.7
	60-69 years (25%)	1.0	1.1	1.3	1.3
	70-79 years (25%)	1.0	1.1	1.2	1.6
	80+ years (60%)	1.3	1.5	1.9	3.5
25% / 60% of those 50+ in treatment for diabetes according to SeniorWatch	50-59 years (25%)	1.0	1.1	1.2	0.9
	60-69 years (25%)	1.1	1.2	1.4	1.4
	70-79 years (25%)	1.1	1.1	1.3	1.7
	80+ years (60%)	1.1	1.3	1.7	3.1
25% / 60% of those in treatment for heart disease according to SeniorWatch	50-59 years (25%)	1.1	1.1	1.3	1.0
	60-69 years (25%)	1.7	1.8	2.1	2.1
	70-79 years (25%)	2.4	2.5	2.9	3.7
	80+ years (60%)	4.0	4.7	5.9	11.0

Source: Own calculation based on Eurostat demographic projection (medium variant)[26] and data available from SENIORWATCH[27] and EURODEM[28]

[26] URL:http://epp.eurostat.cec.eu.int/portal/page?_pageid=0,1136184,0_45572595&_dad=portal&_schema=PORTAL (accessed August 2005)

[27] SENIORWATCH 2002a

[28] HOFMAN et al. 1991

Exhibit 4-6: Estimated market potential for Smart Home / AT for cognitive or physical functions applications among the 50+ population in the EU 25

Indicator of potential demand		Extrapolation of the absolute no. of potential beneficiaries in the EU25 (in Mio)			
		2005	2010	2020	2050
Proportion of 50+ population having difficulties shopping according to SeniorWatch	50-59 years				
	60-69 years	5.7	6.1	7.1	7.1
	70-79 years	7.4	7.7	8.8	11.4
	80+ years	6.8	7.9	9.9	18.5
Proportion of 50+ population having difficulties to take bath or shower according to SeniorWatch	50-59 years	3.0	3.2	3.5	2.8
	60-69 years	4.5	4.8	5.6	5.5
	70-79 years	2.8	3.3	4.1	7.7
	80+ years	4.7	5.4	6.8	12.6
Proportion of 50+ population having difficulties getting dressed according to SeniorWatch	50-59 years	3.0	3.2	3.5	2.8
	60-69 years	3.7	4.0	4.7	4.6
	70-79 years	3.9	4.1	4.7	6.1
	80+ years	2.8	3.3	4.1	7.6
Proportion of 50+ population finding it very difficult to move around according to SeniorWatch	50-59 years	2.6	2.8	3.1	2.5
	60-69 years	4.2	4.5	5.3	5.2
	70-79 years	5.3	5.6	6.4	8.2
	80+ years	5.7	6.6	8.2	14.5

Source: Own calculation based on Eurostat demographic projection (medium variant)[29] and data available from SENIORWATCH[30] and EURODEM[31]

[29] URL:http://epp.eurostat.cec.eu.int/portal/page?_pageid=0,1136184,0_45572595&_dad=portal&_schema=PORTAL (accessed August 2005)

[30] SENIORWATCH 2002a

[31] HOFMAN et al. 1991

Exhibit 4-7: Estimated market potential for wider ambient intelligence applications among the 50+ population in the EU25

Indicator of potential market size		Extrapolation of absolute no. of potential beneficiaries in the EU25 (in Mio)			
		2005	2010	2020	2050
Proportion of 50+ population severely visually restricted in reading small print	50-59 years	5.9	6.2	6.8	5.5
	60-69 years	4.6	4.9	5.8	5.7
	70-79 years	4.8	5.0	5.8	7.5
	80+ years	4.2	4.9	6.1	11.4
Proportion of 50+ population severely restricted in using smart card when tried	50-59 years	0.9	1.0	1.1	0.9
	60-69 years	1.3	1.4	1.7	1.7
	70-79 years	1.3	1.4	1.6	2.0
	80+ years	1.4	1.7	2.1	3.9
Proportion of 50+ population severely restricted in using touch screen when tried	50-59 years	2.0	2.1	2.3	1.9
	60-69 years	3.2	3.4	4.0	4.0
	70-79 years	2.6	2.8	3.2	4.1
	80+ years	1.7	1.9	2.4	4.5

Source: Own calculation based on Eurostat demographic projection (medium variant)[32] and data available from SENIORWATCH[33] and EURODEM[34]

4.2.2 Progress in research and technology development

The ILT domain, as defined for the purposes of this study, comprises a heterogeneous filed of technology applications ranging from quite simple devices such as intelligent medication dispensers to complex systems such as networked homes and interactive services. However, only a comparatively small range of applications have fully matured. There are limited mainly to the Assistive Technology domain and to community alarms, which are by now widely available in many countries.

Many technology applications of great promise are still at an experimental stage, and can be expected to strongly benefit from developments in mainstream technology. Given the extent of the field and the frenetic pace of developments, a comprehensive and in-depth assessment of relevant RTD would go far beyond the scope of this study. In the following, current research topics in some key areas of development with strong relevance for the independent living domain are sketched, centring mainly on robotics and sensor research.

Many industrial processes now use robots, which are however usually fixed in location or bound to tracks or wires. With few exceptions, such fixed-location robots are not expected to of great value in domestic or care provision environments. The promise of robotics research resides in independently mobile "service" robots that navigate their way in the environment,

[32] URL:http://epp.eurostat.cec.eu.int/portal/page?_pageid=0,1136184,0_45572595&_dad=portal&_schema=PORTAL (accessed August 2005)

[33] SENIORWATCH 2002a

[34] HOFMAN et al. 1991

transport and manipulate objects and even interact with people as much as a personal assistant, nurse or doctor would.

Basic navigation functionality required for the typical service robot is now nearing maturity. Such navigation - based on sensors, switches and in some cases image recognition - is now allowing a range of prototype service robots to emerge. Early prototypes are targeted at the more mundane jobs in home and hospital settings, e.g. cleaning, or transport: carrying objects from drugs to food. Products under development in this class include wheelchairs that can sense obstacles and avoid them, and potentially move around under remote control. There is already strong industrial interest in the field. A project by Intel is experimenting with a mobile robot to provide elderly people who may be confused with assistance in daily living. Reminders can be provided to clients to eat, drink, take medicine, or use the bathroom. The service robot can guide a person from room to room, and pass the time by "chatting" about the weather or a TV soap. “Pearl” the “Nursebot” is a prototype mobile robot that is able to recognize speech, follow a person around in the home environment, detect motion patterns and remind an older person to take medication (CEC 2004c, EKBERG et al. 2001, KOUROUPETROGLOU and NÉMETH 1995).

As well as carrying or integrating household implements such as vacuum cleaners or window wipers, robot platforms can be used to carry communications devices and so improve the link to a remote professional care provider. A mobile device or robot carrying terminals providing Internet access - medium bandwidth text & graphics - can already be used to provide basic contact with caregivers using on-screen interaction. The addition of voice and video channels greatly improves the communication capability and the impression of real presence and responsiveness. A prototype product enabling remote "video visits" to the bedside by busy doctors has recently begun tests in the U.S. and at a UK hospital.

Not all service robots in care settings require navigation capability. A rehabilitation robot has been available in Japan since 2000 which is fixed in location, typically by the bedside, and assists the physical therapy of patients recovering from strokes or artificial knee replacement surgery by helping them move their legs with a mechanical arm.

With navigation based on sensors and switches and simple wheel-based propulsion mechanisms, devices with adequate reliability will remain limited in the environments they can be deployed in. Typically the limitation is to living or office spaces with no stairs, level flooring and consisting of bounded spaces free of niches or dead-ends - including those caused by furniture or temporarily located trolleys or other objects. Navigation based on image recognition and more sophisticated software promises to improve the range of environments in which service robots can operate. Improved image recognition is also expanding the range of tasks which can be carried out, even by stationary devices. A recently developed surgical assistant named "Penelope" uses image recognition to distinguish between surgical tools. Penelope is targeted to substitute for the role of a nurse in the operating theatre, handing the surgeon the correct instrument on request.

A key component of a robot of any kind is the actuator, the component which exerts force and produces movement. Such actuators may be employed in devices which do not conform to the classic idea of a robot but are very relevant to improving independent living and care services. For example, a robotic suit has been designed at the University of Tsukuba to make it easier for elderly people with weak muscles and/or suffering from obesity to move around or for care-givers to lift them. The suit straps onto a person's arms, legs and back and is equipped with a computer and motors. Sensors detect the nerve signals transmitted by the brain when the wearer tries to move a limb, enabling the computer to drive the relevant motors and assist completion of the intended movement.

There are common research topics linking robotics - design of physical artefacts capable of transportation and manipulation - and the design of purely virtual agents, consisting of software only. Software agents can act to use information processing and communicate with

other agents and human users. Their communication with users can mimic human interaction by the use of screen-based avatars, voice production and speech recognition, and these same communication techniques are used in some cases to provide smooth interaction with physical robots.

Though robots use simple and complex sensors, there are multiple applications of sensors outside robotics. They are also key components of smart homes and contribute to the realisation of ambient intelligence. Strong advances are currently being made in sensor research by taking advantage of miniaturisation of all components. There are today sensors to measure a range of real-world variables like pressure, temperature, humidity, heat, flow, force, acceleration, position, torque or strain. This information can be integrated in a sensor to generate more complex information such as vibration or shock; two-dimensional images can be captured; information can be sent on demand, regularly or continuously. One problem with applications of sensors in many settings to date is the need to provide wiring to obtain information from the sensor. This is the background to current strong interest in wireless sensors.

A wireless sensor module consists of some combination of sensor, controller, transceiver, battery, and antenna. Cell phones with microphone and camera can be seen as first generation wireless sensors, however, the focus of interest today is on much smaller scales. Research into micro wireless sensors is ongoing across the world. Terms such as "ambient", “invisible”, "smart dust" and "motes" are used to describe related visions, such as that of tiny, self-contained, battery-powered computers with radio links that enable self-organisation into networks and the exchange of data with one another. Intel is seeking to create as "motes" a new platform with a high level of integration, low-power operation and very small physical size, to be provided at low-cost using modular design and high volume production. Crossbow Technology has recently developed "smart dust" sensors that can detect light or vibration, and include computer chip, battery, and radio to pass information to each other and send the information back to a main computer. For micro wireless, research challenges include cost-effective designs of sensor nodes, minimisation of power consumption and heat dissipation, modulation and demodulation schemes, transmission ranges, integrating RF transmissions on silicon, and communications protocols.

As distributed sensor devices, and mobile robots, are given more and more sophisticated communication abilities, wired and wireless networks for carrying the signals in specialist and home environments grow in importance. It is well understood that using separate networks to provide each function is not usually a cost-effective approach, therefore networks and platforms capable of integrating audiovisual streams for information and entertainment have now become topics for research.

Integration of in-home communication and automation with entertainment provided in standard formats such as MPEG 4through Digital Video Broadcasting and Multi-media Home Platform (MHP) is another research field of particular relevance here. A new topic is providing interactive real-time video over wireless networks in the home, e.g. using the IEEE.802.11b,g series of standards. Complementary issues are techniques of distribution of video streams to the home, including provision of video streams and/or video on demand using the Internet infrastructure. Topics include not just network transport but also new displays e.g. based on image projection or providing high definition, image projection at home, sophisticated set-top boxes which can become home communication and control centres - a smart home topic. Residential Gateways provide and manage a communication channel into and out of the home. Standards such as the Open Standards Gateway Initiative (OSGi) focus on providing remote access to home automation.

Use of sophisticated communications in care settings raises issues of security, and here there is still work ongoing on how to - useably - secure information flows on wired and wireless networks. The leading technologies - asymmetric keys and public key infrastructure - are not new in principle but have proved difficult to deploy in practice.

4.3 Current practice

This section presents an analysis of what we know about current policy and practice in relation to each of the sub-domains of the overall ILT domain distinguished at the beginning of this chapter.

4.3.1 Stand alone Assistive Technology

As defined for the purposes of this study, the assistive technology domain covers a wide range of products designed to compensate for motor, sensory and cognitive difficulties frequently experienced by older adults. More generally, assistive devices can be defined as products, instruments, equipment or technical systems that are especially produced (sometimes as customised mainstream products) or generally available to prevent, compensate, relieve or neutralise the disability or impairment and therefore to improve the capabilities of disabled people and help them to live independently. The following subsections present an analysis of current trends in the diffusion of this technology and how these interact with population ageing.

Availability and take up

During the last decade, the nature and variety of assistive technologies has considerably changed, mainly due to accelerating developments in mainstream technologies. Since the early 1990s, many ICT-based assistive technology products have become available including speech synthesizers, Bliss communication devices, text telephones, Braille lines and communicators. Speech technology - including speech recognition, speech synthesis, speech coding and speech analysis - has been increasingly deployed in AT applications. Speech synthesis is used in aids for reading, writing, programming and general voice output communication, and speech recognition in aids for writing and programming and for controlling devices in the user's environment. Portable devices have been developed with the capability to detect lost objects like a key and in this way to support people with light to moderate (but not severe) memory loss. In the longer run, more powerful devices can be expected to become available, including robots designed to support dependent people in carrying out a variety of tasks without any human support.

Today, assistive technology is becoming available to an increasing number of people, and the range of available products and devices is steadily increasing. More than 20 000 assistive technology products[35] are currently available on the European market. However, usage in European populations is not as high as one might expect. The situation in Europe is apparently even worse than in the U.S., where research indicates that uptake of assistive technology among the population is below 5%. The EU situation is that much the worse because uptake of assistive technology is very unevenly spread across Member States (BÜHLER 2000; LITTLER and ROURKE 2003; FORRESTER RESEARCH/ MICROSOFT CORPORATION 2004). Market data is not yet available to quantify actual usage levels of assistive technology devices in the European Union. Existing statistics are based on national taxonomies which often blur distinctions and render aggregation and comparison impossible. Data available for France suggest that 3% of total population are using mobility aids while 1,5% use communication aids (INSEE, Etude HID 2000).

Given the growing offer and increasing functionality of AT on the market, usage of ICT–based assistive technology can be expected to increase in future. On the one hand, there are predictions that devices will increasingly be purchased outside existing assistive technology provision schemes, i.e. out of pocket and over the counter. On the other hand, market as well

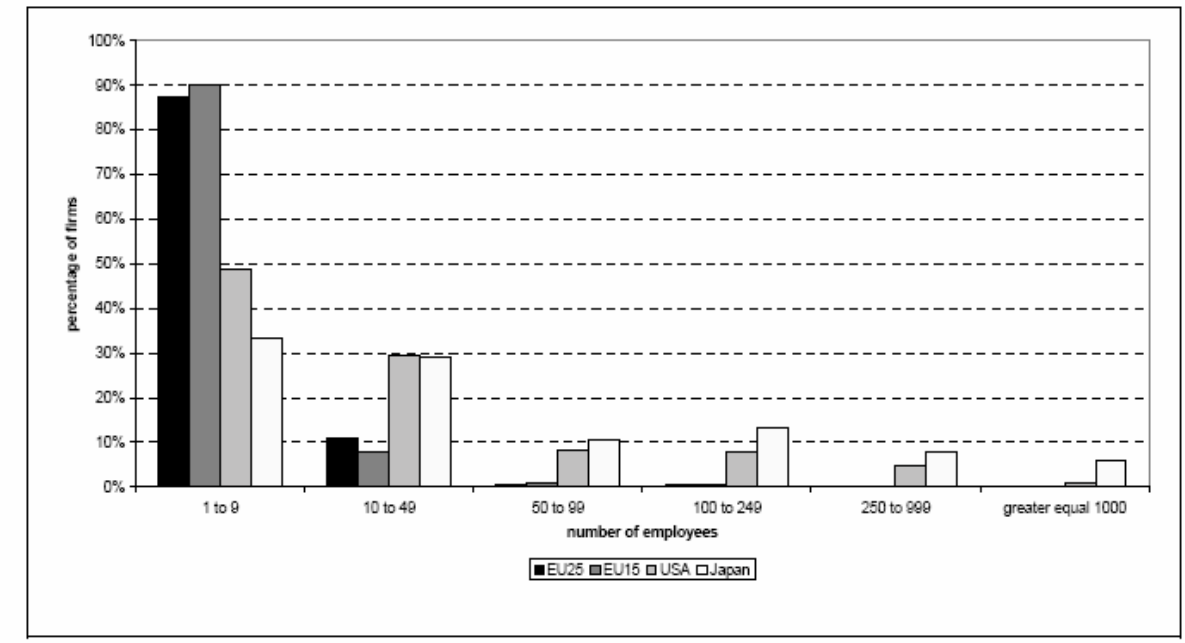
[35] A comprehensive overview on several assistive devices can be assessed at http://www.abilityhub.com

as regulatory developments may lead to a situation were assistive components are increasingly incorporated into mainstream products such as PCs, TV sets or mobile devices (PRICE PARTNERSHIP and IRV 2000; LINDSTRÖM 1999; DEWSBERRY et al. 2002; GILL 2004, http://www.futurhealth.rochester.edu; http://www-2. cs.cmu.edu/ ~pearl/ images4.html accessed August 2005). This is described on more detail in the following section sections.

Market structures

The European assistive technology market in the European Union is dominated by a large number of small and even very small enterprises. More than 80% of the enterprises in the whole medical device industry of the EU25 are small - less than 100 employees. The value chain is such that these enterprises either produce their own products or import products for further processing, particularly from the U.S. (Exhibit 4-8). Manufacturers and distributors rarely address the European market as a whole, but predominantly address local, regional or national markets and tend to be specialized in a particular niche or sub-sector (PRICE PARTNERSHIP and IRV 2000; CEC 2003b).

Exhibit 4-8: Size distribution of the firm in the medical device industry, EU (2001), U.S. and Japan (2002)



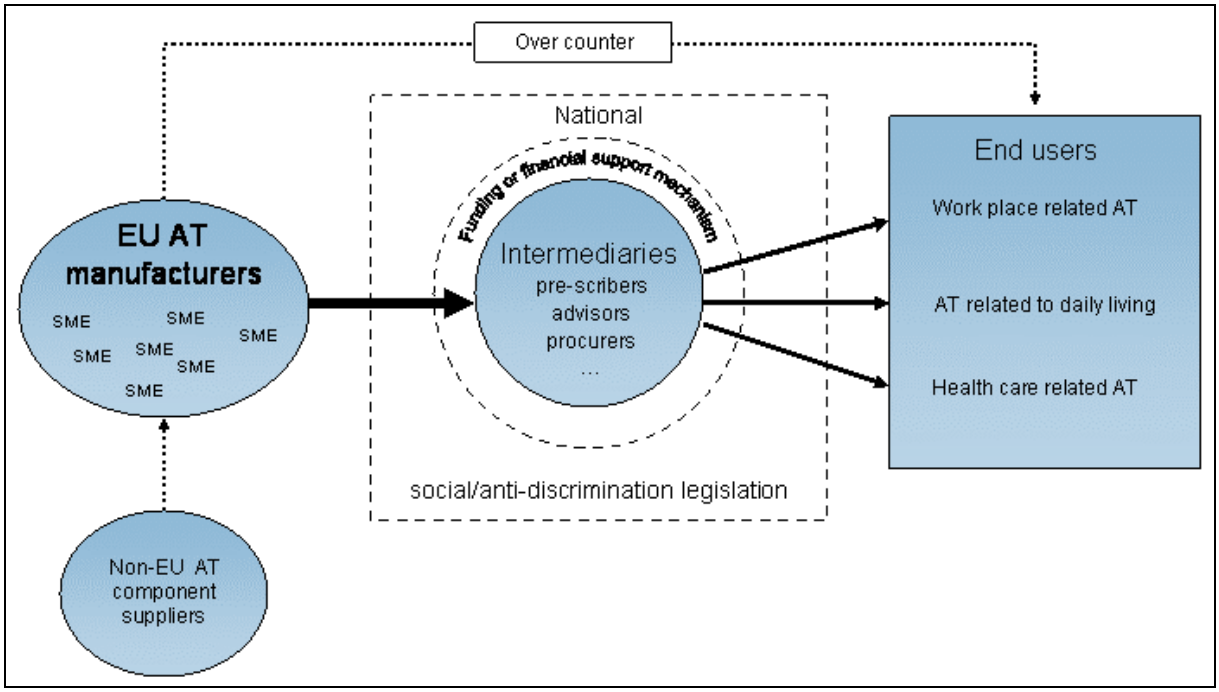
source: PAMMOLI et al 2005: 107

In most European countries, delivery-to-use of assistive technology is embedded into two different service provision systems, the health care system on the one hand and social services on the other. From a legal and regulatory perspective, these delivery schemes are embedded in general social legislation/regulation or anti-discrimination legislation/regulation which have their own history and continue to evolve. This has made European provision schemes even within a Member State diverse and difficult for users to understand. "Sometimes the same assistive device can be obtained through different systems with different potential for choice or levels of financing. For example, delivery of an electronic wheelchair for use at the work place and one for private use after an accident might follow entirely different paths (e.g. in assessment, financing and follow-up), even if ultimately the wheelchair is strictly identical in both cases" (CEC 2003b: 163).

Also, assistive technology provision processes vary considerably across countries, ranging from very centralised and rigorous systems to poorly coordinated delivery processes. However, all national markets have in common that they are not mainly driven by a direct relation between the consumer and the supplier. This is graphically represented by Exhibit 4-9. A range of intermediaries such as prescribes, advisors, medical experts and procurers are typically involved in the delivery process. These decide on the purchase of a particular item on the basis of established assessment mechanisms, or at least strongly influence this decision through the provision of financial support to the end user.

Funding often depends on whether or not specific eligibility criteria are met in a certain case. In most countries, product listings and classifications of certain disabilities and the context of use (e.g. occupational, educational, daily living) are applied. When it comes to the amount of financial support generally available to the end user, large differences can be observed across the European Union, ranging from relatively low levels of cost reimbursement, e.g. in Spain, to entire funding of certain products, e.g. in the Netherlands or Germany - when the end user complies with certain eligibility criteria (CEC 2003b; SENIORWATCH 2002c).

Exhibit 4-9: Generic European assistive technology supply chain



Source: The authors

All in all, the European assistive technology market is characterized by high fragmentation into national, sometimes even regional, sub-markets (PRICE PARTNERSHIP and IRV 2000, BÜHLER 2000; CEC 2003b). All in all, the current situation can be summarised by the following attributes:

- a relatively complex market structure where distribution of product to the end user is mediated by a range of agencies,
- fragmentation of the assistive technology market into small market segments ,
- different national systems with different regulations on reimbursement,
- dominance of SMEs,
- lack of standardization.

When it comes to a future perspective, current market complexity and fragmentation in terms of diverse delivery processes and small sized market segments is likely to remain stable, although there is some evidence that, over recent years, market consolidation has been taking place in sectors such as mobility aids and hearing devices. (CEC 2003b, AUDIT COMMISSION 2004a; BÜHLER 2000; AAATE 2003; PRISMA 2003a; SENSE 2005; PRICE PARTNERSHIP and IRV 2000; CEC 2003b).

Factors facilitating and constraining uptake

Today, there are clearly more assistive technology devices on the market than fifteen or twenty years ago. However, the pace of innovation seems still very low when compared with the mainstream technology domain, and there are numerous examples where promising prototype solutions have not found their way to the market. As already indicated in the previous section, prevailing market characteristics - a strong fragmentation and the dominance of SMEs – tend to constrain uptake in several regards.

Most assistive technology products are produced in small series with the result of high price levels (PRICE PARTNERSHIP and IRV 2000; SENSE 2005). Supply to particularly small demand groups such as persons suffering from a combination of impairments is even more problematic in terms of economies of scale. These issues must certainly be seen as a factor hampering demand and supply. The fact that mainstream technology suppliers are, until now, not really aware of the possibilities potentially offered by the assistive technology sector, may be seen as a confirmation of such an assessment.

A further aspect deserving attention in relation to the demand side concerns the diverse nature of the assistive technology domain. Due to the complexity of current delivery systems and processes - with the many different players and legislative/regulatory schemes involved – the market strongly lacks transparency. It is very difficult to obtain up-to-date information on what possibilities exist, and even health and social professionals seem to have difficulty in obtaining the necessary overview (CEC 2003b). Lacking awareness of an offer, it seems very likely that many people principally in need of an assistive technology do not express their demand. Those who do so may face the risk of not receiving the most appropriate technology product, as the assessment of assistive devices is often undertaken by an individual (for example the general practitioner) who often has insufficient overview of available products.

Current market structures have implications not only in relation to the demand for state of the art assistive technology, but in relation to technological innovation as well. The many small enterprises involved in this market typically do not have the capacity to heavily invest in research and development activities. Even if they had this capacity, considerable uncertainties in relation to the return of investment would remain in view of the complex distribution channels that prevail in the assistive technology domain (e.g. the variety of regulatory ambits, assessment procedures and funding mechanisms concerned). This situation tends to hamper technology transfer from the research domain to the market (PRICE PARTNERSHIP and IRV 2000).

4.3.2 Smart homes

Considerable opportunities to support older people are provided by the networking of ICTs in order to add “intelligence” to the home environment. The term "smart home" was coined more than a decade ago with reference to such an approach. In technical regard the smart home concept is about the utilization of ICTs to integrate various appliances, devices, and services within the immediate home environment, to ultimately enable a resident to control and monitor his entire living space from any location within the home, or even remotely from outside the home. A smart home can encompass relatively simple home automation functions such as turning lights on/off, smoke alarms or access control or comprise fully

automated electrical systems and networking components within the home environment. Smart houses are not always especially designed for older people but can be of assistance in facilitating and extending independent living (ALLEN et al. 1995; DEWSBERRY and EDGE 2000; http://www.smart-homes.nl/engels/ accessed August 2005).

Availability and take up

Despite considerable research effort to exploit smart home technology for the benefit of older people and people with disabilities, actual take up of networked houses or dwellings is largely confined to experimental settings and demonstrators. Several European countries, with the Nordic countries frontrunners, have been active over the last decade in implementing and testing pilot houses ranging from simple control applications to almost futuristic automated houses (FELLBAUM and HAMPICKE 2002). For example, in Sweden three projects were launched in order to test adequate technology solutions[36] for older people. Another example is the Gloucester Smart House[37] in the UK, demonstrating how this technology can assist people suffering from dementia in living independently. In the Netherlands the Smart Home Corporation has initiated the implementation of a number of test dwellings for evaluation purposes. Though some of the projects completed some years ago, trial participants still live in the homes provided. Functions that have been evaluated include for instance safety/security, access control, intruder alarms, automatic lightening at night, automatic cooker switching, personal alarms, authorised access to the dwelling for care workers and automatic curtains (VAN BERLO 2005).

Further to functions focusing on networking internal to the house, smart home technology offers the opportunity to inter-link the networked home infrastructure to external service domains such as tele-medicine and tele-care. Pilot dwellings with screens in the kitchens which remind the resident to take their daily medicine have been set up[38] (VAN BERLO and FELLBAUM 1999). However, these so called “medical houses” or “health houses” have not spread beyond the pilot stage.

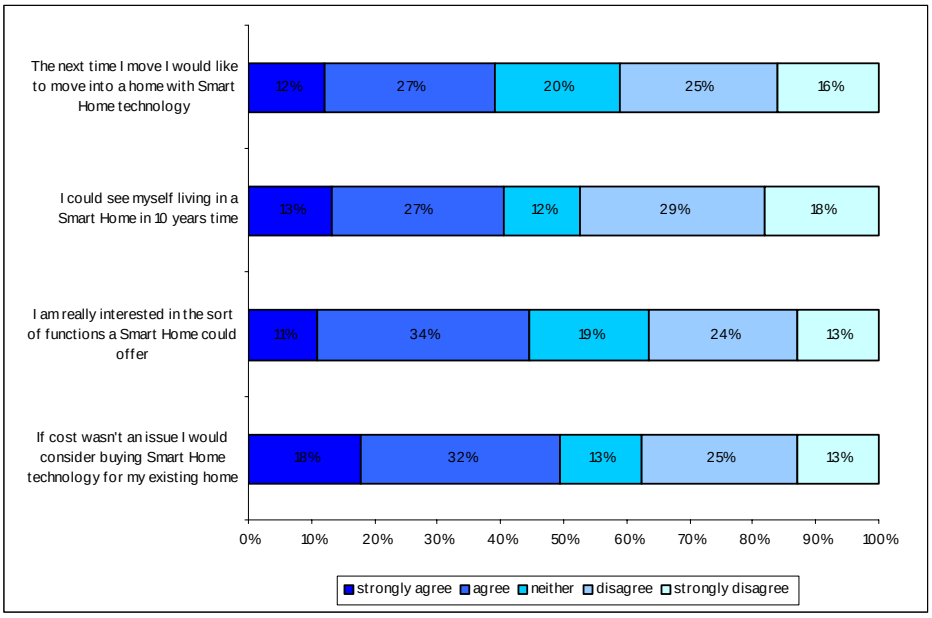
In view of the low level of maturity the smart home domain has reached in terms of marketable products, future development is difficult to predict. Smart homes have been promised for quite some time. Despite serious attempts by large industry players such as Siemens to push smart home technology into the market some years ago, uptake remains low. According to a recent survey conducted in the UK, 39% of British households indicated that they would like to move into a home with smart home technology the next time they move, and half of the respondents said that they even would buy smart home technology today if cost was not an issue (Exhibit 4-10).

[36] (http://www.villasmartbo.se/ and http://www.lboro.ac.uk/research/esri/smarthomes/report/12-214.htm - 14)

[37] http://www.dementia-voice.org.uk/Projects/Projects_GloucesterProject.htm).

[38] (http://www.jrf.org.uk/knowledge/findings/housing/pdf/N40.pdfsearch='the%20market%20potential%20for%2;

Exhibit 4-10: Interest in smart home technology



Source: JOSEPH ROWNTREE FOUNDATION 2000, base: 1000 households in UK

Factors facilitating and constraining uptake

An important stumbling block in the market introduction of smart house technology obviously relates to technology issues. As has been highlighted by some analysts, technologies and in particularly standards have generally failed to create the right conditions for the growth of a mass market for smart home applications (VAN BERLO and FELLBAUM 1999). The latter comes along with a kind of vicious circle hindering a wider market introduction and usage of smart homes: Standards often are only developed if industries see a possible and lucrative market. And market developments are still low since standardization and, as a consequence, compatibility and interoperability is missing. However, the European Commission DG ENTR and CENELEC signed an agreement in January 2004 to develop the European Smart House Code of Practice and the operation of a Smart House Open Forum. The target is to deliver the first Code of Practice by the end of 2005 as part of the eEurope 2005 initiative (http://www.cenelec.org accessed August 2005). This may give the smart home domain a critical push towards the development of marketable products. In addition to this lack of common standards, as interviews with industry experts suggest, there is some evidence of an existing lack of an appropriately skilled workforce with relevant skills and competencies to install smart home technologies into existing houses. This comes along with the general fact that especially retrofitting is a relatively expensive option (DEWSBERRY et al. 2004; ROWNTREE FOUNDATION 2000).

Another aspect concerns a narrow “technology push” approach by suppliers which has tended to fail to take adequate account of user needs. Attempts to develop standard specifications have generally resulted in cumbersome documents and little general agreement on how to proceed. As is evident from pilot implementations there are a number of issues that need to be taken into account if smart home technology is adequately to cater for the needs of older people:

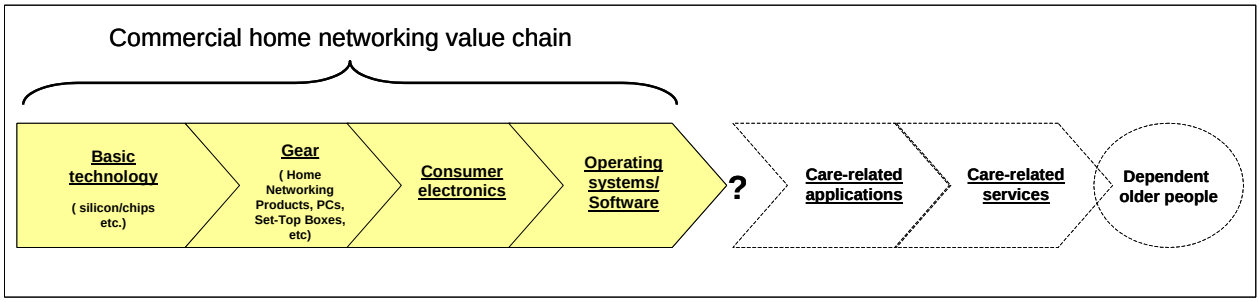
- Technology needs to achieve an optimal fit to the individual needs of older people.
- There seems to be a need to explain the acceptance of new technologies. Constant exchange with older people seems to be a must in the process.
- The components of the system must be invisible to the user and avoid the appearance of “old folks” technology at all costs.

- Systems must be reliable and operate by a small number of commands.
- The few control commands must be simple and not predicated on any technical knowledge.
- An emergency alarm system should be integrated.
- Disruptions in the local network should be detected by outside stations able to make necessary repairs.
- It should be possible to adapt the network components to meet the changing needs of users.

Further developments in mainstream technologies that can be summarised under the ambient intelligence paradigm may help to overcome some of the technology-related problems in relation to lacking user orientations. For instance, ongoing research and technology development in relation natural interfaces may enable a more "unobtrusive" interaction between older users and technical systems.

However, perhaps the major hindrance to wider uptake of a frequently piloted technology seems to be the lack of a functioning value chain in the smart home domain. Without such a value chain[39], i.e. without a series of activities that create and build value exceeding the costs of providing smart home technology and related services to the end user, mass market development remains unlikely. However, since the late 1990s large industry players such as Microsoft have pursued the field of home networking from a marketing hype to actual product introductions. Although the much-touted home of the future - where everything from refrigerators to PCs are part of the home network and can be accessed at the touch of a button - seems still some way off, companies have begun producing devices that lay the foundation for this type of networked home.

Exhibit 4-11: The emerging value chain in the home networking domain



Source: Adapted from Yankee Group 1999

In this context, a commercial value chain seems to be now emerging along which home networking products and services soon may flow to the consumer (Exhibit 4-11). This development may give the smart home domain a critical push towards more mature markets. It remains however to be seen, whether the emerging commercial value chain will actually address those population segments that would most benefit - in terms of improved independence - from a commercial market for home networking products. This seems likely only if the typical agencies that are concerned with catering for these groups such as care service providers will be able to find a place within such a value chain.

[39] The value chain describes the full range of activities that are required to bring a product from its conception to its end use and beyond. This includes activities such as design, production, marketing, distribution and support to the final consumer. The activities that comprise a value chain can be contained within a single firm or divided among different firms and actors respectively. Value chain activities can be contained within a single geographical location or spread over wider areas.(PORTER 1980)

4.3.3 Remote social and medical care

This sub-domain covers ICT applications addressing care-related needs that tend to come with the human ageing process. Here the focus is on applications utilizing ICTs to provide remote support and collaboration with parties that usually interact with older people in a care-related context. In this context, different categories of need to be considered (CULLEN and MORAN 1992):

- security related needs, e.g. the need for getting help in case an emergency situation may arise;
- medical needs, e.g. the need for regular health monitoring or medical interventions;
- psycho-social needs, e.g. the need for support when experiencing a personal crisis.

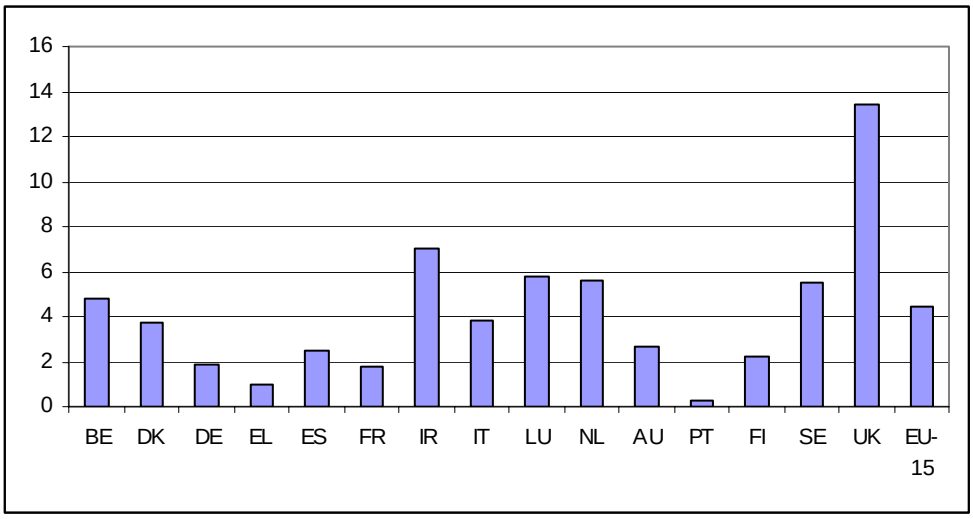
The following subsection focus on an analysis to what extend technology applications are currently applied in the care and independent living domain to address these needs.

Availability and take up

Security-related needs are addressed by so called alarm systems that are meanwhile widely available in many countries (EMPRICA and WRC 2000; PORTEUS and BROWNSELL 2000a; LINDSTRÖM and MARTIN 1995). Depending on the national context, they are known as 'community alarms', 'social alarms' or 'personal alarms'. A basic distinction can be made between active alarm systems and passive ones. In the case of 'active' systems an alarm call is triggered by the individual through activating a body worn "panic button" alerting an alarm centre - or in some cases a person living in the neighbourhood - over the telephone network. Usually, a speech connection is automatically established when the panic button is used. Also, a personal record can be automatically opened at the alarm centre providing staff with relevant information about the client, e.g. in relation to the place of living and prevailing health problems. In many countries these alarms services are offered by the municipality, in other countries charity or commercial organizations act as service providers. Accordingly, different "business models" exist ranging form commercial service prevision were charges have to be paid by the clients and public service provision without any costs incurred by the user. In some countries welfare schemes exists were incurring service charges can be reimbursed, at least when complying with certain eligibility criteria.

Available data suggest that usage levels vary considerable across the European Union. While in the UK 13% of the 50+ population use such a service, penetration levels do not surpass 1% in Greece and Portugal (Exhibit 4-12).

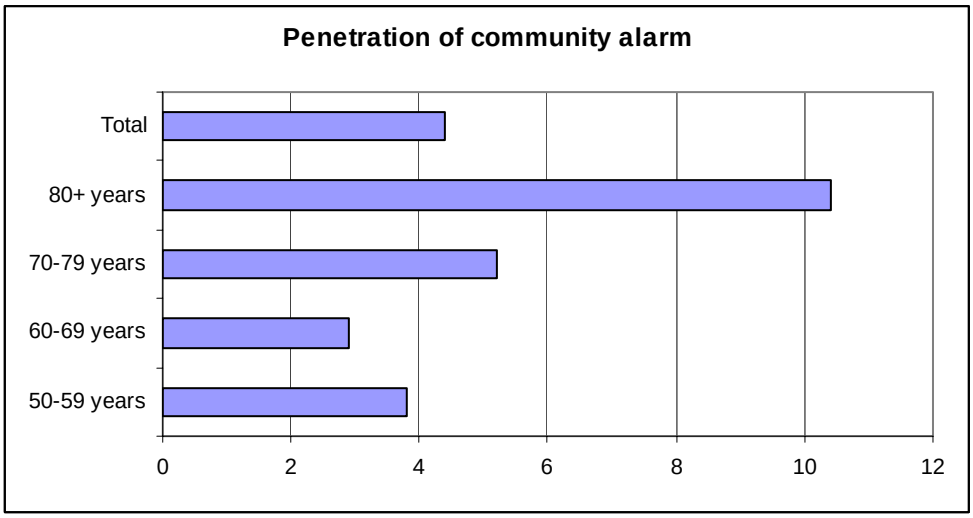
Exhibit 4-12 Community alarm services used by the EU15 50+ population



Source: own calculation based on data available from SeniorWatch 2002

It will not come as a surprise that the older old (80+) seem to make more use of alarm services when compared with younger age cohorts (Exhibit 4-13).

Exhibit 4-13 Community alarm services in EU15 (as % of respective population group)



Source: own calculation based on data available from SeniorWatch 2002

While 'active' alarm systems require the client to actively call for help when an emergency situation arises, 'passive' systems rely upon the registration of the absence of a particular event. Although it is difficult to quantify current penetration levels due to a lack of data, such systems seem to be much less widespread than active alarm systems (CULLEN and ROBINSON 1997). The simplest passive alarm system consists of monitoring agreed regular telephone calls made by the individual to a service centre and triggering an alarm if a call is not made. More recent passive alarm systems have been automated and often combined with the monitoring of particular health parameters like blood pressure or temperature. Also, active and passive components of alarm systems are now being combined. The "PC Emergency Call System" being developed in Finland serves as an example here. In this system, emergency calls from the residents' rooms are directed to the care centre and

additionally, a life style monitoring sensor detects abnormalities in behaviour of the resident and automatically initiates an alarm if appropriate (KENCHIKU KIKAKU SEKKEISHA 2005). Passive alarms have up to now been installed largely in experimental settings. However, some municipal care schemes are now emerging incorporating such technology as part of their day-to-day care practice (Box 2).

Medical needs are addressed by so called tele-medicine, tele-care or tele-monitoring applications. Such applications include physical and psychological measurement as well as interactions with medical or care staff via a telecommunication link that avoids the patients' travelling to a specialist (PRISMA 2003a). Such applications have been implemented in relation to different fields of medical intervention and various medical disciplines ranging from dermatology to rehabilitation (BREIMESSER 2000; EMPIRICA AND WRC 2000, HUGHES et. al. 2003).

Up to now, most telemedicine applications have been used in a day-to-day context only at a professional level with data being transferred between general practitioners and specialists. The ordinary telephone seems to prevail as the main ICT means of ICT-mediated interaction in the medical/care domain. Most recent survey data (Exhibit 4-14) reveal for instance that 26.1% of people aged between 50-64 and 21.1% of people aged 65+ (sampled from 10 European countries) ever had a consultation about health matters with their doctor via telephone. In contrast, the availability of e-consulting, which means using e-mail or the Internet to communicate with a physician, shows much lower usage rates: only 0,4% of people aged 65+ have ever used the Internet or e-mail conversation to communicate about health matters with their doctor and 1,2% within the age cohort 50-64. Within the age group from 18 to 24 years, 2,8% did ever use e-mail or the Internet to get in contact with a physician (EUSER 2005).

Exhibit 4-14: Consultation via e-mail/Internet by age (as % of respective population group)

Age	DE	FR	IT	DK	UK	IE	PL	HU	CZ	SI	Ø
18- 24	1.2	2.3	2.9	7.2	1.6	1.2	1.6	3.3	3.0	4.8	2.8
25- 49	1.8	0.2	2.0	2.3	0.7	2.7	1.7	1.2	2.3	1.1	1.6
50- 64	0.8	1.1	1.6	3.5	0.9	0.9	0.7	0.4	1.0	0.9	1.2
65+	0.7	0.9	0.0	0.8	0.6	0.0	0.0	0.5	0.0	0.0	0.4
total	1.3	0.8	1.7	2.7	0.8	1.7	1.2	1.2	1.7	1.3	1.4

Base: total population 18+

Source: EUSER 2005, the author's own calculation

Of particular interest in the care context are applications focusing on the issue of medication compliance. The proportion of sufferers from chronic disease requiring regular medication rises in older age groups, and compliance seems to be generally low particularly among older patients. In this context, current pilot studies of the use of mobile phones for telemedicine applications are noticeable in the last year. For example, a trial of mobile phone text messaging (SMS) for diabetes management has been undertaken. Patients used SMS to transmit data such a blood glucose levels and body weight to the server. The server replies with an automated message and sends a monthly calculated blood sugar result. The trial suggested that SMS may provide a simple, fast and efficient adjunct to diabetes management. It was particularly useful for elderly persons and teenagers, age groups known to have difficulty in controlling their diabetes. (FERRER-ROCA 2004).

Another application field particularly relevant for in the care context concerns remote monitoring of the older patient's health status from a remote site, especially useful in managing chronic disorders or health problems like high blood pressure, diabetes or chronic pain (KORHONEN et al. n.y.). Other monitoring applications address the safety of wandering

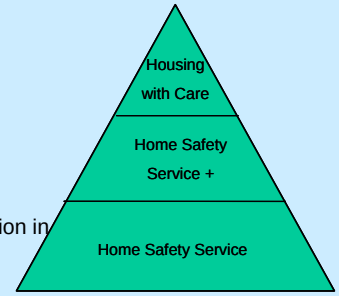
people by preventing undesired wandering or alert others to take corrective action, for example, when someone gets out of bed at night. Moisture sensors on bed sheets are able to detect incontinence, load sensors in beds can allow caretakers to detect periods of restlessness. Until now, monitoring systems are mostly provided as stand-alone solutions recording a single measurement reading. However, a multiple indication monitoring system under development by an Austrian Research Centre measures multiple indicators (blood pressure, glucose levels, ECGs etc) instead of having a different system for each indicator.

Wearable systems, defined as electronic devices that can be embedded in the users' clothes, are an area of growing RTD activity. Such systems in clothing can monitor vital signs such as a patient's heart condition (CEC 2004). In the next few years wearable systems are expected to introduce profound changes and new applications types to health care systems (LUKOWICZ et al. 2004).

Further to the applications described above, ICTs have also been harnessed to address *psycho-social needs* that are usually catered for in the context of elderly care, for example, through combating loneliness and supporting mental well-being as part of the care process. For example, in the context of the rapid development of the Internet peer support groups for older and disabled people have merged that which can help to reduce the experience of loneliness. In this context various "senior nets" and virtual communities have emerged all over Europe (CULLEN and ROBINSON 1997). Virtual communities provide a way for older people (and of course other groups as well) to communicate with each other and serve as a kind of mental health and social support interventions and often have the function of a self-help group. Virtual communities provide typically help and information through mailing lists, chat rooms and discussion forums (EYSENBACH et al. 2004; EYSENBACH and TILL 2000). More formal arrangements for psycho-social support of older people have been piloted in the context of European research programmers. The home tele-service is a social support service based upon so-called videophones, connecting households to a service centre which provides social support via an video communication link (DEVOLDERE 2005, EMPIRICA 1995; ERKERT and SALOMON 1997; GOTT 1995)

Overall, there is currently a tremendous amount of experimentation with tele-medicine and tele-care applications - both within the European Union and beyond - and there are many indications that these developments offer great potential in relation to care and independent living as far as older people are concerned. Many of the more specific tele-medicine applications such as tele-rehabilitation seem not yet to have found their way into the daily routine of the typical health care agencies such hospitals. However, in the field of community care ICTs are now starting to become integrated into routine care processes, as can be illustrated by the example of the West Lothian community in Scotland (Box 2). As far as alarm services are concerned, strong national markets have existed in many countries for some years. However, the large variety in market penetration of current alarms across the EU may serve as an indication that there is demand not yet adequately met.

Box 2: The West Lothian tele-care scheme



A good example of a real-world implementation of Information and communication technologies into existing care provision schemes is the tele-care scheme of a Scottish local authority. The West-Lothian authority has launched an innovative programme reshaping existing services for older people.

Approach: Addressing the challenge of a rapidly ageing population in the West- Lothian community, the main objective is to help more older people remain independently living at home. Therefore, an innovative approach of using three subsequent packages of technology and support within the community has been a adopted:

1) Home Safety Service: The core package is a basic Home security and safety system consisting of a home alert console, a smoke detector, an extreme temperature sensor, 2 flood detectors and 2 passive infra-red movement detectors. These applications are wireless and are connected to a care alarm centre providing a 24-hour monitoring service. As the pyramid shows, the core package is a sufficient solution for the majority of the older population.

2) Home Safety Service Plus: In addition to the services offered by the core package, the Home Safety Service Plus package comprises technology such as a fall detector, chair/bed occupancy detector, a wandering detector, an incontinence detector, automated reminders, automated control of lightning/windows/doors, a video door entry, a carbon monoxide detector and a voice recognition facility.

3) *Housing with Care:* These are complexes of up to 30 home units and one central hub, interlinked to a care line. The hub within the complexes serves as a community facility offering a restaurant, meeting spaces and a hairdressing facility. In each of the complexes, a single unit is used for assessment or for respite if required by one of the residents. Furthermore, the unit can be used to prevent hospital admission in the first place. In addition, the Housing with Care package comprised lifestyle monitoring, smart technology solutions gaining information about the patients' behaviour, monitoring systems for e.g. heart rate, blood pressure or epilepsy and a medication reminder. Some of these applications are in a pilot stage, but first results are very positive.

Starting point of the programme was the initialisation of the "Opening Doors for Older People" project in 1999 which was itself operating under the wider banner of the "Wired West Lothian" initiative. Within the framework of this pilot project, packages of technology were installed into approximately 75 service users' homes. In a second phase beginning in May 2002, a successor project, again together with Tunstall Telecom, enabled the West Lothian Council to upgrade its community alarm service to the "Home Safety Service". Phase three was the beginning of rolling out the Home Safety Service to all people aged 60 and over. In November 2004 the Council has approximately 1700 Home Safety Service users.

Benefits: Initial evaluations identified an increased quality of life by maintaining older people for longer, avoidance of admissions to institutional care, enabling a quicker hospital discharge, supporting more people for longer in the community and at the same time providing a cost-effective alternative to residential care (cf. chapter 4.4).

Lessons learned: Evaluation outcomes reveal, that a greater impact is possible if care service is provided at an earlier stage. Thus, older people would learn to use technology when they are still healthy and are intended to use it more effectively at a later stage of life. Furthermore, the West-Lothian approach clearly shows that implementation of adequate technology applications is rather uncomplicated. Instead, the bottleneck of providing a so-called 'conveyor belt of care' has been the provision, organisation and coordination of the services behind these technologies.

Source: KELLY 2005; WEST LOTHIAN COUNCIL 2005

Emerging market structures

The tele-care domain represents an extremely complex and varied environment for the application of ICTs. The potential ICT generally holds in relation to improving care processes – e.g. in terms of higher quality of life for care recipients and improved outcomes of medical interventions – is very likely not (yet) enough for the sustained success of ICT-based care services. Unless it takes into account the interests of the various players in the care arena

and a long-term "business case" can be proven, it will be very difficult to integrate such services into routine care delivery processes. Before developing concrete delivery models for such a service, the "players" directly involved in such a service need to be identified – e.g. care recipients, care services providers, IT services suppliers, and public/private insurance funds as payers - and their assessment perspectives considered.

This is however not a straight-forward task because of national care/health system idiosyncrasies and barriers at established organizational boundaries. At a generic level, different actor groupings can be identified whose perspective will ultimately determine whether they want to become involved in the tele-care delivery chain (STROETMANN et. al. 2003). These include:

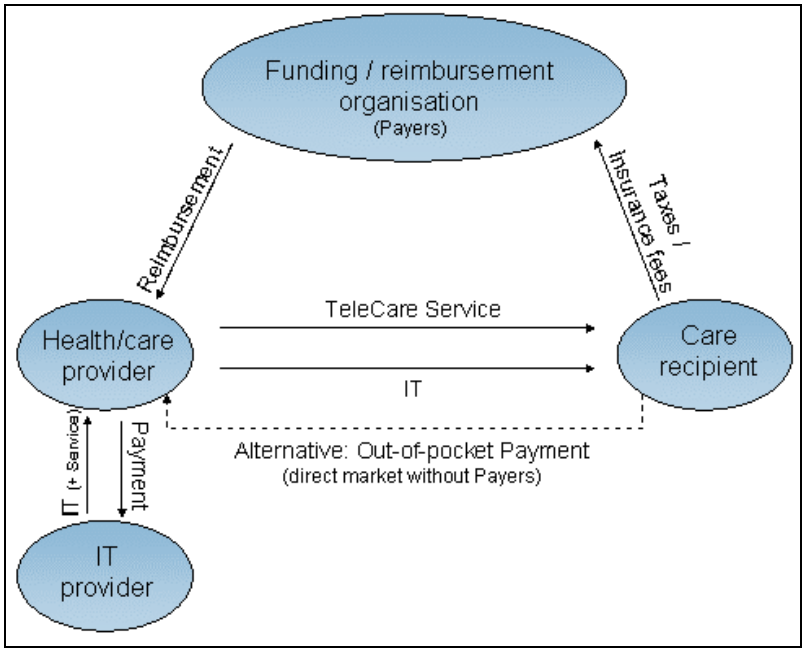
- Care recipients/patients: For them the services they receive as well as the experienced and perceived outcomes will be most important. These include an improvement or at least a stable or slower deterioration of their health situation, admissions to hospital avoided, time and travel costs saved by not having to visit medical/care staff, or the resulting changes in the quality of life and impact on their family/household members. Subjective aspects include an improved feeling of security and of receiving better services.
- Care/health service providers: For this actor group, their assessment will be influenced by considerations like what are the real benefits for their clients, do the outcomes like a more stable health, fewer admissions to hospital or care institutions, etc. justify such a service? How can it be integrated into present work flows without disrupting exiting organisational routines, or is the necessary change worth the effort? Depending on the structure of the national welfare/health care system, other considerations may concern the resulting competitive advantage vis-à-vis other care providers in a more and more competitive, cost-consciousness environment and the costs involved in paying for an IT service provider setting up the system, leasing the measuring devices and securing its technical reliability.
- IT service providers: For them tele-care services must provide a clear-cut business case: they must be able to sustain a reliable rate of return at least equal to their present cost of capital (the rate of return at which investors are prepared to provide the company with financial funds), i.e. they must be able to recover their research and development investment, depreciate the cost of the measuring devices and infrastructure as well as their running service costs. The IT services have to be delivered to both the care recipients in their home and to the care/medical service provider, e.g. a local/regional community centre or physician.
- Payers/Insurance funds: In most welfare/health systems, care/medical services are paid for either by public or private insurance and/or the tax payer, a health management organization or similar organizations. Whether tele-care is an attractive option for them depends on their assessment of the benefits for their clients, cost savings expected from new ways of care, the impact on their competitive market position, and, of course, on the costs the new service involves for them.

In general, there are different possibilities how these actor groupings are involved in the overall service delivery chain. From a market analysis conducted by the TEN-HMS project (STROETMANN et al. 2003) in relation to home monitoring, a generic model can be derived as graphically represented by Exhibit 4-2 overleaf.

According to this model, tele-care service solutions (including the service itself and the necessary IT equipment) are provided by a health/care provider in cooperation with an IT provider. The health/care provider either purchases the entire IT system or he acquires a separate user license for each care recipient. He than combines the IT with his own tele-care service and delivers it to the care recipient as an integrated solution. When it comes to payment of the service, basically two variations are possible. In case of the existence of a

funding or reimbursement organisation (e.g. insurance / health authorities), the health/care provider receives a reimbursement for his (evidenced) service from the payer, who itself is financed by taxes or insurance fees from the care recipient. Alternatively, in a direct market without any payers, the tele-care service is paid out-of-pocket by the care recipient. Various modifications of the payment model are possible, e.g. depending on the structure of the health system in different countries. For example, a shared payment from both the funding / reimbursement organisation and the care recipient would be conceivable. Also, the spouses/relatives of the care recipient could step in to bear all or a part of the expenses.

Exhibit 4-15: Generic model of telecare service provision



Source: The authors

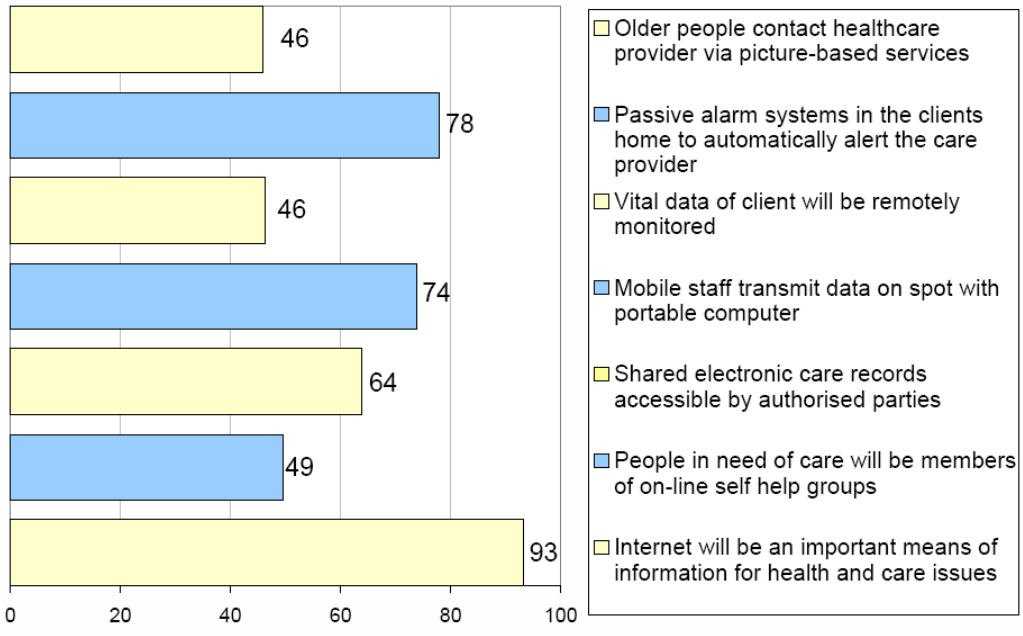
Current implementation – as in the case of the West Lothian tele-care scheme – seem to suggest that such tele-care schemes are most likely to emerge in a community care context rather than in direct markets without an intermediating party paying/reimbursing part or all of the costs involved. Although there is probably a growing inclination by governments to have the general public pay part of their care/health cost out-of-pocket, actual services financed exclusively on this basis are rare exceptions in countries with well developed national health systems. Most people seem to take the stand that they have paid insurance fees and therefore expect the insurance companies or welfare system to cover all or at least part of their care expenses.

Factors facilitating and constraining uptake

Key hurdles for the wider diffusion of advanced remote social and medical care applications across Europe that have been highlighted by several analysts include technical infrastructure, security and privacy issues as well as lacking standardization and business models (EBUSINESS-W@TCH 2003a,b). However, approaches of integrating well established ICT components into day-to-day community care practice that have recently evolved seem to indicate that sustainable tele-care models seem to become possible, at least in a community care environment. Such needs-driven “bottom up approaches” – when compared with the many “technology-push” solutions that have been tried out for many years – may soon be

emulated if they prove able to deliver expected outcomes under routine conditions. Survey results suggest that care professionals expect better and broader services that are empowering older people to lead an independent life for a longer time and they see that the road leads towards more intensive and widespread ICT applications within their professional field (Exhibit 4-16).

Exhibit 4-16: Trends expected by home care service decision makers (in %), 2001



source: SENIORWATCH 2002c

For many of the more advanced applications, the hindrances and barriers that have been observed up to now, e.g. in respect of technical specification, legal issues, licensing and ethical aspects, are however likely to prevail in the immediate future (MEYSTRE 2005).

4.3.4 Wider ambient intelligence

The term “ambient intelligence” (AMI) has a strong place in current European Commission Information Society Technology (IST) policy and stands for a new research and technology development paradigm. The vision behind this concept includes a living environment where humans interact in a natural and non-invasive manner with computational services that help them in their everyday tasks. This concepts may be traced to the concept of “ubiquitous computing”, and involves results from many established areas of research, such as pervasive communications, multimodal user interfaces, artificial vision and domotics.

For the purposes of this study we understand the wider ambient intelligence domain as a newly emerging research domain that can be expected to deliver independent living solutions addressing the wider living environment. In that sense it goes beyond smart home technology and telecare solutions, both of which focus on the immediate living environment of older people. New facilities could include intelligent public facilities such as self service terminals, information kiosks and transport systems as well as mobile communication devices providing tracking / alarm services or other location-based services, all flexibly adapting to the specific communicational, functional and cognitive needs that tend to come with human ageing.

Emerging applications

This domain is less established, when compared with the hitherto described domains. However, there are at least two types of application that have reached a certain level of maturity, although they are not yet widely available as marketable products or services respectively. These include tracking systems helping to monitor movements of people from a distance on the one hand and mobility support systems facilitating movements of frail people in their everyday mobility on the other.

With regard to the tracking systems, people with various forms of dementia are a large potential target group (MOBILALARM 2005). These people are usually unable to use a classical (home-based) social alarm function because they are not able to trigger the alarm buttons when they get lost in outside their immediate living environment. Currently there are three different types of tracking systems available on the market:

- In-house tracking systems which use a locator to detect the lost person are available for quite some time.
- More recently tracking systems relying upon the Global System for Mobile Communications (GSM), like for example the Senior Track[40], have become available.
- Another type of system relies upon the geographic positioning system (GPS). These are the most advances tracking systems currently emerging on the market (LINDSTRÖM 1999). The "Mobile Rescue Phone" developed already some years ago by the MORE project may serve as a good practice example: The phone is based on the Public Switched Telephone Network, a geographic information system (GIS) and GPS (EKBERG et al. 2001). Another system, the so called MobilAlarm, which is currently being developed by Attendo Systems, combines an emergency alarm function with a tracking device via GPS (MOBILALARM 2005). The device works independently from base stations and can constantly check the current position of users. The position identified most recently is restored. In this way, the user can activate the alarm device wherever he or she is. A speech connection between the user in need and a service centre is possible independently from the location - as long as within reach of a GSM provider. Comparable with traditional social alarm services emergency calls are handled in service centres of social provider organisations.

In general, tracking systems are not yet widely implemented. In Japan this technology is used for locating pets rather than family members (MOBILALARM 2005). A reason for this might seem to be ethical issues arising when people are being traced 24 hours a day. This is a problem particularly in the case of lost persons who do not voluntarily use such a system, e.g. people with dementia. In Germany, for instance a court approval for constantly tracing people with dementia is required. (MOBILALARM 2005; CULLEN and ROBINSON 1997).

Also there are technical issues that are relevant in relation to the accuracy and reliability of tracking systems. For instance, systems relying on GPS technology must accept a certain degree of inaccuracy in locating a person to be tracked due to limited technical capabilities. The same holds true for systems relying upon GSM technology due to varying scales of localisation cells available (e.g. in a city when compared with the country side), and due to "dead spots" that still prevail in many geographic areas despite increasing availability of mobile networks.

Another application type that can be assigned to the wider ambient intelligence domain are so called "mobility support" systems. Old age mobility has been analysed from a variety of different perspectives. Nowadays, travelling requires the interaction with a variety of

[40] http://www.tracking-systems.de/handy/ortung/product_info.php? products_id=8&osCsid= 56d4b7bf506235db240479a52ecbe4bc, accessed August 2005

electronic and non-electronic systems (such as screens and keypads, gates, displays, buttons etc). In this context, ICT can be both a threat (if not designed with the needs of older people in mind) and an opportunity (if it helps older people to overcome barriers). For example, smart cards can "tell" a machine to accommodate to the requirements of the user. For older people this may take the form of displaying larger characters and/or providing audible output to simplify choices and to give people more time for transactions (GILL 2004).

Another example would be the transport of information to a blind person's mobile phone. Here, the profile of people can be stored in a mobile phone and according to that, the phone can point out locations accessible for the user, e.g. public facilities or public transportation stops (FREITAS et al.1995).

Navigation systems support people in finding their way from one place to another. Mostly, such navigation systems are not particularly designed for older and disabled people while at the same time they have a great potential for blind or visually impaired people (GILL 2004). A mobile communication link is a pre-condition. One can distinguish navigation support to enable or facilitate navigation outside, for example, with a local navigation context for those on food or covering driving situations, and navigation support inside buildings (PORTEUS and BROWNSELL 2000, http://www.stakes.fi/tidecong/724foste.html accessed August 2005).

Some EU funded projects have focused on developing travel aids for disabled and elderly people. Within the TIDE programme the ASMONC project ("Autonomous System for Mobility Orientation, Navigation and Communication") designed an easy to use portable aid for blind, low vision and older people to enable them to find their way in unknown environments. A more recent project, ASK-IT ("Ambient Intelligence System of Agents for Knowledge-based and Integrated Services for Mobility Impaired users"- FP6, http://www.ask-it.org), has a similar but more ambitious approach. Coordinated by Siemens and with the participation of Nokia and Vodafone (among others) it aims to develop an extended ambient intelligence space for the integration of functions for elderly and disabled people across a variety of environments (car, bus, airplane, home, work, leisure, sport). To this end the project intends to develop a "multi-agent" device that will be tested in several European cities.

An application strongly related to mobility support systems are intelligent public infrastructures. The field of intelligent public infrastructures is relatively new; here smart signs and street furniture may support movement of handicapped people in the future. (http://www.appliancestudio.com/publications/whitepapers/SmartSignsProspectus.pdf#search='smart%20signs' , accessed August 2005).

4.4 Opportunities and risks

The need for adequate health and social care for the growing older age group has been a major policy concern for the European Union for some time already (CEC 1999). In its Lisbon Strategy, the European Commission has highlighted the fundamental role which technological change in general, and Information Society developments in particular, are expected to play in coping with the challenges facing Europe, including demographic change. More recently, this point of view has been reiterated in a Green Paper on the demographic development (CEC 2005a).

As shown in the previous sections, such a perspective is quite well supported by existing evidence. Nevertheless, wider implementation of ILT solutions as outlined there poses both risks and opportunities that need to be considered in the process of policy formulation and implementation. They concerns different aspects including:

- the quality of life of older people;
- the cost effectiveness of care provision to them;

- their self-determination and related ethical issues;
- and finally older people's participation in social and economic processes.

This is described in more detail in the following.

Quality of life of older people

As shown elsewhere in this report, a wide variety of specific ILT applications have emerged during the last decade which hold great potential in meeting increasing demand and constraining cost increases. ILTs provide new opportunities for more client-centred, individualised and thus more needs-driven forms of care and medical intervention, and its wider utilisation ultimately holds the potential to yield higher quality of life for those to be catered for (CEC 2004b). Available evidence suggests for instance that - taking self-reporting on benefits, usefulness and satisfaction as an indicators for improved quality of life – such technology indeed can improve the situation of older people receiving care, and of their carers as well. A number of trials revealed for instance that a large share of the participants assessed the applied ILTs as beneficial for them. Benefits reported concern for instance a higher degree of confidence felt by the care recipient and immediate availability of help in emergency situations. (KELLY 2005; PORTEUS and BROWNSELL 2000; STROETMANN 2000; ERKERT 2000; BREIMESSER 2000). Also, more than ten years of experimentation with videotelephony-based social service provision suggest that this technology can be successfully applied to meet psycho-social needs of older home care recipients (DEVOLDERE 2005). Opportunities exist not only in relation to applications involving complex ICT systems such as those required for remote monitoring and consultation, but also for more low-tech solutions. In the case of dementia for instance, comparatively simple devices such as intelligent medication dispensers and item locators seem helpful not only for improving the quality of life of the care recipients, but the situation of their carers as well (Box 3).

Box 3 : A case story from Ireland highlighting a time saving from using the locator

"The item locator was used by my mother to find her keys to open the door to let me in. This took about 2 minutes. Normally she would have to open the garage door and then we would spend at least 30 minutes looking for keys. We also used it to find her purse, handbag and wallet, this used to take about an hour before we could go anywhere but now it takes all of five minutes. I find it wonderful as sometimes my patience wears thin and I get quite stressed before we leave the house. My mothers mood was also better as she did not have to try and remember where everything was and so did not realise how forgetful she was. I would recommend it for anyone with memory problems. Anyone I have told about it wants to buy it for their mother, father and some even for themselves".

Source: Work Research Centre (2004), ENABLE project, Deliverable no. 3.2 : 33

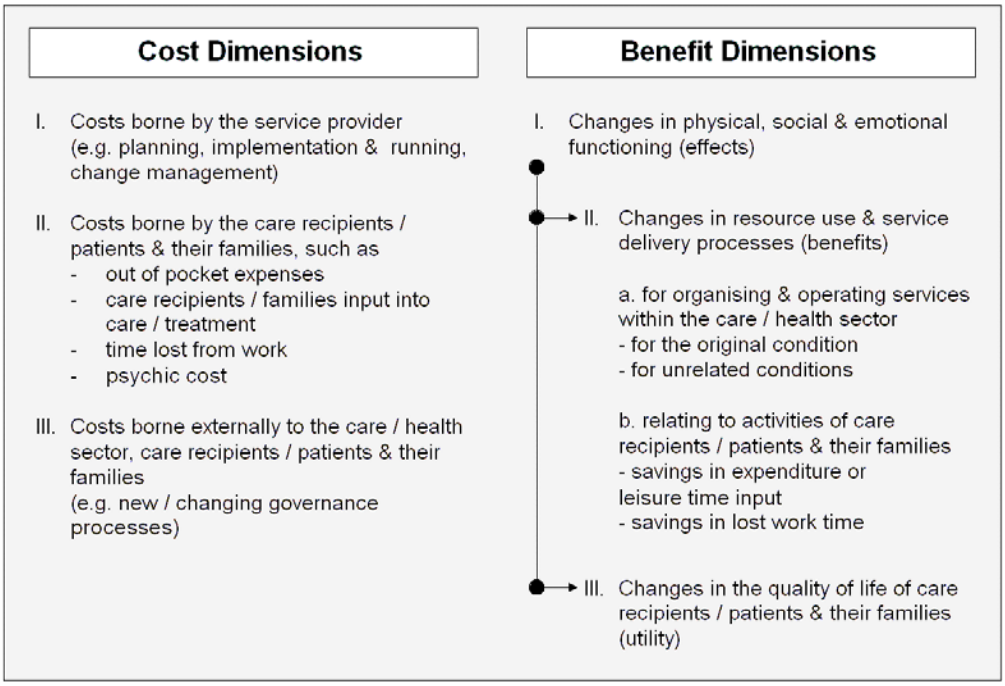
Cost effectiveness of care provision

For some applications it is unclear whether at current costs ICT-based solutions can be regarded as a promising avenue to follow to enable national care and social systems to cope with budgetary constraints - while at the same time delivering high quality services to a steadily increasing client base, promoting independence and self-sufficiency, enhancing quality of life and reducing the need for care by others. Such an assessment is essential to understand whether the outcomes for independent living and social / medical care justify the required public investment. Consideration always needs to be given to the relative merits of

investing in ICT-based solutions and paying for other forms of support, e.g. more labour-intensive service models. Such an assessment is however not a straight-foreward task.

In a recent paper reviewing more than 600 publications, each claiming that tele-medicine is cost-effective, the authors conclude that "it is impossible to assess the extent to which tele-medicine represents a sensible priority for health investments" (WHITTEN et. al. 2002: 1437). This is, of course, not proof that tele-medicine is not cost effective, but points to the need for a thorough assessment of the current situation and to the fact that no reliable evidence base is yet available - clearly because of the complexity of the task. As illustrated by Exhibit 4-17, cost benefit relations in the care and independent living domain are not easy to assess, particularly for applications which require advanced technical infrastructure and the cooperation of different actors within the care process. Depending on structural peculiarities of national welfare and health systems, costs as well as benefits may accrue to a variety of actors in different roles (e.g. care recipients and their families, municipalities, charity organisations, public and private funding organisations, commercial service and technology providers), and the roles are at different levels.

Exhibit 4-17: Dimensions of cost benefits analysis



Source: Adapted from DRUMMOND et. al. 1998

Where a positive assessment of the cost-benefit advantages of an ICT-based solution can be reliably made, a number of difficulties remain before the advantages are actually reaped by society. Despite a positive cost-benefit assessment, uptake may not occur. One factor in many cases is a discrepancy between investment and benefits. The party making an investment in ICTs may not necessarily reap the fruits of this investment in terms of cost reduction. For instance, in systems where municipal elderly care and health care are structurally divided – in terms of financing and provision of the services – return of investments in home care technology made by the municipal care system may to a large extent occur in the health care system.

In cases such as these the uptake of technology-based solutions in the care and independent living domain is hampered by inadequate "market" structures rather than by inherent properties of ICTs or doubtful cost-effectiveness for society as a whole. Thus, "market failure" and not lacking usefulness of the applied technology would hinder its

successful exploitation for care and independent living purposes.

Box 4: Improved coordination of health and social care through ICT – an example from Denmark

A common problem which will increase in size in the future is the seamless coordination and cooperation of social care in the community, e.g. home or residential care, and health care in the hospital. A drastic, real example may illustrate what this implies: an older man, suffering from mild Alzheimer Disease, was lost and searched for by a great number of persons, including the police force and a helicopter. Only after two days it was discovered that he was in a hospital and well looked after.

To improve this situation, Danish local authorities and counties started in 2002 the "Local Authorities and Healthcare Communication" project. It is supported by and coordinated by Med-Com - the Danish Healthcare Data Network. Today, already in several regions the admission of any patient into a hospital and the electronic entry of his or her personal identification number into the hospital administrative system will automatically trigger a notification message coded in XML or EDIFACT to the respective local authority where it is registered in its electronic system and also automatically scanned. If the person is classified as receiving home care, the relevant services will be informed and stopped. Furthermore, the hospital will be informed via an electronic XML message about a contact and telephone number at the local home care services in case they need more background information on the patient.

When the patient is discharged, again a message is triggered to the home care organisation so that all services necessary can start again. Furthermore, the treating family doctor is informed by an electronic XML discharge letter (all data of which are automatically lodged in his patient system) so that he can coordinate necessary health services, an updated medication plan or rehabilitation measures with home care personnel.

In the context of this activity a framework has been created to further expand these data ex-changes between hospitals and local authorities. In future, it will allow also an exchange of more detailed information on the functional capacity of the patient and other characteristics of importance in the home care or nursing home environment. The system will be expanded to allow for electronic exchange also with other local authority services concerned with social in-surance aspects, sickness benefits etc.

Sources: Expert interview on Aug. 17, 2005; MedCom IV – the Danish Healthcare Data Network - Status, plans and projects, Dec. 2003 / MC-S177, http://www.medcom.dk/publikationer/publikationer/MedCom4-ENGELSK.pdf

A further aspect adding complexity is the fact that cost savings may not only occur in relation to the utilisation of ICT at the “front office” level, i.e. for the purposes of immediate services delivery to the older client (e.g. by means of telecare applications), but also at the “back office” level where productivity gains may become possible through ICT (e.g. in relation to a more efficient coordination of the various actors involved throughout the entire service chain). This is a largely under researched issue, at least as far as the care and independent living domain is concerned. There is some evidence that in the health and social services sector only few organisations are already well into taking advantage of ICTs and reaping economic benefits from this (Box 4). The sector as a whole, in spite of its economic significance, seems to trail behind almost all other economic sectors, and no signs of a change in this situation seem to be discernable. (SENIORWATCH 2002; E-BUSINESSW@TCH 2004c).

Thus current evidence shows that ICT uptake in the care and independent living domain cannot solely be seen as a matter of technology. A key issue is the management of innovation processes involving new tools, competencies and work practices of professionals,

and it must be seen as a matter of culture and structural aspects of the welfare system (EMPIRICA and WRC 2000, SENIORWATCH 2002a, E-BUSINESSW@TCH 2003b,c).

Against the background of the complex nature of cost/benefit dynamics in the care and independent living domain, it will not come as a surprise that comprehensive cost/benefit information is hardly available yet. In relation to assistive technology and personal emergency response systems there is some evidence that using this technology yielded a positive cost/benefit ratio mainly through the reduction of the burden of on-site care and assistance (BERSTEIN 2000; ANDRICH 2000; MANN et al. 1999). Also, more recent implementations in community care settings suggest potentials to reduce delayed hospital discharges and the length of hospital stays. For instance, by implementing technology packages into existing houses and the newly built housing with smart technology the West Lothian authorities (Box 2) have achieved a mean duration of stay in hospital by a patient assessed as being ready to move of 9 days, as opposed to the Scottish average of 57 days. Furthermore, an evaluation of the West Lothian Home Safety Service which was undertaken by the University of Stirling highlights strong economic benefits of telecare technology: the gross annual cost for providing one care home place stands at £ 21.840, compared with £ 7.121 for the support in the community package including telecare technology, 24 hours response and ten hours of care (cf. Box 2, chapter 4.3.3) (KELLY 2005; BOWES and MCCOGHAN 2002, 2003, 2005).

However, benefits do not only emerge at the side of the service provider organisation but also at the side of the care recipient. An approach directed towards quantifying such benefits commonly applied in the health care sector relies on the concept of so called Quality Adjusted Life Years (QUALYs)[41]. A case study based assessment in relation to the utilisation of assistive technologies suggests that through such technology up to 8.859 QUALYs could be added for the cases investigated (ANDRICH 2000).

Virtually all cost benefits analyses of ILT applications currently available rely upon small scale evaluations, many of which have been conducted in experimental rather than real-life settings. The real costs and benefits – in particular when it comes to more complex technology applications - are however likely to become visible only when the stage of routine application has been reached. And even then, the non-monetary effects may be much more relevant than direct cost savings that might be realised.

Self-determination of older people and related ethical issues

Once the difficulties of realistic cost-benefit assessments have been overcome, other risks presented by cost-saving measures using ICT have to be addressed before such a development can be seen as contributing in an overall positive fashion to a user-friendly Information Society for older Europeans. Concerns have been voiced that the inherent saving potential of ICT may become the only driving force towards ICT uptake in the health and social service sector, and that quality of service would be neglected (TWEED and QUIGLEY, 1999). Costs would thus be saved at the expense of social interactions and the quality of life of the individual. Such a development would bear the risk of a creeping de-

[41] Quality-adjusted Life Year refers to QALY, a unit of health care outcomes that adjusts gains (or losses) in years of life subsequent to a health care intervention by the quality of life during those years. QALYs can provide a common unit for comparing cost-utility across different interventions and health problems. Analogous units include disability-adjusted life years (DALYs) and healthy-years equivalents (HYEs). The QUALY approach is an adjustment of life expectancy that incorporates a measure of disability among survivors. The data on disability may be collected from hospital discharge data or by health surveys; a subjective weight is given to indicate the quality or utility of a year of life with that disability. For example, a year lived following a disabling stroke may be judged worth 0.8 normal years.

(http://psychology.about.com/od/glossary_az/g/Qualityadjus26.htm, and http://www.google.de/search?hl=de&lr=&rls=GGLC,GGLC:1970-1,GGLC:de&oi=defmore&q=define:QUALITY+ADJUSTED+LIFE+YEARS , 14.08.05)

humanisation of the personal circumstances of dependent people. There are two somewhat different aspects deserving attention in this context.

Firstly, there is the question whether increased ICT utilisation might erode human support networks and practices - let them be operated by formal carers or by family and friends - and thus increase the risk of social isolation. Again, this is an under researched issue as most implementations have not yet matured in terms of large scale application. However, some evidence exists that family support may not necessarily weaken if others – and perhaps technology as well - take on some of the roles of caring. Rather, this may reflect the particular 'welfare mix' available in a given country releasing family members from heavy duties of family care for close kin (ATTIAS-DONFUT 2005a).

Secondly, there is the issue of privacy and control. Here, the question arises whether ICT-based care processes increase the level of intrusion into the private sphere, e.g. in case of dwelling-based monitoring systems, and whether the individual remains able to keep control in procedural and/or informational regard. Ultimately, these questions allude to the issues of self esteem and dignity of the individual. Again, not much evidence is available here, least of all in relation large scale implementations. Evidence available from videotelephony-based social service provision suggest, that older service recipients tend to be very sensitive in relation to the issue of privacy, but take a rather pragmatic approach to it when appreciating the benefits technology is principally offering to them (ERKERT 1995, 2000).

Societal participation of older people

With respect to the societal concept of ageing, a shift from a rather deficit-oriented notion of independent living towards a "participatory" one becomes evident. In a contribution to the Second United Nations World Assembly on Ageing the World Health Organisation has for instance argued "that that countries can afford to get old if they enact the "active ageing" policies and programmes that enhance the health participation and security of older citizens. (…) These policies and programmes should be based on rights, needs, preferences and capacities of older people" (WHO 2002: 6). In this context, it is no longer seen as sufficient to cater for older adults' basic needs in relation to health and material living conditions. Rather, the notion of being able to making an active contribution to social and economic processes comes more to the fore.

ICT has frequently ascribed the potential to facilitate older peoples' participation in such processes - for instance through its distance bridging capabilities in relation to communication and interaction processes (CULLEN and ROBINSON 1997). If this is true ICT would offer the opportunities not only to empower older adults to participate in social and economic life in a general sense. Also, it would offer the opportunity to empower specifically those who are dependent to take a more active role in making care and treatment choices and to participate in the management of the care process. Those who simply cannot due to the seriousness of their state of dependency should nevertheless have the same opportunities and benefits from services and care as others. In spite of much policy talk this is a little understood area of concern needing much more attention and research to create care and independent living solutions which are really appropriate for the situation of various groups of people in need of care and support (CORNFORD and KLECUN-DABROWSKA 2001).

4.5 Conclusive summary and policy implications

As set out in the beginning of this report, this third and last part of the overall study focuses on the intersection of demographic ageing with the opportunities offered by ICTs to support independent living and care of older people. The analytical approach adopted for this purpose cantered on the investigation of four key ICT application domains. For the purposes of this study these have been subsumed under the term Independent Living Technology

(ILT). In the following key outcomes are summarized and their implications for policy formulation and implementation are assessed.

4.5.1 Challenges and opportunities

The hitherto presented analysis has identified four key aspects in relation to impenitent living of older people where the technological change poses challenges and opportunities for the European Union. These include:

- an increasing demand for care and support driven by the demographic development,
- the emergence of a wide range of technologies that hold potential in meeting this demand,
- the quality of life of the increasing number of people that will depend on care and support,
- the participation of these in social and economic processes,
- the cost effectiveness of care services provided to them,
- and finally, ethical consideration connected with the application of technology in the context of care and support provision.

These are briefly summarized in the following.

Increasing demand for social and medical support

Despite the trend towards improved health in later life, the demographic development clearly goes along with increasing demand for care and support. This process is mainly driven by a steady rise of the absolute number of the older old in almost all Member States of the European Union. Limitations in mobility and other aspects of physical functioning as well as cognitive impairments do sharply increase with growing age. This is not only due to a higher incidence of particular health problems going along with rising age. Also, the accumulation of several health problems in one person tends to rise, and these health problems will more easily produce functional limitations because of the non-specific, age related decline of functional reserve capacity. Already today, many of those who suffer from such limitations do obviously not receive adequate help and support. The concurrence of socio-economic developments connected with the demographic change and increasing demand for long-term care bear the risk of a further widening of this “care gap”. Counteracting these developments is one of the core challenges when it comes to harnessing the potentials generally provided by technological innovation in relation to the demographic change.

Technologies holding potentials in supporting older people

Different key ICT applications fields have been identified that hold the potential to benefit older people who are in need of care, or whose independence is otherwise threatened through ill health or functional limitations. These can be summarised as follows.

In the assistive technology (AT) domain a range of ICT-based products have become available that are designed to compensate for motor, sensory and cognitive difficulties frequently experienced by older adults. For instance, speech technology - including speech recognition, speech synthesis, speech coding and speech analysis - has been increasingly deployed in AT applications during recent years. Portable devices have been developed with the capability to detect lost objects like a key and in this way to support people with light to moderate (but not severe) memory loss. In the longer run, more powerful devices can be expected to become available, including robots designed to support dependent people in carrying out a variety of tasks without any human support.

In the smart home domain, opportunities to support the independence of older people are provided by adding "intelligence" to the immediate home environment through the networking of ICTs. In technical regard, ICTs are utilized to integrate various appliances, devices, and services within the home, to ultimately enable a resident to control and monitor his entire living space from any location within the home. This may encompass relatively simple home automation functions such as turning lights on/off, smoke alarms or access control or comprise fully automated electrical systems and networking components within the home environment.

In the remote social and medical care domain, the focus is on applications utilizing ICTs to enable remote provision of support and collaboration with parties that usually interact with older people in a care-related context. Here, different types of personal needs can be catered for by a wide variety of specific applications. These include for instance alarm systems addressing security related needs and remote monitoring of vital data for medical purposes. Also, psycho-social needs can be catered for with help of ILTs, e.g. by means of video-telephony enabled provision of social support and reassurance.

The ambient intelligence (AMI) domain is a newly emerging RTD field rather than an established application field. For the purpose of this study it is understood as an emerging ILT domain that can be expected to deliver independent living solutions addressing the wider living environment. In that sense, it goes beyond smart home technology and telecare solutions, both of which focus on the immediate living environment of older people. Facilities expected to become available in not too distant future include intelligent public facilities such as self service terminals, information kiosks and transport systems as well as mobile communication devices providing tracking/alarm services or other location-based services, all flexibly adapting to the specific communicational, functional and cognitive needs that tend to come with human ageing.

Improving the quality of life of care recipients

The ILT domain clearly holds potentials in improving the quality of life of older people with functional limitations or ill health. Benefits concern for instance a higher degree of confidence felt by ILT users and immediate availability of help in emergency situations. Recent experiences made in the context of community care suggest that ILTs also enable quicker discharge of older people from hospital and retarded admission to institutional care, which plays to the preference of most older people to live in the own home rather than in an institutional setting. Opportunities do however not only exist in relation to applications involving complex ICT systems such as those required for remote monitoring and consultation, but also for more low-tech solutions such as intelligent medication dispensers and item locators which have proved helpful not only for improving the quality of life of older people in need of support, but of those supporting them as well. All in all, evidence in relation to benefits experienced by ILT users in relation to their quality of life is largely available in anecdotal form. Quantitative approaches to measure gains that can be achieved through the application of technology, for instance relying on the concept of so called Quality Adjusted Life Years (QUALYs) frequently applied in medical research, have been rarely applied to the ILT domain yet. Some case study based evidence that is available in relation to the assistive technology domain indicating however that through such technology up to 8.859 QUALYs could be added for the cases investigated is however difficult to generalise.

The questions to what extent ILTs can be harnessed to enable older people to take a more active role in making care and treatment choices and to participate in the management of the care process has been highlighted by some analysts. This issue relates to the quality of life of older care recipients in a more indirect manner, but it constitutes a not well understood area of concern deserving much more attention if ILTs are to facilitate more participatory approaches in care provision.

Empowering older people to participate in social and economic processes

Beyond the immediate care situation, ILTs hold potentials in empowering older people to participate in social and economic life in a more wider sense, e.g. through inherent distance-birding capabilities. This does apply not only to those with functional imitations or ill health, but also to those providing informal care themselves. The core burden of long-term care is currently taken by the family rather than by formal care services, and it seems unlikely that this situation will considerably change in the future. ILTs enabling older carers to provide care from the work place (e.g. by remote monitoring of the well being of the person cared for) may help older family carers to more fully participate in economic and social life. However, this is an area that has so far received relatively little research attention, and aspects that warrant more examination at this point in time include both opportunities (e.g. reduced burden of care) and risks (e.g. intensification of work) posed by the possibilities for ILTs to support working carers.

Cost-effectiveness of care service provision

In relation to the question whether ILT implementations can be regarded as a promising avenue to follow to enable national care and social systems to cope with budgetary constraints, the evidence base currently available does not allow for a general judgment. As the case arises, consideration always needs to be given to the relative merits of investing in ICT-based solutions and paying for other forms of support, e.g. more labour-intensive service models. In the case of relatively simple solutions such as item locators costs do not seem to be a major issue when compared with benefits experienced by older people and their carers.

In the case of more complex ILT systems, it is however very difficult to make a comprehensive cost benefit assessment due to the complexity of cost benefit relations in the ILT domain. Depending on structural peculiarities of national welfare and health systems, costs as well as benefits may accrue to a variety of actors in different roles (e.g. care recipients and their families, municipalities, charity organisations, public and private funding organisations, commercial service and technology providers), and the roles are at different levels. A further aspect adding complexity is the fact that cost savings may not only occur in relation to the utilisation of ILT at the “front office” level, i.e. for the purposes of immediate services delivery to the older client, e.g. by means of telecare applications, but also at the “back office” level. Here, productivity gains seem possible through ILT, e.g. in relation to a more efficient coordination of the various actors involved throughout the entire service chain.

Thus, it may not come as a surprise that comprehensive cost-benefit information on ILT implementations are hardly available yet. Virtually all available cost benefits analyses rely upon small scale evaluations, many of which have been conducted in experimental rather than real-life settings. The real costs and benefits are however likely to become visible only when the stage of routine application has been reached. And even then, the non-monetary effects may be much more relevant than direct cost savings that might be realised. This is, of course, not necessarily proof that ILT implementations are not cost effective, but points to the need for a thorough assessment of the current situation and to the fact that no reliable evidence base is yet available - clearly because of the complexity of the task.

Ethical considerations

In relation to the provision of health and social services, concerns have been voiced by some analysts that ultimately the inherent saving potential of ICT may become the main driving force towards ICT uptake in these domains, and that quality of service may be neglected. In relation to the ILT domain as defined for the purposes of this study, clearly such a development would bear the risk of a creeping de-humanisation of the personal circumstances of dependent people. This relates on the one hand to the question whether increased ILT utilisation might erode human support practices and thus increase the risk of social isolation. On the other hand, the question arises whether ICT-based care processes

increase the level of intrusion into the private sphere, e.g. in case of dwelling-based monitoring systems, and whether the individual remains able to keep control in procedural and/or informational regard.

More practically, this is a little understood area of concerns as most implementations have not yet matured in terms of large scale applications. In any case, simplistic conceptions seem however misplaced here. As for instances suggested by evidence available from experimentation with video-telephony in the context of ambulatory elderly care, service recipients tend to be very sensitive in relation to privacy issues, but take a rather pragmatic approach to it when appreciating the benefits this technology is principally offering to them. Also, there is some evidence that family ties of care recipients may not necessarily weaken when external parties – possibly technology as well – take over some care functions. However, this is an area where not much reliable evidence is available yet, and which needs to receive much more research attention. Merely in relation to the use of ILTs to support people with dementia and their carers considerable attention has been given to ethical issues yet, prompted by the difficulties of informed consent from people with dementia and the possibility of conflicts of interest between those receiving and providing care. In this field expert guidelines have been developed to support ethically and socially appropriate usage of ILTs (c.f. www.astridguide.org).

All in all, the levels of utilisation of ILTs in care are not yet sufficient to draw any robust conclusions on what the overall social implications might be, positive or negative; a possible exception to this are the now quite widespread social alarm systems for older people in many countries. In this regard, the benefits for all seem well proven and it is instructive that there has been little if any voicing of concerns about negative social impacts by older people's organisations.

More macro-ethical issues arise in relation to wider up-take of ILTs particularly as regards equality of access to quality and preferred forms of care. This can be assumed to be an important issue on the future, as existing disparities in access to care between rich and poor older people may well widen in many countries. We must avoid the emergence of inequitable scenarios in this regard. One such scenario would be where ILTs were provided as an "extra" in addition to good quality human care for some (those who can afford it) but as a substitute for quality human care for others (those who cannot afford it). Another would be where, irrespective of the human care aspect, helpful ILTs were only available to those who could afford to pay for them themselves.

4.5.2 Market response

Diverse market structures and maturity levels

The ILT domain as defined for the purposes of this study comprises different ICT application fields, and a wide range of specific applications can be subsumed under each of these sub-domains. It may thus not come as a surprise that there is not a single market for ILTs. Rather different sub markets have - if at all - matured to a quite different extent, and a wide range of actors are involved.

In the AT domain a steadily increasing number of products has become available during the last decade, across Europe currently more than 20.000 products (not all involving an ICT component). Comparable data enabling an EU-wide quantification of actual usage is however not available. All in all, the specific market structures prevailing in the AT domain tend to negatively impact on both demand for and supply of state of the art ILTs. Most assistive technology products are produced in small series with the result of high price levels. Moreover, the market strongly lacks transparency due to the complexity of current delivery systems and processes. Lacking awareness of an offer, it seems very likely that many people principally in need of an AT do not express their demand. On the other hand, complex

distribution channels and the large number of very small manufacturers tend to hamper technology transfer from the research domain to the market.

In the smart home domain, despite considerable research effort to exploit smart home technology for the benefit of older people and people with disabilities, actual take up of networked houses or dwellings is however largely confined to experimental settings and demonstrators. Technologies and in particularly standards seem to have generally failed to create the right conditions for the growth of a mass market for smart home applications. The first Code of Practice expected to be available by the end of 2005 as part of the eEurope 2005 initiative may however give the smart home domain a critical push towards the development of marketable products. Also, more recent activities of large players from consumer electronics industry may contribute to the emergence of a commercial value chain along which home networking products and services may soon flow to the consumer. It seems however unlikely that those population segments that would most benefit - in terms of improved independence - from a commercial market for home networking products would be addressed by consumer electronics industry. This seems only likely if those actors typically working with dependent people (e.g. care service providers) where able to find a place within the emerging commercial value chain of home automation products.

In the tele-care domain/tele-medicine community alarms are by now the most widely available ILT application, although actual take-up varies considerably across countries. In the EU 15 Member States on average some 4% of the 50+ population do use such alarms. With a penetration level of some 16% the UK is the most advanced national market in the EU, followed by Ireland with some 7%. With respect to more advanced ILT implementations such as dwelling-based health monitoring, this domain represents an extremely complex and varied market environment. Despite extensive piloting in Europe and beyond, the potential more advanced applications generally hold in relation to improving care processes – e.g. in terms of higher quality of life for care recipients – is very likely not (yet) enough for the sustained success of ILT-based care services. Key hurdles for the wider diffusion include technical infrastructure, security and privacy issues as well as lacking standardization and business models. However, approaches of integrating well established ILT components into day-to-day community care practice that have recently evolved indicate that sustainable tele-care models seem to become possible, at least in a community care environment. Such schemes may soon be emulated if they prove able to deliver expected outcomes under routine conditions.

Huge potential demand for ILTs

All in all, the ILT domain has not yet matured in terms of a well established products that are widely available. Only few applications such as community alarms and AT devices are widely available today. Many ILT implementations exist only in experimental settings and levels of awareness what is possible tends to be low among potential target groups. It is thus not possible to assess actual levels of demand for most of the applications that have been enclosed in our analysis because these are hardly available on established markets yet. Nevertheless, when considering the number of older people for which the individual sub-domains are judged to be especially beneficial due to specific limitations they have huge potential demand can be observed. Based on demographic data available for potential beneficiary groupings potential demand can be assumed to reach a two digit million figure for each of the sub-domains concerned. In future, market potentials will dramatically rise due to the demographic development, particular among the older old. For instance, the potential demand among adults in the 50+ age range for tele-care applications capable of addressing the needs of people who are in treatment for heart diseases is estimated to nearly double between 2005 and 2050, from some 9 Mio to some 17 Mio. When only considering people aged 80 years an above the potential demand will even nearly triple, from 4 Mio to 11 Mio.

4.5.3 Policy implications

Policy implications that emerge from the hitherto analysis concern both risks and opportunities connected with wider technology take-up in the care and independent living domain. Opportunities for policy intervention do exist in various regards as summarized in Exhibit 4-18 overleaf. Core themes warranting attention in this context include:

- improving uptake of useful technologies that already exist,
- avoiding undesirable impacts of ILT uptake,
- harnessing the potentials offered by emerging technologies.

These are discussed in the following.

Improving uptake of technologies that are already available today

Clearly, a large number of polite implementations and small scale trials have shown that ILT can help to improve the quality of life of older people in need of care and support. This holds true for both rather low tech applications such as item locators and more complex systems such as remote provision of support and reassurance. Despite the fact that cost benefit dynamics in the ILT domain seem to be not well understood yet - particularly in cases where complex ICT systems and collaboration of various actors are involved - there are also encouraging signs that application of such technologies can also make sense in economic regard. On the other hand, Europe-wide actual take-up of principally useful technology is rather low even in case of applications where mature products and market structures have been existing for some time already, as for instance in the case of community alarms.

Against this background, there is a role for the EU in improving take-up of technologies that are already available today. There are several leverages that could be considered here. As demonstrated in the field of smart home technology, facilitating standardization process and interoperability of technology components/infrastructures is an important issue that needs to be tackled on the European level. Also, the EU can play a role in rising the level of awareness of what is possible already today with help of ILT, both among the older population and among actor groupings that are typically involved in catering for older people such as formal/informal care providers, health care/long-term care authorities and insurers. Here, promotion of identification and exchange of good practices are relevant issues, and promotion of ILT solutions as a catalyst for needs-driven seamless integration of typically separated care processes as well. Not at least, the scaling up of smaller technology trials that have yielded useful solutions are an important option in this regard. In relation to the latter co-funding of large-scale trials under real world conditions could be a suitable option, e.g. under existing RTD frameworks such as the eTEN program.

Further to this, there is a role for the European Union in pursuing socio-economic research enabling policy and market actors to better understand market dynamics and achievable outcomes in the ILT domain. Once it has been gained, such knowledge would also need to be brought to bear on relevant processes of policy formulation and coordination, e.g. the Open Method of Coordination (OMC) in the fields of health care and social inclusion.

Avoiding undesirable impacts of wider ILT take-up

Undesirable impacts of wider ILT take-up are not yet well understood. In particular, there is a need for better understanding the practical implications of ethical concerns that have been voiced in this regard, e.g. in relation to a possible de-humanization of life circumstances of people in need of support and in relation to self-determination and privacy issues. This is an area that needs to be given a lot more attention as the cost saving potential inherent to ILTs can be expected to increasingly come to the fore with the progressing demographic development. One way of tackling these issues would be to give ethical issues a prominent place in EU-level research programms, e.g. by explicitly addressing micro-ethical (e.g.

potential threats to privacy and dignity of dependent individuals) and macro-ethical impacts (equal access to quality care) of technology application in the care and independent living domain. Also, the promotion of quality standards or codes of good practice in relation to tele-care is an area of concerns that could be addressed by existing EU-level research and policy formulation/coordination processes.

Similarly, the EU can play a role in better understanding the risk of bad investment of public resources through pursuing socio-economic research enabling a more comprehensive understanding of the costs and benefits that may be associated with wider ILT take-up.

Harnessing the potentials offered by emerging technologies

Many technology applications in the ILT domain, as defined for the purposes of this study, are still at an experimental stage and can be expected to strongly benefit from mainstream technological innovation. Given the extent of the field and the frenetic pace of developments, continued efforts are required to exploit emerging technologies for the care and independent living purposes. The EU has been playing an important role in this for quite some time by giving this theme a prominent place in its subsequent research and technology development programs. Such efforts need to be continued with an increased emphasis on the importance of the independent living theme in all of the main fields of technological innovation. As the care and independent living domain – due to the variety of stakeholders that tend to be involved - constitutes a rather complex techno-economic environment for actual technology implementation, continued emphasis needs to be put on the involvement of key actor groupings (e.g. ICT industry, formal/informal carers, reimburses/insurers, older users) at the stage of RTD already.

Exhibit 4-18: Overview over policy and research priorities

Theme	Policy priorities	Research priorities
Improving uptake of available technologies	EU-driven support for the large-scale real-world trials that are now needed Promotion of technical standardisation and interoperability Increased emphasis on ICT potentials in the context of relevant policy formulation/coordination processes (e.g. the OMC process in the fields of health care and social inclusion) Promotion of needs driven integration of ICT-mediated health/care processes (e.g. seamless care) Promotion of good practice identification and exchange ICT-related awareness rising in the care and independent living domain Promotion of both “high-tech” and “low-tech” solutions Continued emphasis on overcoming market fragmentation in the assistive technology domain	Co-funding under the eTEN and RTD programmes for large-scale, real-world trials of what seems to work well from smaller scale pilots and projects Socio-economic research enabling policy and public/private market actors to better understand market dynamics and potentials Promotion of applied technology research and uptake measures in relation to the care and independent living domain (e.g. in the framework of the RTD and eTEN programmes or articles 169/171 of the European treaty)

Overview over policy and research priorities (continuation)

Theme	Policy priorities	Research priorities
Avoiding undesirable impacts	Attention to ethical issues Promotion of quality standards or codes of good practice in relation to telecare	Socio-economic research to enable a better understanding of micro-ethical impacts of technology application in the care and independent living domain (e.g. potential threats to privacy and dignity of the dependent individual) Socio-economic research to enable a better understanding of macro-ethical impacts of technology application in the care and independent living domain (e.g. potential prioritisation of younger age cohorts in relation to human care) Socio-economic research to enable a comprehensive understanding of costs and benefits that may come with increasing technology application in the care and independent living domain
Harnessing the potential offered by emerging technologies	Increased emphasis on the importance of attention to this field in all of the main fields of technological innovation (including basic research, technology watch and technology transfer to support this field)	Continued RTD efforts to exploit emerging technologies for care and independent living purposes under the framework of relevant RTD programmes (e.g. the IST programme) or under articles 168/171 of the European treaty Socio economic research to better understand in which way needs that come with the ageing process threaten independence and the benefits ICTs may hold in this regard. Continued emphasis on the involvement of key actors groupings (e.g. ICT industry, formal/informal carers, financing/reimbursement bodies, older end users) in the RTD process

5 Conclusions

On the basis of the evidence and analysis presented in the report it can be concluded that ICTs and the emergence of the Information Society present both challenges and opportunities in the context of the demographic ageing of the European population.

Only a minority of older people are actively engaging in the Information Society today and this age-divide should be a matter of real concern to policy. It means that older people are not gaining the benefits of online services and applications that have high potential utility for them and are also facing new risks because important services are increasingly *only* available online. For these reasons it is important that reinforced attention is given to reducing the age-divides in engagement in the Information Society but also that much more attention is given to counteracting the potential negative impacts of such divides. It is neither appropriate nor realistic to try to push all older people online, so substantial efforts will be needed to ensure that those who are not online are not left behind in access to services and to wider civic participation.

As regards work and employment, the evidence suggests that ICTs present both risks and opportunities for work-related active ageing. Increased opportunities for access to good quality ICT-related jobs could make a substantial contribution to the achievement of EU employment targets for older workers as well as providing better quality of work and the possibility of better work-life balance for older workers. However, there is a danger that without policy intervention these benefits may accrue only for those older workers who are already in advantaged positions, those who are better educated and with good quality and well-remunerated jobs already. Therefore, a key dimension of the policy response will need to focus on equality of opportunity and on how to create the conditions whereby older workers (and potential workers) facing less advantageous circumstances can be enabled to benefit from ICTs in the workplace. Equality considerations are also central in relation to the design of ICTs that are used in the workplace. At present, many features of ICTs can make them inaccessible or difficult to use for older workers and this issue must be taken up in employment equality, public procurement and other relevant legislation and practice.

As regards ICTs in support of independent living and care, it is clear that there is a very large unrealised potential to address the care challenges posed by demographic ageing. The innovation processes that are needed to bring technological developments from RTD through to widespread take-up and deployment, by health and care services and by older consumers themselves, are not functioning effectively at present. These innovation and supply chain failures need to be given a lot more policy attention. There are also a number of social and ethical dimensions that require more research and policy attention. In-depth examination is needed of the relative cost-benefit, service quality and quality-of-life merits of technology-based care as opposed to human care services. A priority must be to avoid the risks of widening, income-related inequalities amongst the older population in access to quality ICT-related and human care.

Overall it is clear that market forces alone will not ensure that the outcomes from the intersections between demographic ageing and ICT developments will be optimal for older people and for European society as a whole. Public policy will be required that helps to shape developments in the ways that are needed to exploit the positive potential and reduce the likelihood of negative impacts.

Literature

AAATE- Association for the Advancement of Assistive Technology in Europe (2003): A 2003 view on Technology and Disability. AAATE position paper. Tåstrup.

AARP- American Association of Retired Persons (2003): Older, wiser, wired. Washington, DC.

Abagiu, M., Gál, R., Mogyorósy, Z., Noncheva, T., Prevolnik-Rupel, V., Rebolj, M., Satcheva, D., Stanovnik, T., Stropnik, N., Szende, A., Szivós, P. and M. Vilnoiu (2005): Social Protection in the Candidate Countries. Country Studies Bulgaria, Hungary, Romania, Slovenia. Gesellschaft für Versicherungswissenschaft und -gestaltung e.V.. Köln.

Access4Inclusion (2005): Thematic Study to Analyse Policy Measures to Promote Access to Information Technologies as a Means of Combating Social Exclusion. Main Report (draft version 1). Bonn.

Adaman, F., Abela, A., Azzopardi, N., Cordina, G. and P. Pashardes (2003): Social Protection in the Candidate Countries. Country Studies Cyprus, Malta, Turkey. Gesellschaft für Versicherungswissenschaft und -gestaltung e.V.. Köln.

Adler, R. (2002): Age wave meets the technology wave: Broadband and older Americans. SeniorNet, San Francisco, CA.

AGE- The European Older People's Platform (2005): Special Briefing: The Green Paper "Confronting Demographic change: a new solidarity between the generations. AGE briefing.

AgeConcern (2002a): IT, Internet and Older People. Survey conducted by ICM for AgeConcern. Management summary. Online available at: http://www.ageconcern.org.uk/AgeConcern/staying_250.htm (accessed August 2005).

AgeConcern (2002b): Internet turns on men and women in different ways - new survey reveals. Press release, 21 August, 2002. Online available at: http://www.ageconcern.org.uk/AgeConcern/News_584.htm (accessed August 2005).

Alber, J. and M. Schölkopf (1997): Seniorenpolitik. Die soziale Lage älterer Menschen in Deutschland und Europa. Amsterdam.

Allen, B., Ekberg, J. and J. Willems (1995): Smart Houses- How can they help people with disabilities? In: Roe, P.R.W. (ed.): Telecommunications for All, pp.158-172. Brussels.

Alonso, A. (2004): A new model for home care for COPD. Studies in Health Technology and Informatics 103, pp.368-373.

Andersen-Ranberg, K., Christensen, K., Petersen, I. and J.-M. Robine (2005): Who are the Oldest-Old? In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.35-40. Mannheim.

Ando, Y. et al (2000): Tele-Consultation Using SHD Image for Radiation Therapy. In: German-Japanese Cooperation Council for Hightech and Environmental Technology: Health Telematics for the Elderly. German-Japanese Workshop, pp.99-114. Dagstuhl.

Andrich, R. (2000): SCAI Instrument: Measuring Costs of Individual Assistive Technology Programmes. Online available at: http://www.siva.it.

Anliker, U., Ward, J. A., Lukowicz, P., Troster, G., Dolveck, F. et al. (2004): AMON: A wearable multiparameter medical monitoring and alert system. IEEE Transactions on Information Technology in Biomedicine 8(4), pp.415-427.

Arend, M. and P. Steiner (2003): SEAMATE (socio-economic analysis and macro-modelling of adapting to information technology in Europe). Workpackage No. 3 "Societal Impacts of ICT", D3.3. Zurich.

Aro, A., Avendano, M., and J. Mackenbach (2005): Health Behavior. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.102-107. Mannheim.

ARRHENIUS, V., EKBERG, J., FELLBAUM, K., PEREIRA, L., ROE, P. and M. SOEDE (2000): Development in Telematics Research for Disabled and Older People between 1989 and 2001. In: ROE, P.R.W.: Bridging the Gap? Access to Telecommunications for all People, pp.56-74. Lausanne.

ATTIAS-DONFUT, C., OGG, J. and F.-C. WOLFF (2005a): Family Support. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.171-178. Mannheim.

ATTIAS-DONFUT, C., OGG, J. and F.-C. WOLFF (2005b): Financial Transfers. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.179-185. Mannheim.

AUD, M., DEMIRIS, G., MAREK, K., RANTZ, M., TYRER, H., SKUBIC, M. and A. HUSSAM (2004): Older adults attitudes towards and perceptions of "smart home" technologies: A pilot study. Medical Informations and the Internet in Medicine 29 (2), pp.87-94.

AUDIT COMMISSION FOR LOCAL AUTHORITIES AND THE NATIONAL HEALTH SERVICE IN ENGLAND AND WALES (2004a): Assistive Technology. London.

AUDIT COMMISSION FOR LOCAL AUTHORITIES AND THE NATIONAL HEALTH SERVICE IN ENGLAND AND WALES (2004b): Assistive technology. Independence and well-being. Online available at: http://www.audit-commission.gov.uk/Products/NATIONAL-REPORT/BB070AC2-A23A-4478-BD69-4C19BE942722/NationalReport_Final.pdf (accessed August 2005).

AUDIT COMMISSION FOR LOCAL AUTHORITIES AND THE NATIONAL HEALTH SERVICE IN ENGLAND AND WALES (2004c): Older people - independence and well being. The Challenge for public services. Online available at: http://www.audit-commission.gov.uk/Products/NATIONAL-REPORT/1462310B-E6F1-448e-9e59-4A9FF9480F45/OlderPeople_overarch.pdf (accessed August 2005).

AUSTRALIAN BUREAU OF STATISTICS (2001): Use of the Internet by Householders, Australia. Canberra.

AUSTRIAN CHAMBER OF COMMERCE/WIFI (1997): Der Gast 50+. Handbuch für den touristischen Anbieter. Wien.

AVENDANO, M., ARO, A. and J. MACKENBACH (2005a): Socio-Economic Disparities in Physical Health in 10 European Countries. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.89-94. Mannheim.

BAKOS, Y. (1998): The Emerging Role of Electronic Marketplaces on the Internet. Communications of the ACM 41(8), pp.35-42.

BALL, M.J. et al. (2000): Health informatics: Managing Informations to deliver Value. Medinfo 10(1), pp.305-308.

BALLABIO, M. and R. MORAN (without date): Die Bedürfnisse und Fähigkeiten von älteren Menschen in der Informationsgesellschaft. Ein F&E Konzept für die Europäische Union. DGXIII: Telecommunications, Information market and Exploitation of Research.

BARCELONA EUROPEAN COUNCIL (2002): Presidency Conclusions.

BATES, D.W., HOBBS, J., JAGGANNATH, Y.S., KITTLER, A., MIDDLETON, B., PIZZIFERRI, L., VOLK, L.A. and J. WALD (2003): Opportunities to enhance patient and physician e-mail contact. Medinfo 70 (1), pp. 1-9. Online available at: http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieveanddb=PubMedandlist_uids=22593109anddopt=Abstract (accessed on August 2005).

BBC (2005): Technology 'baffles old and poor'. Online available at: http://news.bbc.co.uk/2/hi/technology/4540595.stm (accessed August 2005).

BELL, D. (1975): Die nachindustrielle Gesellschaft. Frankfurt/New York.

BENNEWITZ, M., BURGARD, W. and S. THRUN (2002): Learning Motion Patterns of Persons for Mobile Service Robots. ICRA 2002, pp. 3601- 3606.

BERGMANN, K., HEUWINKEL, D. and H.J. KUJATH (1996): Entwicklung des Wohnens und Wohnumfelds älterer Menschen bis zum Jahr 2030. In: ENQUETE- KOMMISSION "DEMOGRAPHISCHER WANDEL" DES DEUTSCHEN BUNDESTAGS: Herausforderungen unserer älter werdenden Gesellschaft an den einzelnen und die Politik, Studienprogramm, pp.619-828. Heidelberg.

BIELLI, E., CARMINATI, F., LA CAPRA, S., LINA, M., BRUNELLI, C. and M. TAMBURINI (2004): A wireless health outcomes monitoring system (WHOMS): Development and field testing with cancer patients using mobile phones. BMC Medical Informatics and Decision Making 4 (1), 7.

BISER (2003): Work in the Information Society- the Regional Dimension. BISER Domain Report No 7. Brussels/Bonn 2004.

BLANCHET, D., BRUGIAVINI, A. and R. RAINATO (2005): Pathways to Retirement. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.246-252. Mannheim.

BLS- US DEPARTMENT OF LABOR- BUREAU OF LABOR STATISTICS (2002): Computer and internet use at work in 2001. BLS NEWS, October 23.

BLS- US DEPARTMENT OF LABOR- BUREAU OF LABOR STATISTICS (2004): US employment and labour force statistics. Online available at http://www.bls.gov (accessed August 2005).

BOASE, J. and B. WELLMAN (2006) (in print): Personal relationships, on and off the internet. In D. PERLMAN and A. VANGELISTI (eds.): Handbook of personal relations. Cambridge.

BÖHNE, A. and D. WAGNER (2002): Managing Age im Rahmen von Managing Diversity – Alter als betriebliches Erfolgspotenzial. In: Behrend, Christoph (eds.): Chancen für die Erwerbsarbeit im Alter. Betriebliche Erwerbsarbeit und ältere Erwerbstätige, pp. 33–46. Opladen.

BÖRSCH-SUPAN, A. (2005): Work Disabilities and Health. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.253-258. Mannheim.

BONSANG, E., PERELMAN, S. and K. VAN DER BOSCH (2005): Income, Wealth and Consumption Inequality. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.325-331. Mannheim.

BORCHELT, M., GILBERG, R., HORGAS, A.L and B. GEISELMANN (1996): Zur Bedeutung von Krankheit und Behinderung im Alter In: MAYER, K.U. and P.B. BALTES (eds.): Die Berliner Altersstudie: das höhere Alter in interdisziplinärer Perspektive, pp.449-474. Berlin.

BORGHANS, L. and B. TER WEEL (2002): Do older workers have more trouble using a computer than younger workers? Research Centre for Education and the Labour Market. Faculty of Economics and Business Administration. Maastricht.

BOURN, J. (2003): Progress in making e-services accessible to all - encouraging use by older people. National Audit Office, London.

BOWES, A. and G. MCCOLGAN (2002): Pilot evaluation of 'Opening Doors for Older People' in 'wired' West Lothian- Report to West Lothian Council. Stirling.

BOWES, A. and G. MCCOLGAN (2003): Housing with care: the first new-build development in West Lothian. Interim Report September 2003. Stirling.

BOWES, A. and G. MCCOLGAN (2005): Smart technology at home: users' and carers' perspective. Interim report February 2005. Stirling.

BRADLEY, N. and W. POPPEN (2003). Assistive technology, computers and internet may decrease sense of isolation for homebound elderly and disabled persons. Technology and Disability 15(1), pp. 19-25.

BRADLEY, D., JACK, N., LEVY, S., MORISON, M. and M. SWANTSON (2003): Perspectives on Telecare: The Client View. Journal of Telemedicine and Telecare 9, pp.156-160.

BRATAN, T., JONES, R., and M. CLARKE (2004): A new monitoring service for long term residential care. Studies in Health Technology and Informatics 103, pp.374-380.

BREEDVELD, K. and A. VAN DEN BROEK (eds.) (2001): Trends in de tijd, een schets van recente ontwikkelingen in tijdsbesteding en tijdsordening. den Haag.

BREIMESSER, F. (2000): Rehabilitation Telematics for the Elderly. In: GERMAN-JAPANESE COOPERATION COUNCIL FOR HIGHTECH AND ENVIROMENTAL TECHNOLOGY: Health Telematics for the Elderly. German-Japanese Workshop, pp.87-98. Dagstuhl.

BRITISCH DEPARTMENT OF HEALTH (2005): Telecare. London.

BROWNING, M. and E. MADSEN (2005): Consumption. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.318-324. Mannheim.

BRUGIAVINI, A., CRODA, E. and F. MARIUZZO (2005): Labour Force Participation of the Elderly: Unused Capacity? In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.236-240. Mannheim.

BRUNNER, J., RIESS, C. and R. WINTER-EBMER (2005): Public and Private Pension Claims. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.241-245. Mannheim.

BUCK, H. and B. DWORSCHAK (eds.) (2003): Ageing and work in Europe - strategies and company level and public polices in selected European countries. Booklet Series "Demography and Employment". Stuttgart.

BUCK, H., KISTLER, E. and H.G. MENDIUS (2002): Demographic chance in the world of work - Opportunities for an innovative aproach to work, a german point of view. Booklet Series "Demography and Employment". Stuttgart.

BÜHLER, C. (2000): Assistive Technology Market and Research. Presentation in 2000. Online available at: http://www.acesso.umic.pcm.gov.pt/abril2000/CBuhler.ppt (accessed August 2005).

BÜHLER, C. and H. KNOPS (1997): Assistive Technology on the Threshold of the New Millennium. Assistive Technology Research Studies 6. Amsterdam, Berlin, Oxford, Tokyo, Washington.

BÜLLINGEN, F. and P. STAMM (2001): Entwicklungstrends im Telekommunikationssektor bis 2010. Studie des Wissenschaftlichen Institut für Kommunikationsdienste, GmbH. Bad Honnef.

BUTLER, R.N. (1997): Population aging and health. BMJ 315, pp. 1082- 1084. Online available at: http://bmj.bmjjournals.com/cgi/content/full/315/7115/1082 (accessed July 2005).

CAMBOIS, E., CHAPLAIN, E., JACOBZONE, S. and J.M. ROBINE (1998): The Health of Older Persons in OECD Countries: Is it improving fast enough to compensate for Population Aging? Labour Market and Social Policy - Occasional Papers No. 37. Organisation for Economic Cooperation and Development. Paris.

CARDENAS, A., DIAZ-CARDAMA, A., FERRER-ROCA, O. and P. PULIDO (2004): Mobile Phone Text Messaging in the Management of Diabetes. Journal of Telemedicine and Telecare 10 (5), pp.282-285.

CASTELLS, M. (2000a): Vol.1: The Rise of the Network Society. Blackwell. Oxford, Malden.

CASTELLS, M. (2000b): Vol.3: End of Millennium. Blackwell, Oxford, Malden.

CASTELLS, M. (2004): Vol.2 : Power of Identity. Blackwell, Oxford, Malden.

CASTELLS, M. and P. HIMANEN (2002): The information Society and the Welfare State - The Finnish Model. Helsinki.

CAVE, J. and C. PANIS (1996): Health Care Costs in Aging Population. RAND Europe, Study for the European Commission, DG V, pp. II-36.

CEC- COMMISSION OF THE EUROPEAN COMMUNITIES (1994): Europe and the global information society - Recommendations to the European Council ["Bangemann Report"], Luxembourg.

CEC- COMMISSION OF THE EUROPEAN COMMUNITIES (1999): Towards a Europe for all ages - Promoting Prosperity and intergenerational solidarity. Brussels. COM(1999) 221 final.

CEC- COMMISSION OF THE EUROPEAN COMMUNITIES (2000a): eEurope. An information society for all. Communication on a Commission Initiative for the Special European Council of Lisbon. Luxembourg.

CEC- COMMISSION OF THE EUROPEAN COMMUNITIES (2000b): Eurobarometer. Report Number 53. Brussels.

CEC- COMMISSION OF THE EUROPEAN COMMUNITIES (2001): Benchmarking Report following up the 'Strategies for jobs in the Information Society'. Brussels. SEC(2001) 222.

CEC- COMMISSION OF THE EUROPEAN COMMUNITIES (2002a): Europe's Response To World Ageing. Promoting economic and social progress in an ageing world. A contribution of the European to the 2nd World Assembly on Ageing. Brussels.

CEC- COMMISSION OF THE EUROPEAN COMMUNITIES (2002b): Employment in Europe 2002 - Recent trends and prospects. Luxembourg.

CEC- COMMISSION OF THE EUROPEAN COMMUNITIES (2002c): Information Society jobs - quality for change - Exploiting the Information Society's contribution to managing change and enhancing quality in employment. Commission Staff Working Document SEC(2002) 372.

CEC- COMMISSION OF THE EUROPEAN COMMUNITIES (2002d): Final Report Requirements and Options for future European Research and technological Development in the area of "eAccessibility for All".

CEC- COMMISSION OF THE EUROPEAN COMMUNITIES (2002e): Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions: Commission's Action Plan for skills and mobility. COM(2002) 72 final.

CEC- COMMISSION OF THE EUROPEAN COMMUNITIES / WHO REGIONAL OFFICE FOR EUROPE (2002f): Health Status Overview for Countries of Central and Eastern Europe that are candidates for accession to the European Union. Copenhagen.

CEC- COMMISSION OF THE EUROPEAN COMMUNITIES (2002g): Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions "eEurope 2005: An information society for all. COM(2002) 263 final.

CEC- COMMISSION OF THE EUROPEAN COMMUNITIES (2003a): The Stockholm and Barcelona targets: Increasing employment of older workers and delaying the exit from the labour market. Commission Staff Working Paper, SEC 2003 429.

CEC- COMMISSION OF THE EUROPEAN COMMUNITIES (2003b): Access to Assistive Technology in the European Union.

CEC- COMMISSION OF THE EUROPEAN COMMUNITIES (2003c): The social situation in the European Union. Luxembourg.

CEC- COMMISSION OF THE EUROPEAN COMMUNITIES (2003d): The health status of the European Union. Narrowing the health gap. Luxembourg.

CEC- COMMISSION OF THE EUROPEAN COMMUNITIES (2004a): The social situation in the European Union. Luxembourg.

CEC- COMMISSION OF THE EUROPEAN COMMUNITIES (2004b): eHealth- making healthcare better for European citizens: An action plan for a European e-Health Area. Brussels. COM(2004) 356.

CEC- COMMISSION OF THE EUROPEAN COMMUNITIES (2004c): Reporting from the inclusive Communications (INCOM) Group. Brussels.

CEC- COMMISSION OF THE EUROPEAN COMMUNITIES (2004d): Communication from the Commission to the Council, the European Economic and Social Committee and the Committee of the Regions: Increasing the employment of older workers and delaying the exit from the labour market. COM(2004) 146 final.

CEC- COMMISSION OF THE EUROPEAN COMMUNITIES (2004e): The employment and social cohesion aspects of health in the knowledge society. Commission Staff Working Paper, SEC 2004.

CEC- COMMISSION OF THE EUROPEAN COMMUNITIES (2005a): Communication from the Commission: Green Paper "Confronting demographic change: a new solidarity between the generations". COM(2005) 94 final.

CEC- COMMISSION OF THE EUROPEAN COMMUNITIES (2005b): Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions "i2010- A European Information Society for growth and employment". COM(2005) 229 final.

COMMISSION OF THE EUROPEAN COMMUNITIES (2005c): Communication from the Commission on the Social Agenda. COM(2005) 33 final.

CEC- COMMISSION OF THE EUROPEAN COMMUNITIES (2005d): eInclusion revisited: The Local Dimension of the Information Society. Commission Staff Working Document. SEC 2005 206.

CEC- COMMISSION OF THE EUROPEAN COMMUNITIES (2005e): Communication from the Commission to the Council, the European Economic and Social Committee and the Committee of the Regions: eAccessibility. COM(2005)425 final. SEC(2005)1095.

CEC- COMMISSION OF THE EUROPEAN COMMUNITIES (N.Y.):Towards a Society for all Ages. Conference Paper.

CENTER FOR AGEING SERVICES TECHNOLOGIES (2003): Progress and Possibilities- State of Technology and Ageing Services. Online available at: http://www.agingtech.org/documents/2003CAST_WhitePaper.pdf (accessed August 2005).

CHARALAMBAKIS, D., SAMIOTAKIS, Y. and L. SASSON (2000): Computerised coordinated care system in the RISE project. Studies in Health Technology and Informatics 57, pp.130-136.

CHEVROU-SEVERAC, H., HOLLY, A., LAMIRAUD, K. and T. YALCIN (2005): Out-of-Pocket Payments for Health Care Expenditure. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.126-132. Mannheim.

CHONG, S.K., MOORE, P.R., PU, J. and C.B. WONG (2004): Review of Delivery of Health Care using Computing Technologies in the Home (MEDI-AID). Leicester. Online available at: http://www.nextwave.org.uk/downloads/mediaid_jan04.pdf (accessed August 2005).

CHRISTELIS, D. JAPPELLI, D. and M. PADULA (2005): Wealth and Portfolio Composition. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.310-317. Mannheim.

CLARKE, K., DEWSBERRY, G., EDGE, M., ROUNCEFIELD, M., SOMMERVILLE, I. and B. TAYLOR (2003): Designing acceptable smart home technology to support people in the home. Online available at: http://www.dirc.org.uk/publications/articles/papers/58.pdf#search='support*informal*carer*technology' (accessed August 2005).

CLARKE, K., DEWSBERRY, G., ROUNCEFIELD, M. and I. SOMMERVILLE (2001): Bringing IT into the Home. Online available at: http://www.comp.lancs.ac.uk/computing/research/cseg/projects/dirc/index.htm (accessed August 2005).

COHILL, A., and A. KAVANAUGH (1997): Community networks: lessons from Blacksburg, Virginia. Norwood, MA.

COMPTROLLER and AUDITOR GENERAL (2003): Progress in making e-services accessible to all - encouraging use by older people. London.

CONISBEE, M., Kjell, P., ORAM, J. BRIDGES PALMER, J., SIMMS, A. and J. TAYLOR (2004): Clone Town Britain. London.

CONSTANTELOEU and, A. and S. ZAMBARLOUKOS (2002): "Civilising" Technologies in Healthcare Provision: Experiences and Prospects for Europe. STAR (Socio-Economic Trends assessment for the Digital Revolution) Issue Report No.31, June 2002.

COOMANS, G. (2000): Die Alterung der arbeitenden Bevölkerung in Europa. Fragen und Prioritäten. In: Bullinger, H.-J. (Hrsg.): Zukunft der Arbeit in einer alternden Gesellschaft, pp. 48-62. Stuttgart.

COOMANS, G. (2004): GeoLabour Projection- Atlas of Prospective Labour Supply. Brussels.

CORDER, L., MANTON, K.G. and E. STALLARD (1997): Chronic Disability Trends in Elderly United States Population, 1981-1994. Proceedings of the National Academy of Science 94, pp.2593-2598.

CORNAZ, S., SANTOS-EGGIMANN, B. and J. JUNOD (2005a): Health Service Utilisation in Older Europeans. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.133-140. Mannheim.

CORNAZ, S., SANTOS-EGGIMANN, B. and J. JUNOD (2005b): Quality of Health Care Delivered in Older Europeans. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.141-149.

CORNFORD, T. and E. KLECUN-DABROWSKA (2001): Evaluating Telehealth: The Search for an Ethical Perspective. Cambridge Quarterly of Healthcare Ethics 10 (2), pp. 161- 169.

CORNFORD, T. and E. KLECUN- DABROWSKA (2002): Ethical Perspectives in Evaluation of Telehealth. London.

COUNCIL FOR PUBLIC HEALTH AND HEALTH CARE (2004): The preferences of healthcare customers in Europe. Zoetemeer.

CRABBE, H., BARBER, A., BAYFORD, R., HAMILTON, R., JARRETT, D., and N. MACHIN (2004): The use of a european telemedicine system to examine the effects of pollutants and allergens on asthmatic respiratory health. Science of the Total Environment 334-335, pp.417-426.

CRAIG, J. and B. GREENHILL (2005): Beyond Digital Divides? The Future for ICT in Rural Areas. Wetherby.

CRODA, E, and J. GONZALES-CHAPELA (2005): How Do Older European Adults Use Their Time? In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp. 265-271. Mannheim.

CULLEN, K. and N. CLARKIN (1994) Working and caring: opportunities and social issues raised by technologies. Working paper. European Foundation for the Improvement of Living and Working Conditions.

CULLEN, K., DELANEY, S. and P. DUFF (2004) Caring, working and public policy. Equality Research Series. Equality Authority. Dublin.

CULLEN, K. and R. MORAN (1992): Technology and the elderly. The role of technology in prolonging the independence of the elderly in the community care context. FAST research report for DG RTD. Luxemburg.

CULLEN, K. and S. ROBINSON (1997): Telecommunications for older people and disabled people in Europe. Assistive Technology Research Series, Volume 2. Amsterdam, Berlin, Oxford, Tokyo, Washington.

CURRELL, R., URQUHART, C., WAINWRIGHT, P. and R. LEWIS (2000): Telemedicine versus face to face patient care: Effects on professional practice and health care outcomes. Cochrane Database Syst Rev.2000;(2):CD002098. Review.

CURRIE, K. and G. HELLSTRÖM (1995): Text Telephony and relay Services. In: ROE, P.R.W. (ed.): Telecommunications for All, pp.91-109. Brussels.

CURRY, R., TINOCO, M. T. and D. WARDLE (2002): The use of information and communication technology to support independent living for older and disabled people. Report prepared for the Dept. Of Health. London.

CURRY, R., TINOCO, M.T. and D. WARDLE (2003): Telecare: Using Information and Communication Technologies to Support independent Living by Older, Disabled and Vulnerable People. London.

CUTLER, S. J., HENDRICKS, J. and A. GUYER (2003): Age differences in home computer availability and use. Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 58B(5), pp. 271-280.

CZAJA, S. and P. MOEN (2004) Technology and employment. In: Technology for adaptive ageing. National Research Council of the National Academies. Online available at: http://www.nap.edu/catalog/10857.html (accessed July 2005).

DASDA- DISSEMINATION ACTIVITY SUPPORTING DESIGN-FOR-ALL (2001) Report on user requirements and design-for-all information. Online available at: http://www.design-for-all.info (accessed August 2005).

DEMIRIS, G., RANTZ, M., AUD, M., MAREK, K., TYRER, H., SKUBIC, M. et al. (2004): Older adults' attitudes towards and perceptions of "smart home" technologies: A pilot study. Medical Informatics and the Internet in Medicine 29(2), pp.87-94.

DEPALLO, M. (2000): National Survey on Consumer Preparedness and E-Commerce: A Survey of Computer Users Age 45 and Older. Washington, DC: Online available at: http://assets.aarp.org/rgcenter/consume/ecommerce.pdf (accessed August 2005).

DEPARTMENT FOR WORK AND PENSIONS (2003): Factors affecting the labour market participation of older workers. Research Report No. 200. Online available at: http://www.dwp.gov.uk/asd/asd5/rports2003-2004/rrep200.asp (accessed August 2002)

DEVOLDERE, P.: Videotelephony in Home-based TeleCare Services- a practical example from Kortrijk. Presentation at the Silver Economy in Europe Conference on 16./17. February 2005 in Bonn, Germany.

DEVON, M.H. (2005): Consumer Driven Health Care: The Changing Role of the Patient. National Center for Policy Analysis Study No. 276, May 2005. Online available at: www.ncpa.org/pub/st/st276/ (accessed August 2005).

DEWEY, M. and M. PRINCE (2005a): Mental Health. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.108-117. Mannheim.

DEWEY, M. and M. PRINCE (2005b): Cognitive Functions. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.118-125. Mannheim.

DEWSBERRY, G. and H.M. EDGE (2000): Designing the Home to Meet the Needs of Tomorrow... Today: Deconstructing and rebuilding the home for life. Paper presented at the ENHR 2000 Conference in Gävle.

DEWSBERRY, G., SOMMERVILLE, I., ROUNCEFIELD, M. and K. CLARKE (2002): Bringing IT to the Home.

DEWSBERRY, G., TAYLOR, B.J. and H.M. EDGE (2002): Designing dependable assistive technology systems for vulnerable people. Health Informatics Journal 8, pp.104-110.

DEWSBERRY, G., K. CLARKE, M. ROUNCEFIELD, I. SOMMERVILLE, B. TAYLOR and M. EDGE (2004): Designing acceptable 'smart' home technology to support people in the home. Technology and Disability 15 (3), pp. 191-201.

DHONDT, S., KRAAN, K. and G. VAN SLOTEN (2002): Work organisation, technology and working conditions. Dublin.

DISABILITY RIGHTS COMMISSION (2004): The Web. Access and Inclusion for Disabled People. London. Online available at: http://www.drc-gb.org/publicationsandreports/2.pdf (accessed October 2005).

DRUMMOND, M. F., O'BRIEN, B., STODDART, G. L., and G.W. TORRANCE (1997). Methods for the economic evaluation of health care programmes.. Oxford.

DUCATEL, K. and BURGLEMAN, J.C. (1999) Employment Map. A report from the Future Project. IPTS: Seville.

DUCATEL, K., WEBSTER, J. and W. HERRMANN (2000): The Information Society in Europe. Work and Life in an Age of Globalization. Oxford.

DUTCH MINISTRY OF HEALTH, WELFARE AND SPORT (2004): Health Care in an Ageing Society. The Hague.

E-BUSINESS W@TCH (2003a): ICT and e-Business in the Health and Social Services Sector. Sector Report No 7II.

E-BUSINESS W@TCH (2003b): Electronic Business in the Health and Social Services Sector. Sector Report No 10-II.

E-BUSINESS W@TCH (2003c): Electronic Business in the Health and Social Services Sector. Final Report No 10-I.

E-BUSINESS W@TCH / COMMISSION OF THE EUROPEAN COMMUNITIES (2004): The European E-Business Report 2004. A portrait of e-business in 10 sectors of the EU economy. Luxembourg.

EKBERG, J., ABASCAL, J., FELLBAUM, K., PEREIRA, L. and P.R.W. ROE (2001):General Overview of Situation between 1989 and 2001. In: P.R.W. ROE: Bridging the Gap? Access to Telecommunications for all People, pp. 18-35. Lausanne.

EMCC- EUROPEAN MONITORING CENTRE ON CHANGE (2005a): Inclusion of ageing workers. Four company case example. Online available at: http://www.emcc.eurofound.eu.int/content/source/eu04009ahtml?p1=ef_publication&p2=null (accessed August 2005).

EMCC- EUROPEAN MONITORING CENTRE ON CHANGE (2005b): The workplace of the future – managing the challenge of an ageing workforce. Online available at: www.emcc.eurofound.eu.int (accessed August 2005).

EMPIRICA (1992): Der Haus-Tele-Dienst in Frankfurt am Main-Westhausen. Projektbericht. Kuratorium Deutsche Altershilfe. Köln.

EMPIRICA (1995): Unveröffentlichter Projektbericht "TeleCommunity". Bonn.

EMPIRICA and WRC (2000a) Study on the telecommunications needs of the healthcare sector and possible implications for universal service. Bonn, Dublin.

EMPIRICA and WRC (2000b): Study on the Use of Advanced Telecommunications Services by Health Care Establishments and possible Implications for Telecommunications Regulatory Policy of the European Union. SATS Final Report. Bonn, Dublin.

EINCLUSION@EU (2004): Strengthening eInclusion and eAccessibilty across Europe. D1.1. Analytic framework - eInclusion and eAccessibility priority issues.

ENGELEN, J. (2002): Sm@rt on Tour - Introduction of DfA (Design for All). Online available at: http://canada.asat.kuleuven.ac.be/docarch/smart/EU_seminar_Engelen.pdf (accessed August 2005).

ENGLAND, R. S. (2001): The Fiscal Challenge of an Aging Industrial World. Washington D.C.

ENGLESAKIS, M., EYSENBACH, G., POWELL, J., RISZO, C.and A. STERN (2004): Health related virtual communities and electronic support groups: Systematic review of the effects of online peer interactions. BMJ 328, pp.1166-1170.

EOS GALLUP EUROPE (2002): Flash Eurobaromter 135- Internet and the Public at Large. Online available at: http://europa.eu.int/comm/public_opinion/flash/fl135_en.pdf (accessed August 2005).

ERKERT, T. (2000): Virtual Nursing Home Concepts in Germany. In: GERMAN-JAPANESE COOPERATION COUNCIL FOR HIGHTECH AND ENVIRONMENTAL TECHNOLOGY: Health Telematics for the Elderly. German-Japanese Workshop, pp.59-70. Dagstuhl.

ERKERT, T. and J. SALOMON (eds.) (1997): Abschlussbericht Hausteledienst der AG 5. Bonn.

ERKERT, T. (2000): Virtual Nursing Home Concepts in Germany. In: GERMAN-JAPANESE COOPERATION COUNCIL FOR HIGHTECH AND ENVIRONMENTAL TECHNOLOGY: Health Telematics for the Elderly. German-Japanese Workshop, pp.71- 78. Dagstuhl.

ERKERT, T. (1995): Moderne Techniken im unterstützenden Einsatz in der ambulanten Versorgung- Möglichkeiten und Grenzen der Technik. In: empirica (ed.): Neue Wege in der Betreuung älterer und behinderter Menschen. Bonn, Frankfurt a.M. 1995, pp. 59- 73.

ERLINGHAGEN, M. and K. HANK (2005): Volunteer Work. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.259-264. Mannheim.

E-SKILLS FORUM (2004): Synthesis Report. Online available at http://www.eskills2004.org (accessed August 2005).

ESTO-STUDY (2003): Science and Technology Roadmapping: Ambient Intelligence in Everyday Life (Aml @ Life). Karlsruhe, Seville.

ETSI (2002): Human Factors (HF); Guidelines for ICT products and services "Design for all". Sophia Antipolis Cedex. Online available at: http://portal.etsi.org/docbox/EC_Files/eg_202116v010201p.pdf#search='EG%20202%20116' (accessed August 2005).

EURES (2002): Employment in Europe 2002. Recent Trends and Prospects. Luxembourg. Online available at: http://europa.eu.int/comm/employment_social/publications/2002/keah02001_en.pdf (accessed November 2005).

EUROPEAN FOUNDATION FOR THE IMPROVEMENT OF LIVING AND WORKING CONDITIONS (2002): Work organisation, technology and working conditions. Luxembourg.

EUROPEAN FOUNDATION FOR THE IMPROVEMENT OF LIVING AND WORKING CONDITIONS (2004): Seminar “Workplace of the Future”. Online available at: http://www.emcc.eurofound.eu.int/content/source/eu04014a.html?p1=ef_publication&p2=null (accessed August 2005).

EUROPEAN FOUNDATION FOR THE IMPROVEMENT OF LIVING AND WORKING CONDITIONS (2005): Information technology: Use and training in Europe. Luxembourg.

EUROSTAT (2001) Disability and social participation in Europe. Luxembourg.

EUROSTAT (2004): Eurostat yearbook 2004. The statistical guide to European Data 1992-2002. Luxembourg.

EUROSTAT (2005a): Statistics in Focus 18/2005 Internet usage by individuals and enterprises 2004.

EUROSTAT (2005b): Statistics in Focus 3/2005 Labour markets latest trends - 3rd quarter 2004 data.

EUSER (2005): D 5.1- First Synthesised Inputs to Knowledge Repository, Including Initial Survey Results and Good Practice Examples.

EYSENBACH, G. and E. TILL (2000): Ethical issues in qualitative research on internet communities. BMJ 323, pp.1103-1105.

EYSENBACH, G., POWELL, J., ENGLESAKIS, M., RIZO, C. and A. STERN (2004): Health related virtual communities and electronic support groups: systematic review of the effects of online peer to peer interactions. BMJ 328. Online available at: http://bmj.bmjjournals.com/cgi/reprint/328/7449/1166 (accessed August 2005).

EWON (2001): Integration of the ageing workforce. Thematic paper presented to DG Employment and Social Affairs. European Work Organisation Network, November 2001. Online available at: http://www.dwp.gov.uk/asd/asd5/rports2003-2004/rrep200.asp (accessed August 2005)

FELLBAUM, K. and M. HAMPICKE (1999): Integration of Smart Home Components into Existing Residences. In: BÜHLER, C. and H. KNOPS: Assistive Technology on the Threshold of the New Millennium. Assistive Technology Research Series Vol. 6, pp.497-501. Amsterdam.

FELLBAUM, K. and M. HAMPICKE (2002): Human-Computer Interaction in a Smart Home Environment. Symposium "Domotics and Networking", Miami, 11/19-12/02. Online available at: http://www.sentha.tu-berlin.de/paper/fm_ha_miami.pdf (accessed August 2005).

FERLANDER, S. (2003): The internet, social capital and local community (PhD thesis). Stirling.

FERRER-ROCA, O., CARDENAS, A., DIAZ-CARDAMA, A., and P. PULIDO (2004): Mobile phone text messaging in the management of diabetes. Journal of Telemedicine and Telecare, 10(5), pp.282-285.

FINKELSTEIN, S. M., SPEEDIE, S. M., DEMIRIS, G., VEEN, M., LUNDGREN, J. M., and S. POTTHOFF (2004): Telehomecare: Quality, perception, satisfaction. Telemedicine Journal and E-Health, 10(2), pp.122-128.

FISK, M. J. (2003): Social alarms to telecare: Older people's services in transition. Bristol.

FORRESTER RESEARCH / MICROSOFT CORPORATION (2003) The wide range of abilities and its impact on computer technology. Online available at: http://download.microsoft.com/download/0/1/f/01f506eb-2d1e-42a6-bc7b-1f33d25fd40f/ResearchReport.doc (accessed August 2005).

FORRESTER RESEARCH / MICROSOFT CORPORATION (2004): Accessible technology om computing – examining awareness, use and future potential. Online available at: http://download.microsoft.com/download/0/1/f/01f506eb-2d1e-42a6-bc7b-1f33d25fd40f/ResearchReport-Phase2.doc (accessed August 2005).

FOUNDATION FOR ASSISTIVE TECHNOLOGY (2004): Reporting on assistive technology in a rapidly changing world. London.

FOX, S. and PEW INTERNET AND AMERICAN LIFE PROJECT (2004): Older Americans and the internet. Washington D.C.

FREITAS, D., GJÖDERUM, J., HELLSTRÖM, G. and M. SOEDE (1995): Mobile Telephony. In:. ROE, P.R.W (ed.): Telecommunications for All, pp.137-157. Brussels.

FRIEDBERG, L. (2001). The Impact of Technological Change on Older Workers: Evidence from Data on Computer use. National Bureau of Economic Research, Inc, NBER Working Papers.

FRIEDRICH, K. (1996): Intraregionale ind interregionale Muster und Prinzipien der Mobilität älterer Menschen. In: ENQUETE- KOMMISSION "DEMOGRAPHISCHER WANDEL" DES DEUTSCHEN BUNDETAGS: Herausforderungen unserer älter werdenden Gesellschaft an den einzelnen und die Politik, Studienprogramm, pp.501-618. Heidelberg.

GAREIS, K., KORTE, W.B. and M. DEUTSCH (2000): Die E-Commerce Studie. Braunschweig, Wiesbaden.

GAREIS, K. and A. MENTRUP (2001): Virtualisation of Labour Market Transactions: Technological Potential and Status Quo. STAR Issue Report No. 7.

GARMS-HOMOLOVA, V. (2000): The Challenge of Elderly Care in the German Public Health System.In: GERMAN-JAPANESE COOPERATION COUNCIL FOR HIGHTECH AND ENVIRONMENTAL TECHNOLOGY (2000): Health Telematics for the Elderly. German-Japanese Workshop, pp.9-14. Dagstuhl.

GAZIER, B. (1999). Employability: Concepts and policies. European Observatory RESEARCH Network, Institute of Socio-economics, Berlin.

GERHARDS, M. and A. MENDE (2004): Offliner 2004: Anpassungsdruck steigt, Zugangsbarrieren bleiben erhalten. Media Perspektiven 8, pp. 371-385.

GERMAN-JAPANESE COOPERATION COUNCIL FOR HIGHTECH AND ENVIRONMENTAL TECHNOLOGY (2000): Health Telematics for the Elderly. German-Japanese Workshop. Dagstuhl.

GFK (2002): 50plus- Mehr als nur eine Generation, Band 1. Nürnberg.

GILL, J.: (2000): Scientific and Technology Reports. Inclusive Design of Interactive Television. London. Online available at: http://www.tiresias.org/reports/dtg.htm (accessed August 2005).

GILL, J. (2004): Access- Ability. Making Technology more usable by people with disabilities. London.

GILL, J., ROE, P.R.W. and M. MARTIN (1999): Pay phones with immediate public access - design guideline. Online available at: http://www.stakes.fi/cost219/payphones.htm (accessed August 2005).

GOTT, M. (1995): Telematics for Health- The role of Telehealth and Telemedicine in Homes and Communities. Oxford, New York.

GRIFFITHS, A. (1997): Ageing, health and productivity: A challenge for the new millennium. Work and Stress 11(3), pp. 197-214.

GRIP, A., VAN LOO, J. and J. SANDERS (2004): The industry employability index: taking account of supply and demand characteristics. International Labour Review 143 (3), pp. 211- 233.

GRUMBACH, C., HEIKELÄ, M., SKILTON, T., OKKONEN, A., HUISMAN, R. and K. HAUKIPURO (2002): Independent living market in Germany, UK, Italy, Belgium and Netherlands. National Technology Agency. Helsinki.

GUISO, L. TISENO, A. and J. WINTER (2005): Expectations. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.332-338. Mannheim.

GUNKEL, D. (2003): Second thoughts: Toward a critique of the digital divide. New Media and Society, 5(4), pp.499-522.

HAILEY, D., ROINE, R., and A. OHINMAA (2002): Systematic review of evidence for the benefits of telemedicine. [review] [86 refs]. Journal of Telemedicine and Telecare 8(Suppl 1), pp.1-30.

HAULIKOVA, L., KOLDINSKÁ, K., GOLINOWSKA, S., NEMEC, J., PIETKA, K., SOWADA, C., TOMES, I. VAGAC, L. and M. ZUKOWSKI (2003): Social Protection in the Candidate Countries. Country Studies Czech Republic, Slovak Republic, Poland.

HEINLEIN, M. (2004): Pflege und Materialität: Die Geschichte des Herrn Imker. In: DUNKEL, W. and G. VOß (eds.): Dienstleistung als Interaktion. Beiträge aus einem Forschungsprojekt Altenpflege – Deutsch Bahn – Call Center. München.

HELGESSON, A., JOHANSSON, U. B., WALTHER-STENMARK, K., ERIKSSON, J., STROMGREN, M., and R. Karlsson (2005): Coordinated care planning for elderly patients using videoconferencing. Journal of Telemedicine and Telecare, 11(2), pp.85-92.

HERZOG, C. (2005): Seniors set the pace for german ecommerce. Online available at: http://www.forrester.com/Research/Document/Excerpt/0,7211,36536,00.html (accessed August 2005).

HIGGS, P., HYDE, M., VON DEM KNESEBECK, O., KUPFER, A. and J. SIEGRIST (2005): Quality of Life and Well-Being. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, p.199-203. Mannheim.

HIGH LEVEL TASK FORCE ON SKILLS AND MOBILITY (2001): Final Report. Online available at http://europa.eu.int/comm/employment_social/news/2001/dec/taskforce2001_en.pdf (accessed August 2005)

HJELM, M. (1999): Benefits and Drawbacks of Telemedicine. In: WOTTOM, R. and J. CRAIGS (eds.) (1999): Introduction to Telemedicine, pp. 139- 157. London.

HOENIG, H., LANDSDALE, D. and L. LUNDBERG (2002): Assistive and Smart Technologies: Improving Older Adults' Quality of Life. Annals of Long-Term Care,10 (8). Online available at: http://www.podiatrytoday.com/altc/attachments/Assistive_8_02.pdf#search='assistive%20devices*older%20people' (accessed August 2005).

HOENIG, H., TAYLOR, D. H. and F.A. SLOAN (2003): Does assistive technology substitute for personal assistance among the disabled elderly? American Journal of Public Health, 93(2), pp.330-337.

HOFFMANN, N., KLINE, S., KOBB, R. and R. LODGE (2003): Enhancing Elder Chronic Care through Technology and Care Coordination: Report from a Pilot. Telemedicine Journal and e-Health, 9 (2), pp.189-195.

HOFMAN A, ROCCA W.A., BRAYNE, C. et al. (1991):The Prevalence of Dementia in Europe: A Collaborative Study of 1980-1990 Findings. International Journal of Epidemiology 20 (3), pp. 736-748.

HORIO, H. (2000): Concepts and Implementation for Fetal Monitoring at Home. In: GERMAN-JAPANESE COOPERATION COUNCIL FOR HIGHTECH AND ENVIROMENTAL TECHNOLOGY: Health Telematics for the Elderly. German-Japanese Workshop, pp.127-136. Dagstuhl.

HORRIGAN, J. and L. RAINIE (2002): Getting Serious Online: As Americans Gain Experience, They Pursue More Serious Activities. Washington D.C..

HÜSING, T., KUBITSCHKE, L., STROETMANN, K.A. and V.N. STROETMANN (2002a): Expectations and Needs of Older People for Telehealth: Results from the European SeniorWatch Survey. Paper for the TeleMed 2002 conference, January 29-30, Royal Society of Medicine, London.

HÜSING, T., KUBITSCHKE, L., STROETMANN, K.A. and V.N. STROETMANN (2002b): The attitudes, expectations and needs of elderly people in relation to e-health applications. Journal of Telemedicine and Telecare, 8, Suppl. 2: S2, pp.82-84.

HÜSING, T. and H. SELHOFER (2004): DIDIX: A Digital Divide Index for Measuring Inequality in IT Diffusion. ITandSOCIETY, 1(7), pp.21-38.

HUGHES, B., HUDGINS, J., HOPPER, E., and B. WALLACE (2003): User Satisfaction with Rehabilitation Services delivered using Internet Video. In: Journal of Telemedicine and Telecare 9 (3), pp.180-183.

HUTH, R.(2005): Küchenmanagement in Wohngemeinschaften. Was der Einsatz einer Software dabei leisten kann. Heim und Pflege 36 (2), pp.51-52.

HUUHTANEN, P. (1988): The aging worker in a changing work environment. Scandinavian Journal of Work, Environment & Health, 14 (Suppl 1), pp. 21-23.

HUUHTANEN, P. and T. LEINO (1992). The impact of new technology by occupation and age on work in financial firms: A 2-year follow-up. International Journal of Human-Computer Interaction, 4(2), pp. 123-142.

HYUN KIM, J., BAUER, J.M. and S.S. WILDMAN (2003): Broadband uptake in OECD countries. Policy lessons from comparative statistical analysis. Paper presented at the 31st Research Conference on Communication, Information and Internet Policy, September 19-21, Arlington, Virginia. Online available at: http://assets.wharton.upenn.edu/~faulhabe/790/Broadband%20Uptake%20in%20OECD.pdf (accessed August 2005).

ICES- INTEGRATING COMMUNITY EQUIPMENT SEVICES (2005): Getting started: Telecare. London.

IDCNET (2003): D.2.1- The needs of industry and future technologies landscapes and the resultant requirements for the graduate profile. Online available at: ftp://ftp.fit.fraunhofer.de/bika/projects/IDCnet/IDCnet_D2.1.1.pdf (accessed August 2005).

ILO (2001): Work Employment Report 2001 “Life at work in the Information Economy”. Geneva.

INADA, H. (2000): Health Care Information Collection System for the Elderly at Home. In: GERMAN-JAPANESE COOPERATION COUNCIL FOR HIGHTECH AND ENVIRONMENTAL TECHNOLOGY (2000): Health Telematics for the Elderly. German-Japanese Workshop, pp.15-26. Dagstuhl.

INTER-AMERICAN DEVELOPMENT BANK et al. (2003): The Age of Digital Opportunity. Connecting the Generations (Contribution to the WSIS).

INQA- INITIATIVE QUALITÄT DER ARBEIT (2005). Demographic change and a call for new corporate strategies. Online available at: www.inqa.de (accessed August 2005).

JOSEPH ROWNTREE FOUNDATION (2000): The market potential for Smart Homes. Online available at: http://www.jrf.org.uk/knowledge/findings/housing/pdf/N40.pdf#search=`the%20market%20potential%20for%20smart%20homes (accessed August 2005).

JRC/IPTS- ESTO STUDY (2003a): The Effective Delivery of Healthcare in the Context of an Ageing Society (HCTRM).

JRC/IPTS- ESTO STUDY (2003b): Healthcare Technology Roadmapping: The Effective Delivery of Healthcare in the Context of an Ageing Society (HCTRM). Online available at: http://esto.jrc.es/docs/HealthcareTechnologiesRoadmapping.pdf#search='evidence*quality*telecare' (accessed August 2005).

JÜRGES, H. (2005a): Cross-Country Differences in General Health. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.95-101. Mannheim.

JÜRGES, H. (2005b): Gifts, Inheritances and Bequest Expectations. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.186-191. Mannheim.

KAELBE, H. and G. SCHMID (eds.) (2004): Das Europäische Sozialmodell. Auf dem Weg zum transnationalen Staat. Jahrbuch 2004. Berlin.

KAUFMAN, D. R., PATEL, V. L., HILLIMAN, C., MORIN, P. C., PEVZNER, J., WEINSTOCK, R.S. et al. (2003): Usability in the real world: Assessing medical information technologies in patients' homes. Journal of Biomedical Informatics, 36(1-2), pp.45-60.

KELLY, D. (2005): Touching People's Lives with Technology. Presentation at the Silver Economy in Europe Conference on 16./17. February 2005 in Bonn, Germany.

KENCHIKU KIKAKU SEKKEISHA (2005): Introducing New PC emergency Call Systems. Presentation at the IAHSA Symposium in Norway.

KLUMPP, D. (2003): Informationsgesellschaft- nur eine "symbolische Diskussion"? In. KLUMPP, D. et al. (eds.) (2003): Next Generation Information Society? Notwendigkeit einer Neuorientierung. pp. 25-42. Mösslingen-Talheim.

KOHLI, M., KÜNEMUND, H. and J. LÜDICKE (2005): Family Structure, Proximity and Contact. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.164-170. Mannheim.

KOHLI, M., KÜNEMUND, H. and T. ZÄHLE (2005): Housing and Living Arrangements. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, p.41-47. Mannheim.

KORHONEN, I., PAAVILLAINEN, P. and A. SÄRELA (2003): Applications of ubiquitous computing technologies for support of independent living of the elderly in real life settings. Online available at: http://www.healthcare.pervasive.dk/ubicomp2003/papers/Final_Papers/2.pdf (accessed August 2005).

KOTKIN, J. (2000): The New Geography. How the Digital Revolution Is Reshaping the American Landscape. Random House, New York.

KOUM, M. (2000): Elderly and Self Determined Life. Concepts and Solutions to Support a Self Determined Way of Life. In: GERMAN-JAPANESE COOPERATION COUNCIL FOR HIGHTECH AND ENVIRONMENTAL TECHNOLOGY: Health Telematics for the Elderly. German-Japanese Workshop, pp.29-40. Dagstuhl.

KOUROUPETROGLOU, G. and G. NEMETH (1995): Speech Technology for Disabled and Elderly People. In: ROE, P.R.W (ed.): Telecommunications for All, pp.186-195. Brussels.

KOUTKIAS, V. G., CHOUVARDA, I. and N. MAGLAVERAS (without date): Agent-based monitoring and alert generation for a home care telemedicine system. Proc AMIA Symp. 2002, pp. 395-399.

KRAUT, R., PATTERSON, M., LUNDMARK, V., KIESLER, S., MUKOPADHYAY, T. and W. SCGERLIS (1998): Internet Paradox. A social tendency that reduces social involvement and psychological well-being? American Psychologist 53 (9), S. 1017-1031.

KRAUT, R., KIESLER. S., BONEVA, B., CUMMINGS, J. HELGESON, V. and A. CRAWFORD (2002) 'Internet Paradox Revisited', Journal of Social Issues 58, pp.49-74.

KUBITSCHKE, L. (2000): Improving access to IT for older people - status quo and perspectives. Presentation at the "IT for Seniors" Workshop at the IBM Academy of Technology, 26th-27th March 2002, Warwick.

KUBITSCHKE, L., STROETMANN, V. and K. A. STROETMANN (2002): European SeniorWatch observatory and inventory: A market study about the specific IST needs of older and disabled people to guide industry, RTD and policy: Final report.

KUBITSCHKE, L., STROETMANN, V.N., HÜSING, T. and K.A. STROETMANN (2002): Older People and Information Society Technology: Results from the European SeniorWatch Survey. In: BRITISH COMPUTER SOCIETY: ICAT-International Conference on Assistive Technology, 24- 25 April 2002, pride Park Stadium, Derby.

LANDSDALE, D. (2002): Touching Lives: Opening Doors for Elders in Retirement. Communities through e-Mail and the Internet. In: MORELL, R.W.: Older Adults Health Informations and the World Wide Web. pp.133-151. Mahwah.

LANG, O. (1994): Die Einkommens- und Vermögensverhältnisse künftiger Altersgenerationen in Deutschland. Band I. Vorgehensweise und Ergebnisse. ZEW. Manheim In: ENQUETE- KOMMISSION "DEMOGRAPHISCHER WANDEL" DES DEUTSCHEN BUNDETAGS (1994) Herausforderungen unserer älter werdenden Gesellschaft an den einzelnen und die Politik, Studienprogramm, pp.57-184. Heidelberg.

LASH, S. (2002): Critique of Information. London.

LEBO, H., COLE, J. I., and USC ANNENBERG SCHOOL FOR COMMUNICATION (2004): The Digital future report: Surveying the digital future: Year four: Ten years, ten trends. Los Angeles.

LEHOUX, P. (2004): Patients' perspectives on high-tech home care: A qualitative inquiry into the user-friendliness of four technologies. BMC Health Services Research, 4(1), p. 28.

LEITNER, C., MOUSSALLI, A. and P. WILSON (2004): Mapping the Potential of eHealth: Empowering the Citizen through eHealth Tools and Services. Cork.

LEVY, S., JACK, N., BRADLEY, D., MORISON, M., and M. SWANSTON (2003): Perspectives on telecare: The client view. Journal of Telemedicine and Telecare, 9(3), pp.156-160.

LINDEN, R., GILBERG, R., HORGAS, A.L. and E. STEINNHAGEN-THIESSEN (1996): Die Inanspruchnahme medizinischer und pflegerischer Hilfe im hohen Alter. In: MAYER, K.U. and P.B. BALTES (eds.): Die Berliner Altersstudie: das höhere Alter in interdisziplinärer Perspektive, pp.475-496. Berlin.

LINDSTRÖM, J.-I. (1999): Through the looking glass: ICT for independent living- what can we learn from the past for the future? In: BÜHLER, C. and H. KNOPS (1997): Assistive Technology on the Threshold of the New Millennium. Assistive Technology Research Studies 6, pp.82-85. Amsterdam, Berlin, Oxford, Tokyo, Washington.

LINDSTRÖM, J.-I. and M. MARTIN (1995): Emergency Services and Alarm Systems. In: ROE, P.R.W. (ed.): Telecommunications for All, pp. 173-185. Brussels.

LING, R. (2004): e-living D11.4a - social capital and ISTs. Online available at: http://wwweurescom.de/e-living/deliverables/e-liv-D11.4a-Final.pdf (accessed August 2005).

LITTLER, M. and M. ROURKE (2003): "Assistive Technology in the Eu"- an Industry Perspective. Online available at: http://europa.eu.int/information_society/policy/accessibility/regulation/indus_ws_2003/a_documents/atia_ace.pdf (accessed August 2005).

LOANE, M., WOOTTON, R. et al. (1997): The Potential of Telemedicine in Home Nursing. Journal of Telemedicine and Telecare 4, pp.214-218.

LOGES, W. E., and J. JUNG (2001): Exploring the digital divide: Internet connectedness and age. Communication Research, 28(4), pp.536-562.

LÜHRMANN, M. (2003): Demographic Change, Foresight and International Capital Flow. MEA Discussion Paper 39-03.

LUKOWICZ, P., KIRSTEIN, T. and G. TROSTER (2004): Wearable Systems for Health Care Applications. Methods of Information in Medicine 43 (3), pp.232-238.

LYBERAKI, A. and P. TINIOS (2005): Poverty and Social Exclusion: A New Approach to an Old Issue. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.302-309. Mannheim.

MAAS, I. and U.M. STAUDINGER (1996): Lebenslverlauf und Altern: Kontinuität und Diskontinuität der gesellschaftlichen Beteiligung. des Lebensinvestment und ökonomischer Ressourcen. In: MAYER, K.U. and P.B. BALTES (eds.) (1996): Die Berliner Altersstudie: das höhere Alter in interdisziplinärer Perspektive, pp 543-572. Berlin.

MACKENBACH , J., AVENDANO , M., ANDERSEN-RANBERG, K., and A.R. ARO (2005): Physical Health. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.82-88. Mannheim.

MAGLAVERAS, N. (2003): Citizen health system: Telehealth homecare. Studies in Health Technology and Informatics, 92, pp.117-125.

MAGLAVERAS, N., GOGOU, G., CHOUVARDA, I., KOUTKIAS, V., LEKKA, I., GIAGLIS, G. et al. (2002): Communication infrastructure in a contact centre for home care monitoring of chronic disease patients. AMIA Symp., pp. 479-483.

MAGLAVERAS, N., KOUTKIAS, V., CHOUVARDA, I., GOULIS, D. G., AVRAMIDES, A., ADAMIDIS, D. et al. (2002): Home care delivery through the mobile telecommunications platform: The citizen health system (CHS) perspective. International Journal of Medical Informatics, 68(1-3), pp.99-111.

MAGNUSSON, L., and E.J. HANSON (2003): Ethical issues arising from a research, technology and development project to support frail older people and their family carers at home. Health and Social Care in the Community, 11(5), pp.431-439.

MANN, W. C., OTTENBACHER, K. J., FRAAS, L., TOMITA, M. and A.V. GRANGER (1999). Effectiveness of assistive technology and environmental interventions in maintaining independence and reducing home care costs for the frail elderly. Archives of Family Medicine 8, pp. 210-217.

MARSISKE, M., DELIUS, J., MAAS, I., LINDENBERGER, U., SCHERER, H. and C. TESCH-RÖMER (1996): Sensorische Systeme im Alter. In: MAYER, K.U. and P.B. BALTES (eds.): Die Berliner Altersstudie: das höhere Alter in interdisziplinärer Perspektive, pp.379-403. Berlin.

MARTINEZ-GRANADO, M. and P. MIRA (2005): The Number of Living Children. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.48-52. Mannheim.

MATTERLAT, A. (2003): The Information Society: An introduction. London.

MAYER, K.U. and M. WAGNER (1996): Lebenslagen und soziale Ungleichheit im hohen Alter. In: MAYER, K.U. and P.B. BALTES (eds.) (1996): Die Berliner Altersstudie: das höhere Alter in interdisziplinärer Perspektive, pp.251-276. Berlin.

MAYER, K.U., BALTES, P.B., BALTES, M.M., BORCHELT, M. et al. (1996): Wissen über das Alter(n): Eine Zwischenbilanz der Berliner Altersstudie. In: MAYER, K.U. and P.B. BALTES (eds.) (1996): Die Berliner Altersstudie: das höhere Alter in interdisziplinärer Perspektive, pp.599-634. Berlin.

MCCONATHA, D. (2002): Aging online: Towards a theory of e-quality. In: MORELL, R.W. (ed.): Older adults, health information and the world wide web, pp.21-41. New York.

MCMELLON, C. A., and L.G. SCHIFFMAN (2002): Cybersenior empowerment: How some older individuals are taking control of their lives. Journal of Applied Gerontology, 21(2), pp.157-175.

MCNAMARA, K.S. (2003): Information and Communication Technologies, Poverty and Development: Learning from Experience. A Background Paper for the infoDev Annual Symposium December 9-10, 2003 Geneva, Switzerland.

MCPHERSON, M., SMITH-LOVIN, L., and J. COOK (2001): Birds of a Feather: Homophily in Social Networks. Annual Review of Sociology 27, pp. 415-444.

MEDIA AND MARKETING (2001): Mit 66 Jahren fängt der Konsum erst an. Online available at: http://www.mediaundmarketing.de/imperia/md/content/pdfdateien/marktforschung/zielgruppen/aeltere/2.pdf (accessed August 2005).

MESTHENEOS, E. et al. (1999): The health of older people in the European Union: current state and future trends. Report prepared for the CEC, DG V (Public Health). Athens.

METZ, D. and M. UNDERWOOD (2005): Older richer fitter. Identifying the customer needs of Britain's ageing population. London.

MEYER, J.-U. and S. KIEFER (2000): Concept and Demonstration of a Telematic Platform for Home Healthcare. In: GERMAN-JAPANESE COOPERATION COUNCIL FOR HIGHTECH AND ENVIROMENTAL TECHNOLOGY (2000): Health Telematics for the Elderly. German-Japanese Workshop, pp.115-126. Dagstuhl.

MEYER, J.-U., ONO, S., PAUL, V. and T. SAKANO (2000): International Telemedicine for Elderly and Other People in Foreign Countries. In: GERMAN-JAPANESE COOPERATION COUNCIL FOR HIGHTECH AND ENVIROMENTAL TECHNOLOGY: Health Telematics for the Elderly. German-Japanese Workshop, pp.155-164. Dagstuhl.

MEYER, S. and E. SCHULZE (without date): Smart Home and Ageing User- Trends and Analyses of Consumer Behaviour. Symposium "Domotics and Networking", Miami, 11/19-12/02. Online available at: http://www.sentha.tu-berlin.de/paper/meyer_miami.pdf (accessed August 2005).

MEYSTRE (2005): The Current State of Telemonitioring: A Comment on the Literature. In: Telemedicine Journal and E-Health, 11(1), pp.63-69.

MITCHELL, W.J. (1995): City of Bits. Space, Place and the Infobahn. Cambridge, Massachusetts.

MOBILALARM (2005): Validating European Mobile Alarm Services for Inclusion and Independent Living. D 2.1 Market Analysis.

MOLINIE, A. (2003): Age and working conditions in the European Union. European Foundation for the Improvement of Living and Working Conditions. Dublin.

MONSER, E. (2003): The Convergence of the Ageing Workforce And Accessible Technology. The implications for commerce, business and policy. Online available at: http://download.microsoft.com/download/d/2/3/d23515f3-2d73-49f4-b3b3-6fae6ac975ce/agingworkforce.doc (accessed October 2005).

MOORE, J. and E. RAYBOURN (without date): Promoting the Wellness Model of Elderly Health Care through Technology and Social Support. Online available at: www.sandia.gov/ACG/docs/ presentations_other/swepaper.pdf (accessed July 2005).

MORELL, R.W. (ed.): Older adults, health information and the world wide web. New York.

MORI (2002): Digital Television 2002: A Final Report: Research Conducted for the Department for Culture, Media and Sport. London.

MOSNER, E. and C. SPIEZLE (2003): The Convergence of the Aging Workforce and Accessible Technology. The implications for commerce, business and policy. Age Light Marketing Consultancy. Online available at: http://download.microsoft.com/download/d/2/3/d23515f3-2d73-49f4-b3b3-6fae6ac975ce/agingworkforce.doc (accessed August 2005).

MURDOCK, G. (2002): Tackling the Digital Divide: Evidence and Intervention. Paper given at the "The Digital Divide Day Seminar" on 19 February 2002 at British Educational Communications and Technology Agency, Coventry.

MURRAY, C.J. and A.D. LOPEZ (1997): Alternative projections of mortality and disability by cause 1990-2020: global burden of disease study. Lancet, 349, pp. 1498-1504.

NAO- NATIONAL AUDIT OFFICE (2003): Progress in making e-services accessible to all – encouraging use by older people. Report by the Comptroller and Auditor General. Stationary Office, London.

NAHM, E. (2002): Exploring Internet Use Among Older Adults. Social Support through the Internet and Email. SeniorNet, San Fransisco, CA.

NAKAJIMA, I. (2000): Analysis on Sharing Human Pathos for the Elderly Direct Patient Care. In: GERMAN-JAPANESE COOPERATION COUNCIL FOR HIGHTECH AND ENVIROMENTAL TECHNOLOGY: Health Telematics for the Elderly. German-Japanese Workshop, pp.41-58. Dagstuhl.

NEGROPONTE, N. (1995): Being Digital. New York.

NERLICH, M. and U. SCHAECHINGER (2003): Integration of Health 'Telematics into Medical Practice. Studies in Health Technology and Informatics 97, pp. 79- 82.

New York Times (2005): Grandparents help keep families afloat. July 25 2005, p.11.

NIE, N., and S. HILLYGUS (2002a): The impact of internet use on sociability: time-diary findings. ITandSOCIETY 1(1), 1-20 and online available at: www.ITandSociety.org (accessed August 2005).

NIE, N., and S. HILLYGUS (2002b): Where does internet time come from? a reconnaisance. ITandSOCIETY 1(2), pp. 1-20 and online available at: www.ITandSociety.org (accessed August 2005).

NOGAMI, K. (2000): Okinawa Prefecture Medical Support Information System for Remote Areas and Islands. In: GERMAN-JAPANESE COOPERATION COUNCIL FOR HIGHTECH AND ENVIRONMENTAL TECHNOLOGY (2000): Health Telematics for the Elderly. German-Japanese Workshop, pp. 9-14. Dagstuhl.

NORBY, K. (without date): Design for all - shaping the end-users Tel-eEurpoe.

NORAS- NATIONAL ONLINE RECRUITMENT AUDIENCE SURVEY (2005): Enhance Winter 2005. Online available at: http://www.noras.co.uk/ (accessed August 2005).

NORRIS, P. (2001): Digital Divide: Civic Engagement, Information Poverty, and the Internet Worldwide. Cambridge.

NORDIC COUNCIL OF MINISTERS (2005): Health and Social Sectors with an "e". Copenhagen.

NTIA- NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION (1995): Falling Through the Net – A Survey of the "Have Nots" in Rural and Urban America. NTIA.

NTIA- NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION (1998): Falling Through the Net II – New Data on the Digital Divide. NTIA.

NTIA- National Telecommunications and Information Administration (1999): Falling Through the Net – Defining the Digital Divide. NTIA.

NTIA- National Telecommunications and Information Administration (2002): A Nation Online: How Americans Are Expanding Their Use of the Internet. NTIA.

NTIA- National Telecommunications and Information Administration (2004): Entering the Broadband Age. NTIA.

NTIA- National Telecommunications and Information Administration and Economics and Statistics Admonistration (2004): A Nation Online: Entering the Broadband Age. Online available at: http://www.ntia.doc.gov/reports/anol/NationOnlineBroadband04.pdf (accessed August 2005).

OCHEL, J. (2003): Senioren im Internet. Köln

OECD (1999): The Economic and Social Impact of Electronic Commerce. Preliminary Findings and Research Agenda. OECD, Paris.

OECD (2001): Understanding the Digital Divide. Paris.

OECD (2003): ICT and Economic Growth. Evidence from OECD Countries, Industries and Firms. Paris.

OECD (2004) OECD Information Technology Outlook. Paris.

OECD (2005a) New perspectives on ICT skills and employment. Working party on the Information Economy. Paris.

OECD (2005b): Ageing Populations: High Time for Actions. OECD Background Paper for the Meeting of G8 Employment and Labour Ministers, London 10-11 March.

OECD (2005c): The Impact of Ageing on Demand, Factor Markets and Growth. OECD, Paris.

OFCOM (2005): Ofcom Consumer Panel Research. Quantitative Research Findings. Focus on Older People. London.

OTTENS, M. (2004): Internet usage by individuals and enterprises 2004. Statistics in focus 16/2004.

PACCAGNELLA, O. and G. WEBER (2005): Household Income. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.296-301. Mannheim.

PACOLET J., BOUTEN, R., LANOYE, H. and K. VERSIECK (1999): Social Protection for Dependency in Old Age in the 15 EU Member States and Norway. Statistical and Institutional Annexes. Leuven.

PAMMOLI, F., RICCABONI, M., OGLIALORO, C., MAGAZZINI, L., BAIO, G. and N. SALERNO (2005): Medical Devices Competiveness and Impact on Public Health Expenditure. Online available at: http://europa.eu.int/comm/enterprise/medical_devices/c_f_f/md_final_report.pdf (accessed November 2005).

PEW, R. W. and S. B. VAN HEMEL (2004): Technology for adaptive aging. Washington, DC.

PEW INTERNET (2005): The Future of the Internet. In a survey, technology experts and scholars evaluate where the network is headed in the next ten years. Washington.

PILLINGER, J. (2004): Managing diversity in public health and social care in the interest of all citizens. Report III: Age. European Social Network. Dublin.

PORTER, M. (1980): Competitive Strategy. New York, London.

PORTEUS, J. and S. BROWNSELL (2000a): A report on the Anchor Trust/BT Telecare Research Project.

PORTEUS, J. and S. BROWNSELL (2000b): Navigation Systems within large Buildings.

PORTEUS, J. and S. BROWNSELL (2000c): Using Telecare. Exploring Technologies for Independent Living for Older People. Brigthon.

POWE, N.A. and T. SHA (2004): Exploring the Current and Future Role of Market Towns in Servicing Their Hinterlands: a Case Study of Alnwick in the North East of England. Newcastle.

PRICE PARTNERSHIP AND IRV (2000): Study on Technology Trends and Future Perspectives within Assistive Technologies. Online available at: http://cordis.lu/ist/ka1/special_needs/library.htm (accessed August 2005).

PRISMA (2003a): Prisma Strategic Guideline 3: eServices for all - treating all users equally. Online available at: http://www.prisma-eu.net/deliverables/SG3services.pdf (accessed August 2005).

PRISMA (2003b): Prisma Strategic Guideline 2: eHealth. Online available at: http://www.prisma-eu.net/deliverables/SG2health.pdf (accessed August 2005).

PUTNAM, R., and L. FELDSTEIN (2003): Better together. New York.

REDING, V. (2005): i2010. Europe Must Seize the Opportunities of the Digital Economy. Press Conference on the occasion of the launch of the initiative European Information Society 2010, Brussels 1 June 2005.

RHEINGOLD, H. (1993): The virtual community, homesteading on the electronic frontier. Rading.

REISCHIES, F.M. and U. LINDENBERGER (1996): Grenzen und Potentiale kognitiver Leistungsfähigkeit im Alter. In: MAYER, K.U. and P.B. BALTES (eds.): Die Berliner Altersstudie: das höhere Alter in interdisziplinärer Perspektive, pp.351-377. Berlin.

RIALLE, V., DUCHENE, F., NOURY, N., BAJOLLE, L., and J. DEMONGEOT (2002): Health "smart" home: Information technology for patients at home. [review] [58 refs]. Telemedicine Journal and E-Health, 8(4), pp.395-409.

RICHARDSON, R. (2002): Information and Communication Technologies and Rural Inclusion. Centre for Urban and Regional Development Studies, University of Newcastle.

RIGGS, K. E. (2004). Granny at work: Aging and new technology on the job in America. New York, NY.

RIVA, G. (2003): Ambient Intelligence in Health Care. Cyberpsychlogy and Behavior 6 (3). Online available at: http://labstudenti.unicatt.it/doo/autori/Username%20n.%2007/p295_s.pdf (accessed August 2005).

RIZZUTO, T. (2005). Study shows Older Workers are More Open to Change (Los Angeles, CA ed.) 20th annual conference of the Society for Industrial and Organizational Psychology April 15-17. Online available at: http://siop.org/media/news/olderworkers0305.htm (accessed August 2005).

ROCKWELL, S. and L. Singleton (2002): The effects of computer anxiety and communication apprehension on the adoption and utilization of the Internet. Electronic Journal of Communication 12(1).

ROE, P.R.W. (1995): Consumer Overview. In: ROE, P.R.W.: Tele Communications for all, pp. 9- 27. Brussels.

ROE, P.R.W. (1999): A Guideliness-Booklet on mobile phones. Online available at: http://www.stakes.fi/cost219/mobiletelephone.htm (accessed August 2005).

ROE, P.R.W. (2001a): Bridging the Gap? Access to the telecommunications for all people. Lausanne.

ROE, P.R.W. (2001b): Relay Services: A comparison between 1991 and 2001. In: ROE, P.R.W.: Bridging the Gap? Access to Telecommunications for all People, pp.36-54. Lausanne.

ROGERS, E.M. (1995): Diffusion of Innovations. New York.

ROUSH, R., TEASDALE, T., J. MURPHY and M. KIRK (1995): Impact of a Personal Emergency Response System on Hospital Utilisation by Community Residing Elders. South Medical Journal 88 (9), pp.917-922.

SALOMON, J. and T. ERKERT (1997): Seniorinnen und Senioren in der Wissensgesellschaft. Bielefeld.

SAVENSTEDT, S., ZINGMARK, K., and P.O. SANDMAN (2003): Video-phone communication with cognitively impaired elderly patients. Journal of Telemedicine and Telecare, 9(Suppl 2), pp. 52-54.

SCALVINI, S., VOLTERRANI, M., GIORDANO, A., and F. GLISENT (2003): Boario home care project: An Italian telemedicine experience. Monaldi Archives for Chest Disease, 60(3), pp.254-257.

SCHLEIFE, K. (2004) Computer use and the employment status of older workers - an analysis based on individual data. ZEW Discussion paper 04-62. Mannheim.

SCHNEPEL, M. (2000): Concepts and Implementation of Call Centers including Emergency Calls for Elderly. In: GERMAN-JAPANESE COOPERATION COUNCIL FOR HIGHTECH AND ENVIRONMENTAL TECHNOLOGY (2000): Health Telematics for the Elderly. German-Japanese Workshop, pp.137-144. Dagstuhl.

SCIADAS, G. (ed.) (2003): Monitoring the Digital Divide ...and beyond. Montreal.

SEAMATE (2002): Socio-Economic Analysis and Macro-Modelling of Adapting to Information Technology in Europe. Workpackage 3 "Social Impacts of ICT" - First Interim Report. Zurich.

SECOND WORLD ASSEMBLY ON AGEING (2002): International Plan of Action on Ageing 2002. Madrid.

SEGRIST, K. A. (2004a): Computer training program for older adults: Identifying and overcoming barriers to continued computer usage. In: COUTURE, L. Activities, Adaptation and Aging. pp. 13-26.

SEGRIST, K. A. (2004b): Attitudes of older adults toward a computer training program. Educational Gerontology, 30(7), pp.563-571.

SELWYN, N. (2004): The information aged: A qualitative study of older adults' use of information and communications technology. Journal of Aging Studies Vol 18:4, p.369-384.

SELWYN, N., GORARD, S., FURLONG, J., and L. MADDEN (2003): Older adults' use of information and communications technology in everyday life. Ageing and Society, 23(5), pp.561-582.

SENIORNET (2002): SeniorNet survey in Internet use. San Fransisco.

SENIORNET (2004): SeniorNet members interest survey. San Fransisco. Online available at: http://www.seniornet.org/php/default.php?PageID=7414 (accessed August 2005).

SENIORWATCH (2001a): European Markets for IST Products and Services for Older and Disabled People- Descriptive Results. WP2 deliverable 2.3.

SENIORWATCH (2001b): Analytical and methodological framework. Annex 1: Further Consideration of Needs and Lifestyles. WP1 deliverable 1.1.

SENIORWATCH (2002a): Older People and the Information Society. Deliverable 5.1.

SENIORWATCH (2002b): Older People and the Information Society. Deliverable 5.2.

SENIORWATCH (2002c): Older People and the Information Society. Deliverable 5.3.

SENSE (2005): make technology work. Report on technology access for deafblind people. Online available at: http://www.sense.org.uk/NR/rdonlyres/A1B3FCDF-BFD0-49AE-A93F-198150E318E7/0/make_technology_work_report.pdf (accessed August 2005).

SHARE (2005): Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe. Mannheim.

SHARIT et al. (2004): An evaluation of performance by older people on a simulated telecommuting task. The journal of gerontology 59B (6) pp.305-316.

SHIPLEY, T. and J. GILL (2005): Equal Meassures. Closing the Accessibility Gap. Online available at: http://www.tiresias.org/cost219ter/equal_measures/equal_measures.pdf (accessed August 2005).

SHOVEN, J.B. et al. (1994): The impact of the demographic transition on Government spending. In: WISE, D.A. (ed.): Studies in the Econokics of Aging. National Bureau of Economic Research. Chicago and London: University of Chicago Press, pp. 13-37.

SIBIS (2003a): Towards the Information Society in Europe and the US. Highlights 2002.

SIBIS (2003b): Statistical indicators benchmarking the information society - statistics and indicators

SIBIS (2003c): Work, employment and skills. Topic Report No.5.

SIBIS (2003d): Social Inclusion. Topic Report No. 6.

SIDSEL, B. (2005): Experiences with wise Homes for elderly people in Norway. Oslo.

SIEGRIST, J., VON DEM KNESEBECK, O. and M. WAHRENDORF (2005): Quality of Employment and Well-Being. In: SHARE: Health Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe, pp.192-198. Mannheim.

SMITH, J. and P.B. BALTES (1996): Altern aus psychologischer Perspektive. Trends und Profile hohen Aller. In: MAYER, K.U. and P.B. BALTES (eds.) (1996): Die Berliner Altersstudie: das höhere Alter in interdisziplinärer Perspektive, pp.221-250. Berlin.

STANDARD AND POOR´S (2005): In the long run, we are all debt: Aging societies and sovereign Ratings.

STEPHANDIS, C. and P.L. EMILIANI (1995): Measuring the cost and benefits of emerging technologies in the rehabilitation field. In: PORRERO, I.P. and P. DE LA BELLASCA: The European Context for Assistive Technology. Assistive Technology Research Series 1, pp.159-162.

STEPHANIDIS, C. (1999): Designing for all in the Information Society. Heraklion.

STEPHANIDIS, C. (2001): Ambient Intelligence in the Context of Universal Access. Online available at http://www.ercim.org/publication/Ercim_News/enw47/stephanidis.html (accessed October 2005).

STEYAERT, J. (2002): Inequality and the digital divide: myth and realities. In: HICK, S. and J. MCNUTT (eds.): Advocacy, activism and the internet, pp. 199-211. Chicago.

STEYAERT, J. (2004): Medicijnen voor de zilveren digitale kloof. In DE HAAN, J., KLUMPER, O. and J. STEYAERT (eds.): surfende senioren, kansen en bedreigingen van ict voor ouderen (pp. 33-45). den Haag.

STOCKHOLM EUROPEAN COUNCIL (2001): Presidency Conclusions.

STODDARD, S., JANS, L., RIPPLE, J.M. and L. KRAUS (1998): Chart Book on Work and Disability in the United States. An InfoUse Report. Berkeley, CA.

STROETMANN, K. (2000): Can Elderly and Frail People Benefit from Health Telematics / Home TeleCare? In: German-Japanese Cooperation Council for Hightech and Enviromental Technology: Health Telematics for the Elderly. German-Japanese Workshop, pp.27-28. Dagstuhl.

STROETMANN, K.A., STROETMANN, V.N. and C. WESTERTEICHER (2003): Implementation of TeleCare Services: Benefit Assessmant and Organisational Models. n: M. NEHRLICH et al. (eds.). Integration of Health Telematics into Medical Practice, Amsterdam, pp. 131-141

TEKES (2002): Independent Living Market in Germany, UK, Italy, Belgium and the Netherlands. Helsinki.

TESCH-RÖMER, C. et al (2004): Internet Plattform Demenz. Expertentagung am 30. und 31. Oktober im Deutschen Zentrum für Altersfragen. Informationsdienst Altersfragen Heft Januar/Februar 2004, pp.10-11.

THE NEW STATESMAN (2005): Nominations for New Media Awards 2005. Online available at: http://www.newstatesman.co.uk/nma/nma2005/nma2005index.php (accessed August 2005).

THEOBALD, H. (2004): Care services for the Elderly in Germany - infrastructure, access and utilisation from the perspective of different user groups. Veröffentlichungsreihe der Arbeitsgruppe Public Health (07/2004). Online available at: http://skylla.wz-berlin.de/pdf/2004/i04-302.pdf (accessed August 2005).

THIE, J. and K. WEBERS (1999): Tele-Monitoring: A new application in social alarms? In: BÜHLER, C. and H. KNOPS (1999): Assistive Technology on the Threshold of the New Millennium. Assistive Technology Research Series Vol. 6, Amsterdam, Berlin, Oxford, Tokyo, Washington, p.96-101. Online available at: http://www.flos.cbs.dk/publijationer/SJIS-paper-final.pdf#search='patientcentered*ICT*impact' (accessed August 2005).

TOFFLER, A. (1980): The Third Wave. London.

TSUCHIYA, H. (2000): Telecare for the Elderly. In: GERMAN-JAPANESE COOPERATION COUNCIL FOR HIGHTECH AND ENVIROMENTAL TECHNOLOGY: Health Telematics for the Elderly. German-Japanese Workshop, pp.145-154. Dagstuhl.

TSUTSUI, J. (2000): Remote Care of Elderly in Japan. In: GERMAN-JAPANESE COOPERATION COUNCIL FOR HIGHTECH AND ENVIROMENTAL TECHNOLOGY: Health Telematics for the Elderly. German-Japanese Workshop, pp.71-78. Dagstuhl.

TWEED, C. and G. QUIGLEY (1999): Some ethical considerations of dwelling-based telecare systems for the elderly. Working paper, School of Architecture, The Queen's University of Belfast. Online available at: http://www.qub.ac.uk/arc/research/projects/papers/Ethical.pdf (accessed October 2005).

UNITED NATIONS POPULATION DIVISION (2001): World Population Prospects. The 2000 Revision. Highlights. New York.

UNITED STATES ADMINISTRATION ON AGING (2001): Profile of older americans, 2001. Washington D.C.

UNITED STATES NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION and UNITED STATES ECONOMICS AND STATISTICS ADMINISTRATION (2002): Nation online: How Americans are expanding their use of the internet. Washington D.C.

VAN BERLO, A. and K. FELLBAUM (1999): Smart Home Technology: Useful Applications for older people. In: BÜHLER, C. and H. KNOPS: Assistive Technology on the Threshold of the New Millennium. Assistive Technology Research Series 6, pp.508-512. Amsterdam.

VAN BERLO, A. (2005): Smart Houses and smart living for senior citizens: chances and markets. Presentation at the Silver Economy in Europe Conference on 16./17. February 2005 in Bonn, Germany.

VAN DIJK, J. (1999): The Network Society: Social Aspects of the New Media. Sage, London.

VAN DIJK, J. (2005): The deepening divide - inequality in the information Society. Thousand Oaks, London, New Delhi.

VANDERHEIDEN, G. (2002): Future Technology Developments and Domotics. Symposium "Domotics and Networking", Miami, 11/19-12/02. Online available at: http://www.sentha.tu-berlin.de/paper/vanderheiden_miami.pdf (accessed August 2005).

VINCENT, C., DROUIN, G. and G. ROUTHIER (1999): Environmental Control Systems for Disabled and older Adults: A Challenge and the Threshold of the New Millenium. In: BÜHLER, C. and H. KNOPS: Assistive Technology on the Threshold of the New Millenium. Assistive Technology Research Series Vol. 6, pp.486-490. Amsterdam.

VOLLEBERGT, L.P. (2004): Accelerating Health Innovation Rollout Across Europe. Brussels.

VON NORDHEIM, F. (2003): EU policies in support of Member States to retain, reinforce and re-integrate older workers in employment. In: BUCK, H. and B. DWORSCHAK (eds.): Ageing and work in Europe, pp.9-26. Stuttgart.

VSIW- SENIORINNEN UND SENIOREN IN DER WISSENSGESELLSCHAFT (2000): Senior-Info-Mobil: Internet und Wohntechnik für Seniorinnen und Senioren, eine Informationskampagne des Verein für Seniorinnen und Senioren in der Wissensgesellschaft e.V. Evaluationsbericht 1998/1999. Bonn.

WAGNER, G. MOTEL, A., SPIEß, K. and M. WAGNER (1996): Wirtschaftliche Lage und wirtschaftliches Handeln alter Menschen. In: MAYER, K.U. and P.B. BALTES (eds.): Die Berliner Altersstudie: das höhere Alter in interdisziplinärer Perspektive, pp.277-300. Berlin.

WAGNER, M., SCHÜTZE, Y. and F.R. LANG (1996): Soziale Beziehungen alter Menschen. In: MAYER, K.U. and P.B. BALTES (eds.) (1996): Die Berliner Altersstudie: das höhere Alter in interdisziplinärer Perspektive, p.301-320. Berlin.

WALKER, A. et al (1997): Combating age barriers in employment. Research Summary. Dublin. Online available at: http://www.eurofound.eu.int/publications/files/EF9718EN.pdf (accessed August 2005).

WALKER, A. (1998): Managing an ageing workforce – a guide to good practice. European Foundation for the Improvement of Living and Working Conditions, Dublin.

WEBERS, K. and J. THIE (1999): Tele- monitoring: A new application in social alarms? In: BÜHLER, C. and H. KNOPS: Assistive Technology on the Threshold of the New Millenium. Assistive Technology Research Series Vol. 6, pp.96-101. Amsterdam.

WEBSTER, F. (2002): Theories of the Information Society. London, New York.

WEBSTER, F. (2003): The Information Society Reader. London, New York.

WEISS, M.J. (2001): Online America. American Demographics 23(3), pp.53-60.

WEST LOTHIAN COUNCIL (2005): A Guide to Housing Options in West Lothian. Online available at: http://www.wlothian.org.uk/content/housing/824134/823518?s=824134 (accessed October 2005).

WHITTEN, P. et. al. (2002) Systematic review of cost effectiveness studies of telemedicine interventions. BMJ 324 (15 June), pp. 1434-37.

WHO- WORLD HEALTH ORGANISATION (2002): Active Ageing- A Policy Framework. A Contribution of the World Health Organisation to the Second United Nations World Assembly on Ageing. Madrid.

WIK (1999) Study on the re-examination of the scope of universal service. Bad Honnef.

WILLIAMSON, O.E. (1975): Markets and Hierarchies. New York.

WRIGHT, D. (1997): Telemedicine and Developing countries. In: Journal of Telemedicine and Telecare 7 (Supplement 2) 1998.

WWW-ICT (2003) Conceptual framework and state-of-the-art. Deliverable 1. Online available at: http://www.ftu-namur.org/www-ict (accessed August 2005).

YANKEE GROUP (1999): Home Networking Value Chain and Vendor Profiles: Part 2.

ZDF (2003): Reiche Rentner. Rüstig im Generationenkonflikt. Frontal 21, September 2, 2003.

ZWEIFEL, P. et al (1999): Ageing of Population and Health Care Expenditure: A Red Herring? In: Health Economics 8, pp.485-496.