Ageing and technology

Citation for published version (APA):

Document status and date:
Published: 01/01/1997

Publisher’s PDF, also known as Version of Record (includes final page, issue and volume numbers)

Please check the document version of this publication:
- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher’s website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

Link to publication

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the “Taverne” license above, please follow below link for the End User Agreement:
www.tue.nl/taverne

Take down policy
If you believe that this document breaches copyright please contact us at:
openaccess@tue.nl
providing details and we will investigate your claim.

Download date: 15. Jan. 2022
AGEING & TECHNOLOGY

Niilo Saranummi, Sirkku Kivisaari, Tuomo Särkikoski, Jan Graafmans

VTT Information Technology, VTT Group of Technology Studies
National Research & Development Centre for Welfare and Health
(STAKES), Eindhoven University of Technology - Centre BMGT
Ageing & Technology

Niilo Saranummi, Sirkku Kivisaari\textsuperscript{\textdegree}, Tuomo Särkikoski\textsuperscript{\beta} and Jan Graafmans\textsuperscript{\textdagger}

VTT Information Technology, \textsuperscript{\textdegree} VTT Group of Technology Studies, \textsuperscript{\beta} National Research & Development Centre for Welfare and Health (STAKES), \textsuperscript{\textdagger} Eindhoven University of Technology - Centre BMGT
## CONTENTS

CONTENTS ............................................................................................................................................ 2  

SUMMARY ............................................................................................................................................. 4  

I INTRODUCTION .................................................................................................................................. 6  

AGEING - A CHALLENGE OF MANY DIMENSIONS ........................................................................... 6  
LIFE COURSE BY AGES ....................................................................................................................... 7  
ABOUT TERMINOLOGY ....................................................................................................................... 8  
STRUCTURE OF THE REPORT .............................................................................................................. 10  

II DOUBLE AGEING OF EUROPEAN POPULATION .......................................................................... 11  
THE GROWING SHARE AND NUMBER OF THE ELDERLY ............................................................ 11  
RATIO BETWEEN THE WORKING AND ELDERLY POPULATION .................................................. 12  
LIVING ALONE AS A RISK FOR WELL-BEING .................................................................................. 13  

III SOCIAL AND HEALTH CARE EXPENDITURE ............................................................................. 15  
OVERALL SOCIAL PROTECTION EXPENDITURE ............................................................................. 15  
HEALTH CARE IN PARTICULAR ....................................................................................................... 17  
NATIONAL WELFARE AND HEALTH POLICIES AND SERVICES ..................................................... 17  

IV SOCIAL DIMENSION OF AGEING & TECHNOLOGY ................................................................ 19  
TECHNOLOGY AND THE SOCIAL INTEGRATION OF ELDERLY ..................................................... 19  
SOCIAL AGEING AND TECHNOLOGICAL AGEING ....................................................................... 19  
FAMILY AND GENDER STRUCTURES ............................................................................................... 20  

V ADDITIONAL ASPECTS .................................................................................................................... 21  
INDUSTRY & SERVICE PROVIDERS ........................................................................................... 21  
LEGISLATION AND STANDARDS ................................................................................................... 21  
EVALUATION AND ASSESSMENT .................................................................................................... 22  

VI AGEING & TECHNOLOGY ............................................................................................................ 23  
EUROPEAN INITIATIVES .................................................................................................................... 23  
TIDE & TELEMATICS FOR DISABLED AND ELDERLY .................................................................. 24  
COST AS 'AGEING AND TECHNOLOGY' .......................................................................................... 26  
COST 219 AND 219 BIS ....................................................................................................................... 28  
OTHER FORUMS AND JOINT ACTIVITIES ....................................................................................... 29  
USA & JAPAN ..................................................................................................................................... 29  

VII FRAMEWORK FOR AGEING & TECHNOLOGY ........................................................................ 30  
AGEING ............................................................................................................................................... 30  
FROM COMPANY-CENTRED TO CO-OPERATIVE INNOVATION .................................................... 31  
DOMAIN OF AGEING & TECHNOLOGY ............................................................................................ 33  
MARKET SEGMENTS IN AGEING & TECHNOLOGY ...................................................................... 34  
COMBINED PRODUCTS AND SERVICES ......................................................................................... 35  
MARKET SEGMENTATION BY NEED ................................................................................................. 36  

VIII OPPORTUNITIES AND RECOMMENDATIONS ..................................................................... 38  
IX CONCLUSIONS .............................................................................................................................. 40  
REFERENCES ...................................................................................................................................... 46
ANNEXES

1 VALUE-STAR FRAMEWORK ................................................................. 48
2 CHANGES IN HEALTH SYSTEMS AND HEALTH CARE DELIVERY IN EUROPE .......... 51
3 TIDE PROJECTS .............................................................................. 53
4 EXAMPLES OF TECHNOLOGIES FOR AGEING ...................................... 58
5 LIFE-CYCLE OF THE VALUE-STAR ...................................................... 68
6 STAKEHOLDER INTERESTS ............................................................... 70
7 PREPARATION HISTORY ................................................................. 72
SUMMARY

Ageing & Technology is a response to the challenges the ageing Europe is facing. The focus of this report is the role of technology as a partial solution to the challenge.

The fact that Europe is ageing is not only a challenge. It is also an opportunity for Europe. Ageing is a problem in all industrialised countries and it will become a problem in the developing countries. Therefore the European solutions should find markets also elsewhere and thereby contribute towards the improved competitiveness of European enterprises against those in USA, Japan and other countries.

Being retired in the modern society by no means implies frailty or loss of independence. These are present only in the 4th Age which in the case of a single person can happen at any moment of time and may last for any duration. Ageing & Technology, therefore, addresses the needs and solutions of the 3rd and 4th Age, with different needs and different solutions. However, the values for both are the same, i.e. well-being, independence and dignity.

Baseline demographic data (see table below)

<table>
<thead>
<tr>
<th>Key indicators of the Ageing Europe</th>
<th>1995</th>
<th>2025</th>
<th>change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>persons 65 years and older</td>
<td>57 million</td>
<td>81 million</td>
<td>+ 42</td>
</tr>
<tr>
<td>persons 75 years and older</td>
<td>23 million</td>
<td>37 million</td>
<td>+ 61</td>
</tr>
<tr>
<td>ratio of working age adults over</td>
<td>16</td>
<td>10</td>
<td>- 39</td>
</tr>
<tr>
<td>persons 75 years and older</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>social expenditure (of GDP)</td>
<td>28 %</td>
<td>40 % *</td>
<td></td>
</tr>
<tr>
<td>health care expenditure (of GDP)</td>
<td>8.5 %</td>
<td>15 % *</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>* (linear estimation)</td>
</tr>
</tbody>
</table>

Market (see table below)

In terms of purchasing power it has been estimated that in 2025 the elderly population controls roughly 70% of the money (disposable income + fixed assets).

Segmenting by

<table>
<thead>
<tr>
<th>Needs</th>
<th>3rd and 4th Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types</td>
<td>Products and services</td>
</tr>
<tr>
<td>Users</td>
<td>Citizens and service providers</td>
</tr>
<tr>
<td>Purchasing decision makers</td>
<td>Citizens; Service providers both private and public; and third party payers (e.g. insurance companies)</td>
</tr>
<tr>
<td>Technologies</td>
<td>Performance enhancing technology; Wellness &amp; health technology; Compensative technology; Technology for care givers; and Ageing research technology. Of these 1 &amp; 2 are directed to the 3rd Age population and 3 &amp; 4 for the 4th Age population</td>
</tr>
</tbody>
</table>

DATE: 28.11.96
Specific actions

The solutions to the double ageing challenge require a combined approach as shown by the multitude of directions by which this market can be segmented. The complexity is due to the mixed market place, the number of stakeholders, the need to create new incentives to empower the stakeholders including the elderly citizens jointly to innovate new products and services, and to enable these to co-exist in a mixed market place of consumers, public and private services.

As technologies are shaped by people, organisations and groups, the technological and social aspects of technological development cannot be separated. Technology should serve the needs not establish 'needs'. Instead of letting technology lead we need to build also the social structures at the same time.

The speed and direction of the development of the Ageing & Technology market depends on how the different stakeholders experience and view the incentives. Issues to be considered include:

- The responsibility for the development of the infrastructure on which the Ageing & Technology products and services will exist remains with the society.
- Social and health policies and public funding and service provision systems determine the incentives for industry and the welfare-mix of public and private service providers.
- Thirdly, consumer power should be brought to bear on this domain.

A number of European and European Union actions are already ongoing in Ageing & Technology. However, the ageing challenge Europe is facing combined with social changes of e.g. the new role of the family, cultural differences across Europe, competitiveness of European industry etc. a more holistic approach is needed.

In the 5th Framework Program Ageing & Technology should be integrated into all programs, and specific actions should be established with goals, work plans and budgets to address the following issues:

- Increasing the co-ordination of efforts and dissemination of information
- Implementing lead pilots to act as spearheads where the new concepts of products and service-mix are demonstrated, validated and evaluated in real-life situations
- Mobilising other funds from regional and other European sources to support these pilots, especially for the infrastructure investments
- Investing into understanding the social side of this and into education and awareness creation.
AGEING & TECHNOLOGY

I  INTRODUCTION

Ageing - A challenge of many dimensions

In 25 years nearly one person in three of the population of the European Union will be over 60 years old. The total number of these citizens will be nearly 100 million (27% of the total population of EU). The percentage of very old people (those over 80 years old who have the greatest needs in terms of care and other services) is growing most rapidly: An increase of 300% is forecasted for the period of 1960 to 2020.

"Imagine yourself when you are over 80 years old. Will you be able to do the things you do now for example your favourite hobby or even simple things such as reading the paper, taking a bath, turning on a stereo, driving a car or using an automatic cash dispenser? Where will you live, in what kind of a house? Will you be able to enjoy your freedom after a life of work?"

This is a direct quote of the opening sentences of a recent paper on gerontechnology (Graafmans 1996) which presents the challenge that our ageing society is now facing. Why should the quality of life decrease as one grows older? Should we not use our knowledge, technology and other skills to the maximum to 'stretch' the period of independence and the quality of life that goes with it? Naturally we are not omnipotent and ageing takes its course with diminishing capabilities, chronic diseases and handicaps. But we know already a lot of the ageing processes and there are means and technologies to compensate for these.

Ageing & Technology is the composite term used in this report to describe an emerging multidisciplinary field which addresses ageing and technologies through the following issues:

- Prevention of age related problems
- Improving the quality of life
- Seeking new opportunities and sources previously untapped
- Compensation for declining abilities
- Use technology to make the work of partners and professional carers easier
- Research into ageing and to finding technologies to further study the ageing processes.

It seeks to enhance the interaction between elderly people and their environment in order to maintain the maximum level of sustained functional autonomy and independence.

The major reason for the emergence of this new field is the ‘double-ageing’ of the European population. Unless something is done now - as getting solutions in place takes several years - the health and social systems and the national economies cannot cope with this trend. Already cost containment is highest on the agenda of health care systems in most European countries. In addition to the economical dimension double-ageing is another kind of challenge for the society, families, individuals and industry.

This trend will deteriorate in the years to come. Therefore, no time should be wasted in responding to it.
When planning for responses to this the fragmented nature of Europe in these issues needs to be taken into account. In Europe, we enjoy a richness of different cultures and family values. The health and social systems differ in the way they are organised - if not so much in their objectives. The 'market' in which the Ageing & Technology services and products exist is a mixed one with providers both from the open and closed sectors. Industry views Ageing & Technology as a very interesting field but at the same time very risky. Products should be generic enough to be marketed across Europe whereas currently they require a lot of 'tailoring' to adapt them to user needs.

It has become clear that the ageing challenge cannot be met with linear responses. For example, enhancement of the current service structures and measures will not be enough. New solutions must be innovated and implemented throughout Europe.

This report attempts to describe also the context in which 'Ageing & Technology' exists. By identifying the issues, the stakeholders and their relationships the barriers and carriers can be recognised. Based on these problems and solutions and especially the 'owners' of these solutions can be identified.

Phrasing this in another way how can Ageing & Technology be 'normalised'? By normalisation we mean that there is a market for services and products, that there are customers whose needs are satisfied by this market and that there is an established dialogue and set of rules on how the stakeholders interact creating the competitive environment for continuous improvement and innovation.

**Life Course by Ages**

In his plenary talk in the recent 2nd Gerontechnology conference Prof. Peter Laslett (Trinity College, Cambridge University, UK) provided an interesting way to look at ageing as described in Table 1 below. Although these four Ages are periods of life they are not divided from each other by birthdays and are of no specific length in years. The 4th Age can occur at any point in the life course or be altogether absent, as with sudden death or death after a short illness. The separation of the 4th Age from the 3rd Age is the fundamental point of this division.

<table>
<thead>
<tr>
<th>Ages</th>
<th>Characterised by</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Age</td>
<td>Natality, infancy, childhood, socialisation, and education</td>
</tr>
<tr>
<td>2nd Age</td>
<td>Maturity, earning, career-pursuit and advancement; family formation, procreation, maintenance and socialisation of offspring; responsibility for the dependent old and young; membership of productive organisations and submission to their authority; self-fulfilment; preparation for full self-realisation</td>
</tr>
<tr>
<td>3rd Age</td>
<td>Autonomy and self-fulfilment; release from the trammels of the 2nd Age; pursuit of aims freely chosen; cultural activity and satisfaction 'The Crown of Life'</td>
</tr>
<tr>
<td>4th Age</td>
<td>Final dependency and death</td>
</tr>
</tbody>
</table>
About Terminology

As a rule, it is futile to discuss terminology because what is important is not what an item is called but what it means or contains. Especially in new emerging fields names are invented and ‘owned’. The same applies to the domain which in this report is named Ageing & Technology. It is addressed by many other ‘names’ e.g. social technology, health (care) technology, wellness technology, technology for independence and security, and gerontechnology.

Because of the way these have been created they also cover the domain to a degree which depends much on subjective interpretation. In the case of Ageing & Technology, the domain it is covering is also being addressed at least by those discussed below. An attempt to relate these with each other is made in Figure 1.

For the purposes of this report ‘Ageing & Technology was found to be the best descriptor (at this moment of time) on one hand of the challenges posed by the ageing of European populations and on the other, the solutions that can be provided through the innovative use of present and emerging technologies.

![Figure 1. A map of the technology terms used in the domain of 'Ageing & Technology'](image)

- **Gerontechnology**

  Gerontechnology has been defined as a composite of two words ‘gerontology’, the scientific study of ageing, and ‘technology’, research and development of techniques and products. Gerontechnology covers the whole continuum of technological artefacts from care to independence and from prevention to assistance. As illustrated above it gets closest in covering the whole field.

- **Health care technologies**

  Certain health care technologies are used in the homes of patients either by themselves or by the care providers (examples include drugs and pharmaceuticals and devices for diabetes management). With the cost containment of health care there is a strong pull for services and technologies that enable care outside the hospital walls and especially in the homes of patients.
• **Health technologies**

Prevention being formerly focused on environment, education and information dissemination has acquired a new dimension as citizens are taking more responsibility for the maintenance of their health. This includes all kinds of services and products. The common denominator of services and products in this class is that they are all marketed to consumers.

• **Wellness technologies**

Wellness has been coined (probably in USA) to represent the opposite of ‘illness’ (therefore the two ‘l’s in the name). Consequently, it is more or less the same as ‘health technologies’.

• **Assistive technologies (Figure 3)**

This is the current name for what was in the past known as ‘technical aids for the disabled’. It describes the purpose of these technologies quite well as their role is to assist people in overcoming (compensating) their respective handicaps. The availability and cost of these devices depends on the way health and welfare services are organised and paid for in each country. The well recognised difficulty of this market segment is that solutions must be tailored and adapted to the individual and his/her environment. Consequently, European-wide markets rarely exist for these products.

• **Technologies used by care providers**

New communication technologies especially have been demonstrated to be of value in the delivery of home-based health care and welfare services.

![Figure 2. Components of social technology (V. Taipale in Ekberg et al. 1995)]

![Figure 3. The pyramid of Ageing & Technology products]

• **Independence and security technologies**

Security services and technologies have found a growing market in modern society. Most of these with some enhancements are well suited for use also by the elderly population.

• **Social technologies**

DATE: 28.11.96 PAGE: 9
Social technologies (Figure 2) provide a viewpoint which incorporates assistive technologies, independence and security technologies and technologies used by care workers.

Structure of the report

In the following the current status of Ageing & Technology, the environment in which it exists and the forces shaping are outlined (Chapters II through VI).

Based on this analysis a framework for Ageing & Technology is discussed in Chapter VII. This framework is based on the value-star model. Through the value-star we attempt to describe the roles of the actors and the dynamics between them.

In Chapter VIII some recommendations are presented and discussed which could be used to further advance Ageing & Technology and to accelerate its development. Finally, Chapter IX presents the conclusions.
II DOUBLE AGEING OF EUROPEAN POPULATION

Double ageing is one of the most striking features in EU’s demographic future (European Commission 1995b). The term refers to simultaneous decline in fertility and mortality. From the point of view of well being the trend brings about two major challenges. Firstly, there will be an explosion in the number of people approaching retirement and old age. Secondly, the ratio between those in working age and elderly people in need for care will dramatically fall. The demographics mean rising needs of care, on the one hand, and more limited funding resources, on the other. This generates new problems for the organisation of care of the elderly population in the near future.

The growing share and number of the elderly

Demographic ageing is especially wide and rapid in EU-countries where the percentage of elderly people of 65 years or more from the total population is expected to increase from 15 % to 22 % whereas globally the percentage is expected to grow from 6 % to 10 % between 1995-2025 (Table 2). Immigration is not expected to compensate for demographic ageing in Europe according EU-estimations (European Commission 1995b). The rapid ageing that is distinctive for the European population characterises also US and Japanese demographics. The trend is, however, somewhat slower in the US and more rapid in Japan.

Table 2. Estimated share of elderly people in EU-countries in 1995 and 2025. (United Nations 1994)

<table>
<thead>
<tr>
<th>Country</th>
<th>65 and over % of population 1995</th>
<th>65 and over % of population 2025</th>
<th>75 and over % of population 1995</th>
<th>75 and over % of population 2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>14,9</td>
<td>21,4</td>
<td>6,0</td>
<td>9,6</td>
</tr>
<tr>
<td>Belgium</td>
<td>15,8</td>
<td>22,3</td>
<td>6,2</td>
<td>9,9</td>
</tr>
<tr>
<td>Denmark</td>
<td>15,2</td>
<td>20,9</td>
<td>6,9</td>
<td>9,6</td>
</tr>
<tr>
<td>Finland</td>
<td>14,1</td>
<td>21,7</td>
<td>5,7</td>
<td>9,8</td>
</tr>
<tr>
<td>France</td>
<td>14,9</td>
<td>21,3</td>
<td>6,2</td>
<td>9,7</td>
</tr>
<tr>
<td>Germany</td>
<td>15,2</td>
<td>22,9</td>
<td>6,2</td>
<td>10,1</td>
</tr>
<tr>
<td>Greece</td>
<td>15,9</td>
<td>23,9</td>
<td>6,4</td>
<td>11,5</td>
</tr>
<tr>
<td>Netherlands</td>
<td>13,2</td>
<td>22,2</td>
<td>5,6</td>
<td>9,9</td>
</tr>
<tr>
<td>Ireland</td>
<td>11,3</td>
<td>16,5</td>
<td>4,6</td>
<td>6,7</td>
</tr>
<tr>
<td>Italy</td>
<td>16,0</td>
<td>25,2</td>
<td>6,1</td>
<td>12,5</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>14,0</td>
<td>21,2</td>
<td>5,4</td>
<td>8,9</td>
</tr>
<tr>
<td>Portugal</td>
<td>14,1</td>
<td>19,4</td>
<td>5,4</td>
<td>8,2</td>
</tr>
<tr>
<td>Spain</td>
<td>14,9</td>
<td>22,6</td>
<td>6,0</td>
<td>10,5</td>
</tr>
<tr>
<td>Sweden</td>
<td>17,3</td>
<td>21,2</td>
<td>8,2</td>
<td>10,8</td>
</tr>
<tr>
<td>UK</td>
<td>15,5</td>
<td>19,0</td>
<td>6,7</td>
<td>8,8</td>
</tr>
<tr>
<td>EU total</td>
<td>15,2</td>
<td>22,0</td>
<td>6,2</td>
<td>10,1</td>
</tr>
<tr>
<td>World total</td>
<td>6,5</td>
<td>9,8</td>
<td>2,2</td>
<td>3,4</td>
</tr>
</tbody>
</table>
While one characteristic of EU demographics is the rather imminent fall in population, the number of elderly people (aged over 65 years) is estimated to grow from 57 million to 81 million by 2025. The number of the 'very old' (aged over 75 years) is estimated to grow from 23 million to 37 million by the year 2025 (Table 3).

Table 3.
Estimated number of elderly people in EU-countries in 1995 and 2025 (United Nations).

<table>
<thead>
<tr>
<th>Country</th>
<th>Population 65 and over (1000's)</th>
<th>Population 75 and over (1000's)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1995</td>
<td>2025</td>
</tr>
<tr>
<td>Austria</td>
<td>1 188</td>
<td>1 765</td>
</tr>
<tr>
<td>Belgium</td>
<td>1 598</td>
<td>2 318</td>
</tr>
<tr>
<td>Denmark</td>
<td>789</td>
<td>1 061</td>
</tr>
<tr>
<td>Finland</td>
<td>720</td>
<td>1 174</td>
</tr>
<tr>
<td>France</td>
<td>8 645</td>
<td>13 021</td>
</tr>
<tr>
<td>Germany</td>
<td>12 417</td>
<td>17 497</td>
</tr>
<tr>
<td>Greece</td>
<td>1 661</td>
<td>2 357</td>
</tr>
<tr>
<td>Netherlands</td>
<td>2 043</td>
<td>3 617</td>
</tr>
<tr>
<td>Ireland</td>
<td>400</td>
<td>639</td>
</tr>
<tr>
<td>Italy</td>
<td>9 196</td>
<td>13 180</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>57</td>
<td>93</td>
</tr>
<tr>
<td>Portugal</td>
<td>1 387</td>
<td>1 876</td>
</tr>
<tr>
<td>Spain</td>
<td>5 921</td>
<td>8 490</td>
</tr>
<tr>
<td>Sweden</td>
<td>1 520</td>
<td>2 071</td>
</tr>
<tr>
<td>UK</td>
<td>9 009</td>
<td>11 710</td>
</tr>
<tr>
<td>EU total</td>
<td>56 524</td>
<td>80 869</td>
</tr>
<tr>
<td>World total</td>
<td>371 148</td>
<td>809 339</td>
</tr>
</tbody>
</table>

Since 1960 life expectancy has increased in all EU countries. However, progress has been greatest in countries with, initially, the shortest life expectancy. In the past, the increase in life expectancy was primarily caused by declining infant mortality rates but nowadays, it involves particularly those aged over 60, thanks to the advancement in the prevention and treatment of cardiovascular diseases and cancer (European Commission 1995b).

Ratio between the working and elderly population

The fall in fertility, in turn, started around 1965. Since then the base of the age pyramid has decreased year by year. However, the history in terms of fertility varies greatly among countries within this period (European Commission 1995b). For instance, the northern countries (Sweden, Finland and Denmark) are known for the upturn in fertility towards the end of the 1980s while the southern countries and Ireland are characterised by a delayed but sudden fall of fertility. In Germany and Austria the 'baby boom' took place earlier and
fertility levels have remained very low for the past 20 years. In the central countries (United Kingdom, the Netherlands, Belgium, France and Luxembourg) fertility has, since 1975, fluctuated at levels lower than that which would maintain the population size constant.

The ratio between the number of adults of working age and the elderly is also in decline as Table 4 indicates. While in EU in 1995 there were almost seven adults of working age per one elderly person (aged 65 or over), by 2025 the ratio is expected to decrease close to four. From the point of view of care, more important, however, will be the change in the ratio concerning the very old. While today there are sixteen adults of working age per a person aged 75 or over, in 2025 the ratio is expected to be ten. The trend implies difficulties in future funding of the social welfare and health care services.

Table 4.
Estimated ratio between adults of the working age and the aged in EU-countries in 1995 and 2025. (United Nations 1994)

<table>
<thead>
<tr>
<th>Country</th>
<th>Working aged (20-64) / retired (65 and over)</th>
<th>Working aged (20-64) / very old (75 and over)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1995</td>
<td>2025</td>
</tr>
<tr>
<td>Austria</td>
<td>6,7</td>
<td>4,7</td>
</tr>
<tr>
<td>Belgium</td>
<td>6,3</td>
<td>4,5</td>
</tr>
<tr>
<td>Denmark</td>
<td>6,6</td>
<td>4,8</td>
</tr>
<tr>
<td>Finland</td>
<td>7,1</td>
<td>4,6</td>
</tr>
<tr>
<td>France</td>
<td>6,7</td>
<td>4,7</td>
</tr>
<tr>
<td>Germany</td>
<td>6,6</td>
<td>4,4</td>
</tr>
<tr>
<td>Greece</td>
<td>6,3</td>
<td>4,2</td>
</tr>
<tr>
<td>Holland</td>
<td>7,6</td>
<td>4,5</td>
</tr>
<tr>
<td>Ireland</td>
<td>8,9</td>
<td>6,1</td>
</tr>
<tr>
<td>Italy</td>
<td>6,2</td>
<td>4,0</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>7,1</td>
<td>4,7</td>
</tr>
<tr>
<td>Portugal</td>
<td>7,1</td>
<td>5,2</td>
</tr>
<tr>
<td>Spain</td>
<td>6,7</td>
<td>4,4</td>
</tr>
<tr>
<td>Sweden</td>
<td>5,8</td>
<td>4,7</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>6,5</td>
<td>5,2</td>
</tr>
<tr>
<td>EU total</td>
<td>6,6</td>
<td>4,5</td>
</tr>
</tbody>
</table>

Living alone as a risk for well-being

Living alone often means freedom and independence for an elderly person, but it may also involve risk for well-being, because help from family members is not as easily available as when living together with family.

The percentage of elderly living alone varies across countries and cultures. The figures in Table 4 are the latest available data, and refer either to persons of ages 60 and over or ages 65 and over. The main trend in developed countries is that the percentages of elderly people
living alone are high and rising. In Europe the highest percentages are found in Sweden (40 %) and what was West Germany (39 %). According to the same source the USA percentage was 30 % while in Japan the figure was only 9 %.

Table 4.
Percent of elderly population living alone in some EU-countries (US, Department of Commerce, 1991)

<table>
<thead>
<tr>
<th>Country</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>31</td>
</tr>
<tr>
<td>Belgium</td>
<td>32</td>
</tr>
<tr>
<td>Denmark</td>
<td>38</td>
</tr>
<tr>
<td>Finland</td>
<td>33</td>
</tr>
<tr>
<td>France</td>
<td>33</td>
</tr>
<tr>
<td>Germany (FR.)</td>
<td>39</td>
</tr>
<tr>
<td>Greece</td>
<td>15</td>
</tr>
<tr>
<td>Ireland</td>
<td>20</td>
</tr>
<tr>
<td>Italy</td>
<td>25</td>
</tr>
<tr>
<td>Netherlands</td>
<td>31</td>
</tr>
<tr>
<td>Portugal</td>
<td>18</td>
</tr>
<tr>
<td>Spain</td>
<td>14</td>
</tr>
<tr>
<td>Sweden</td>
<td>40</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>30</td>
</tr>
</tbody>
</table>

Living alone, among the elderly, is usually the result of having outlived a spouse and other relatives. The share of elderly women is greater than the share of elderly men living alone. That is mainly because women outlive men on the average, and because women tend to be younger than their spouses. Both numbers and proportions of elderly people living alone have increased sharply during the past three decades in Europe. (US, Department of Commerce 1991, De Jong and Beekink 1993).
III SOCIAL AND HEALTH CARE EXPENDITURE

Overall social protection expenditure

Table 5 indicates that between 1980 and 1993, total social expenditure increased in relation to GDP in all Member States with only two exceptions - Belgium and Germany, where it declined. Over the Union as a whole, average expenditure went up from 24 % to just under 28 %. In all countries without exception, social expenditure went up in relation to GDP between 1990 and 1993 (Table 6).

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>0,2</td>
<td>0</td>
<td>0,6</td>
</tr>
<tr>
<td>Belgium</td>
<td>0,3</td>
<td>-0,5</td>
<td>0,2</td>
</tr>
<tr>
<td>Denmark</td>
<td>-0,2</td>
<td>0,4</td>
<td>1,1</td>
</tr>
<tr>
<td>Finland</td>
<td>0,8</td>
<td>0,3</td>
<td>4,7</td>
</tr>
<tr>
<td>France</td>
<td>0,7</td>
<td>-0,2</td>
<td>1,1</td>
</tr>
<tr>
<td>Germany</td>
<td>-0,1</td>
<td>-0,3</td>
<td>0,3</td>
</tr>
<tr>
<td>Greece</td>
<td>1,1</td>
<td>0,1</td>
<td>0</td>
</tr>
<tr>
<td>Ireland</td>
<td>0,6</td>
<td>-0,8</td>
<td>0,6</td>
</tr>
<tr>
<td>Italy</td>
<td>0,6</td>
<td>0,3</td>
<td>0,6</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>-0,6</td>
<td>-0,3</td>
<td>0,9</td>
</tr>
<tr>
<td>Netherlands</td>
<td>0,3</td>
<td>0,1</td>
<td>0,5</td>
</tr>
<tr>
<td>Portugal</td>
<td>0,3</td>
<td>0,2</td>
<td>1,1</td>
</tr>
<tr>
<td>Spain</td>
<td>0,4</td>
<td>0,1</td>
<td>1,1</td>
</tr>
<tr>
<td>Sweden</td>
<td>0,1</td>
<td>0,1</td>
<td>0,2</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>0,6</td>
<td>-0,3</td>
<td>1,7</td>
</tr>
</tbody>
</table>

Almost all policy actions taken in respect of social protection in recent years have been aimed at containing costs and, where possible, reducing them. This has taken the form of tightening the regulations on eligibility to benefit, increased targeting of support, increased emphasis on active measures, and increased privatisation. Privatisation has included contracting-out services but also shifting the responsibility of providing protection to individuals themselves or to those employing them (European Commission 1995a).
### Table 6.
Total expenditure on social protection as percentage of GDP in some EU-countries, 1970-1993 (European Commission 1995a) (Figures for Germany exclude new Länder)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>28,0</td>
<td>29,3</td>
<td>27,0</td>
<td>27,6</td>
</tr>
<tr>
<td>Denmark</td>
<td>28,7</td>
<td>27,8</td>
<td>29,8</td>
<td>33,2</td>
</tr>
<tr>
<td>France</td>
<td>25,4</td>
<td>28,8</td>
<td>27,7</td>
<td>30,9</td>
</tr>
<tr>
<td>Germany</td>
<td>28,8</td>
<td>28,4</td>
<td>26,9</td>
<td>27,6</td>
</tr>
<tr>
<td>Greece</td>
<td>9,7</td>
<td>15,4</td>
<td>16,1</td>
<td>16,3</td>
</tr>
<tr>
<td>Ireland</td>
<td>20,6</td>
<td>23,6</td>
<td>19,5</td>
<td>21,4</td>
</tr>
<tr>
<td>Italy</td>
<td>19,4</td>
<td>22,6</td>
<td>24,1</td>
<td>25,8</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>26,5</td>
<td>23,4</td>
<td>22,1</td>
<td>24,9</td>
</tr>
<tr>
<td>Netherlands</td>
<td>30,1</td>
<td>31,7</td>
<td>32,2</td>
<td>33,6</td>
</tr>
<tr>
<td>Portugal</td>
<td>12,9</td>
<td>14,2</td>
<td>15,0</td>
<td>18,3</td>
</tr>
<tr>
<td>Spain</td>
<td>18,2</td>
<td>20,0</td>
<td>20,6</td>
<td>24,0</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>20,5</td>
<td>23,8</td>
<td>22,1</td>
<td>27,3</td>
</tr>
</tbody>
</table>

### Table 7.
Total health care expenditure in EU countries of Gross Domestic Product (%) (OECD Health Data 1996)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>7,9</td>
<td>8,1</td>
<td>8,4</td>
<td>9,7</td>
</tr>
<tr>
<td>Belgium</td>
<td>6,6</td>
<td>7,4</td>
<td>7,6</td>
<td>8,2</td>
</tr>
<tr>
<td>Denmark</td>
<td>6,8</td>
<td>6,3</td>
<td>6,5</td>
<td>6,6</td>
</tr>
<tr>
<td>Finland</td>
<td>6,5</td>
<td>7,3</td>
<td>8,0</td>
<td>8,3</td>
</tr>
<tr>
<td>France</td>
<td>7,6</td>
<td>8,5</td>
<td>8,9</td>
<td>9,7</td>
</tr>
<tr>
<td>Germany</td>
<td>8,4</td>
<td>8,7</td>
<td>8,3</td>
<td>9,5</td>
</tr>
<tr>
<td>Greece</td>
<td>3,6</td>
<td>4,1</td>
<td>4,3</td>
<td>5,2</td>
</tr>
<tr>
<td>Ireland</td>
<td>8,7</td>
<td>7,8</td>
<td>6,7</td>
<td>7,9</td>
</tr>
<tr>
<td>Italy</td>
<td>6,9</td>
<td>7,0</td>
<td>8,1</td>
<td>8,3</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>6,2</td>
<td>6,1</td>
<td>6,2</td>
<td>5,8</td>
</tr>
<tr>
<td>Netherlands</td>
<td>7,9</td>
<td>7,9</td>
<td>8,4</td>
<td>8,8</td>
</tr>
<tr>
<td>Portugal</td>
<td>5,8</td>
<td>6,3</td>
<td>6,6</td>
<td>7,6</td>
</tr>
<tr>
<td>Spain</td>
<td>5,7</td>
<td>5,7</td>
<td>6,9</td>
<td>7,3</td>
</tr>
<tr>
<td>Sweden</td>
<td>9,4</td>
<td>8,9</td>
<td>8,6</td>
<td>7,7</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>5,6</td>
<td>5,9</td>
<td>6,0</td>
<td>6,9</td>
</tr>
<tr>
<td>United States</td>
<td>9,1</td>
<td>10,7</td>
<td>12,7</td>
<td>14,3</td>
</tr>
<tr>
<td>Japan</td>
<td>6,4</td>
<td>6,7</td>
<td>6,0</td>
<td>6,9</td>
</tr>
</tbody>
</table>
Health care in particular

Total expenditure on health care averaged 8.5% of GDP in the EU in 1993. The scale of spending, however, varied significantly between countries as shown in Table 7. The general trend in the expenditure on health care (Figure 4) has showed a significant rise in relation to GDP since 1980. This has been the case in all but three EU countries where the expenditure has declined (Sweden, Ireland and Denmark).

Much of the increased expenditure has been due to an increase in private sector provision, which increased its share of total spending markedly in most parts of the Union (the only exceptions being Belgium, the Netherlands and Finland). The relative rise was particularly pronounced during the early 1990s when restraints on public expenditure were identified.

There has been a marked trend towards privatisation in the provision of health care. This has taken two related forms: the growth of private treatment per se and an increase in the extent of co-payment for prescriptions and consultations.

![Figure 4. Change in Total Health Care Expenditure in selected countries (in % of the value in 1980) (OECD Health Data 1996)](image)

National welfare and health policies and services

National welfare and health systems in all European Union countries are being shaped by a number of forces. The most notable of these is the reassessment of policy as countries are faced - to varying degree - with rising costs, inefficiency, waste, distorted incentives and inflexibility. The 'cure' for these in most countries is the same, a 'contractual' approach by which effective incentives can be established for achieving better use of available resources. However, creating effective competition on either the financiers side or the service providers side or between these two blocks has turned out to be difficult.
Of the other forces (Table 8) some are internal to the systems such as innovation and development of new services and the use of technologies to streamline old practices. Some are external, the most important of these being the ageing of the population.

The most notable change caused by these forces is the shift from in-patient care to ambulatory care. This is reshaping the role of hospitals as evidenced by the recent survey of hospital managers (Annex 2). At the same time with the support of modern telematics applications care can be moved from institutions at least partly to the homes of the customers. Furthermore, the contents of care are being reformulated to cover also other services than just health care related. In fact, health care is becoming a minor part of these modern home-based services. Finally, these technologies also allow the customers to become consumers and provide some of the services on their own. In total, the institutional care concept is being completely overhauled and is putting the citizen in much more control of her / his own destiny and thereby enabling prolonged independence and security.

Table 8.

Forces shaping welfare and health systems

- Welfare and health policy goals
- Increasing the value of services as experienced by consumers
- Ageing of the population
- Increase in the demand of welfare and health services as the level of awareness and general education increases
- Increasing need for integration between organisations and units providing services
- Information overload in care processes
- New care services, technologies, devices and pharmaceuticals
- The promise of telematics and information technology in general as a platform to support integration and interoperability of the various actors
IV SOCIAL DIMENSION OF AGEING & TECHNOLOGY

Technology and the social integration of elderly

At the level of society, ageing has impacts on social, political and economic structures, institutions and activities. At the level of individuals and groups, ageing brings about changes in behaviour, roles, status and attitudes. The mission of Ageing & Technology is to contribute to the welfare of elderly people. In principle, this is done by creating equal possibilities at the social and individual level to use technical devices and services. This task is a complicated one. It is a broad question of how (ageing) people are socially integrating themselves into a complexity and dynamism of technological development. For example, the working capacity of elderly people can be maintained in many ways in society by creating suitable ways for them to use technology. But at the same time, changes in production structures may favour younger people with greater abilities to adopt new knowledge and new ways of working.

As a whole, the social dimension of Ageing & Technology has to be seen as cultural change, a transition from a traditional "natural" ageing process into the social process where technology occupies an increasingly important role. Throughout modernisation, ageing has become a social issue in a new way. In a contemporary technological society ageing has to be understood as a complex phenomenon with varying interests, social relations and abilities of individuals to act in a community. In a society based on rapidly increasing scientific knowledge, the traditional concept of ageing has to be reformulated by using contemporary language which also means that ageing has to be considered both by social gerontological and social technological terms.

From a sociological point of view, Ageing & Technology must not mean only that technology completes human deficiencies and that it is expected to prevent, delay or compensate physical losses or the loss of social contacts. Ageing & Technology has to be understood also as an effort to study the potential benefits of technology from the elderly people's point of view. We have to ask what their own preferences concerning technology are. (Östlund 1995, 245-6)

Social ageing and technological ageing

Ageing is crucially linked with a person's relationship with his or her context of living. In contemporary society we cannot speak only of social ageing (social gerontology) but also of technological ageing. If technologies which we have learnt to use turn out to be obsolete, the social skills interrelated to these technologies will also become obsolete. This is especially true with elderly people who are not active in the working life, i.e. in the environment where the techno-social skills are easiest to maintain.

Technologies and persons' relationships to them are in a continuous state of change. Correct technical solutions should bridge a gap between lowering physical or social skills and the accelerating cycle of technological change. For keeping elderly people integrated in the social life, it is, therefore, important to study elderly people's attitudes towards technology and their ability to include it in their everyday life.

Technological innovations can have a profound influence on life styles and life situations. There are several issues which should be considered in applying technology into the social and health care interventions on elderly people's lives (Vanhuus ja vanhuksen tukeminen...
Their social and economic security as well as their self-determination, i.e. their right to choose the services themselves should be guaranteed. Although elderly people’s autonomy depends on the individuals’ own level of performance and also on their living environment (Fabris et al. 1996, p. 196) their autonomy should be supported so that they can use all of their own resources. Elderly people should have a right to live independently at home in familiar surroundings as long as possible and normal services should be provided for them. They should be considered as equal users of services who can personally influence the development of services.

Family and gender structures

Changes of family structures have influenced the provision of services. The family, close relatives and friends are still the most important helpers of elderly people. However, the old family structures have been eroded, and the role of public institutions and professional care givers has become more important. The use of new technology may again increase the role of families and other close helpers. At the same, it creates new possibilities to professional care givers to establish better methods of caring.

The concept of networking may well describe the remodifying of informal (e.g. families) and formal service providing systems (Marin 1996). It is probable that in the future the provision of services for elderly people will be a mix of different types of informal and formal care. The models of care may consist of individual, professional and technological ways of care and assistance.

Gender is another relevant issue in Ageing & Technology because of several reasons (Berg and Aune 1994, see also Mackenzie and Wajcman 1993, pp. 173-222). One of them is the fact that majority of the elderly are women. Second, the formal and informal care work in western societies is mainly done by women. Third, on the basis of recent knowledge on gender and technology we can assume that similar problems are faced in Ageing & Technology as in other fields of technology as well. Women are weakly involved in the development of technologies and, thus, their needs and perceptions for example due to involvement in caring work are not well included into technological development. One can assume that due to their weak involvement in the development of technology women’s resistance for new technologies may be stronger than men’s. In addition, gendering effects of Ageing & Technology need to be recognised.
V ADDITIONAL ASPECTS

Industry & service providers

It proved to be impossible to get clear figures of the size of the market for Ageing & Technology. This mainly caused by the fact that this market has not yet been established. There are no established rules to divide it into market segments. As it is mainly directed to the population in the 3rd Age some of its segments overlap with the traditional markets for consumers, health care etc.

Another way to estimate the market is through the purchasing power of the aged population. It has been estimated that in 2025 retired citizens comprise nearly 1/3 of the population and control nearly 70% of purchasing power (including fixed assets). This market is big enough and growing with enough speed to be of interest to industry.

The challenge in this market is to develop products that can readily be marketed all over Europe and the world. For the moment this market is, however, for the most characterised by small and medium sized companies (SME’s) of products with a limited geographical spread.

As technology and services have progressed they have become more and more intertwined. The emergence of the Information Society and the information highway have demonstrated that technology can be a strategic change agent in innovating new services and in streamlining old ones into more efficient ones. In the case of Ageing & Technology these elements are similarly in a dynamic relationship as shown in Figure 5 below.

\[
\text{Services require new products} \\
\text{Service(-s) Product(-s)} \\
\text{Products enable new services}
\]

Figure 5.
Technology is a strategic resource in streamlining and innovating services and vice versa new services require new products

Legislation and standards

Legislation is also a factor influencing the services and products available to support the ageing and aged citizens. This relationship extends from the welfare and health legislation to consumer safety. Depending on the social protection systems of a country varying amount of legislation and guidelines exist on the rights for services and (mainly) assistive technologies in the health and social services, education and employment sectors.
Consumer safety is regulated through a number of channels depending on the technologies utilised in gerontotechnology products. For medical devices Council Directive 93/42/CEC of June 14 is applicable. In telecommunications the availability of telematics services is based on standards prepared through ETSI and CEN.

Accessibility is a key element not only for housing mobility and transport but also in the rapidly evolving information society. United Nations General Assembly adopted in 1993 a resolution on this with the title ‘The standard rules on the equalisation of opportunities for persons with disabilities’.

In the European context it is important to note the division of powers between the European Union and member countries.

**Evaluation and assessment**

Products and services should always be safe, effective and efficient. Product safety is being legislated through standards and in the European Union through Council Directives.

The efficiency of a certain product and service has been left to the responsibility of the user. Increasingly we have become aware that this is not enough. It is of no use to propagate efficient technologies unless they are also effective. This has lead to the emergence of technology assessment as a methodology to provide information in order to decide which technologies should be allowed to diffuse into general use.
VI AGEING & TECHNOLOGY

A brief review on ongoing and planned activities in this field is given below. It does not cover all European activities. The reason for this coverage is to show what traditions this new field already has established and what visions it intends to realise.

European initiatives

A short summary of the involvement of the various Directorate Generals of the European Union in actions related to Ageing & Technology is given in the Table 9 below.

Table 9.
Involvement of Directorate Generals in actions related to Ageing & Technology

<table>
<thead>
<tr>
<th>Responsible</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DG III Industry</td>
<td>• Within the IT program special emphasis to ‘adaptable housing’, the smart house</td>
</tr>
<tr>
<td>DG V Employment, industrial relations and social affairs</td>
<td>• HELIOS (Handynet), HORIZON</td>
</tr>
<tr>
<td>DG VII Transport</td>
<td>• European Union programme ‘in favour of older people’ (1991-93) within which a ‘European observatory on ageing and old people’ was established</td>
</tr>
<tr>
<td>DG XII Research</td>
<td>• Action programme ‘Accessible transport’, which aims to increase the usability of transport for persons with reduced mobility.</td>
</tr>
<tr>
<td>DG XII Tele-communications, Information market and Exploitation of research</td>
<td>• In Targeted Socio-Economic Research program social exclusion, science and technology policy in general tasks also focus on the ageing and its consequences for research policies.</td>
</tr>
<tr>
<td>DG XII Tele-communications, Information market and Exploitation of research</td>
<td>• BIOMED-2 addresses age-related problems, health services research etc. in a number of projects. For instance, Technology, Ethics and Dementia focuses on the ethical issues</td>
</tr>
<tr>
<td>DG XII Tele-communications, Information market and Exploitation of research</td>
<td>• Industrial and Material Technologies program includes materials and technologies for innovation of products, including materials for biomedicine and bio-engineering.</td>
</tr>
<tr>
<td>DG XII Tele-communications, Information market and Exploitation of research</td>
<td>• Standardisation, Measurements and Testing program addresses the measurement of human biological constants important to the restoration and maintenance of body function.</td>
</tr>
<tr>
<td>DG XII Tele-communications, Information market and Exploitation of research</td>
<td>• ACTS addressees advanced communications and validates this by means of applications and services for elderly people. In the preceding RACE program several projects addressed this sector</td>
</tr>
<tr>
<td>DG XII Tele-communications, Information market and Exploitation of research</td>
<td>• TIDE (more in a separate chapter)</td>
</tr>
<tr>
<td>DG XII Tele-communications, Information market and Exploitation of research</td>
<td>• Telematics applications in its sub-programs such as Health Telematics, Rural and Urban Areas, Transport and Support Actions contain a number of projects relevant to the field (e.g. EQUALITY, ETHOS, INCLUDE, PLANEC, ...)</td>
</tr>
</tbody>
</table>
TIDE & Telematics for Disabled and Elderly

In the two first phases of TIDE (pilot and bridge phases) the acronym stood for ‘Technology Initiative for Disabled and Elderly’. In the current 4th Framework Program TIDE is one of the sectors of the Telematics Application Program (TAP) and the full name has changed to ‘Telematics for Disabled and Elderly’. Annex 3 lists all projects that have run under the TIDE program.

For the current program projects have been selected but the process of contracting these is still ongoing. Therefore no list of these projects is included into this report.

Below one example is given of a project that already has been completed (MarTel) and another of a project which is ongoing and cross-sectoral, i.e. funded from two TAP-sectors health telematics and telematics for disabled and elderly (PLANEC).

MarTel

MarTel (Market awareness of Technology for the care of older people, a horizontal action supported by the TIDE program of the EU) was a response to three seemingly incompatible imperatives:

• The demographic imperative deriving from the rising cost of services and care from the increasing numbers of older people;
• The industrial imperative deriving from the call for improved competitiveness in a coherent market; and
• The quality of life imperative deriving from the urge for greater individual independence and social participation for all citizens irrespective of age or disability.

The purpose of MarTel was to create awareness of the potential market of technology for older people. MarTel bridged the gap between the interests of the industry and that of older people, their representatives and the service provider organisations by providing arenas for these actors to communicate in partnership. The approach adopted is based on the concept of ‘Technology for All’. MarTel segmented the technologies and the market using the pyramid shown in Figure 6.

MarTel approach was based on building a dynamic actor network of different stakeholders which may assist in the shaping of the markets in the direction of extending the ‘Design for All’ concept towards a larger community of customers (Figure 7). The major stakeholders are

- End users and their organisations
- Care provision organisations
- Providers of technology
- Care funders
- Policy makers
- Designers, planners
- Researchers
- Network providers
Figure 6.  
The pyramid of social technology

Figure 7.  
Extending the 'Design for All' market through MarTel actions

PLANEC

PLANEC (Planning of the Care of the Elderly in European Countries, in the Health Telematics program of the EU) aims at a PC based intelligent information system for the planning, monitoring and evaluation of services for elderly people. Within the project a verified, demonstrated, user friendly and flexible prototype will be produced with the following elements:

- Relational database for demographics, socio-economics, demand and use of care services, service structure, resources and finance;
- Modules for socio-economic monitoring and evaluation of existing care systems;
- Basic modules for design of alternative care models; and
- Facilities for electronic data interchange linked to WWW.

The rationale for the PLANEC project is based on the need to improve allocation efficiency of care systems in all European countries. PLANEC started about a year ago and runs for three years in total.
COST A5 'Ageing and Technology'

COST A5 Ageing and Technology came into existence out of the need for co-operation between European researchers in the field of ageing and technology. It was formally established in 1991 with the participation of 16 European countries. Its general aims are to:

- Create European co-ordination for research on ageing and technology
- Co-ordinate and promote national activities at a European level
- Stimulate the multidisciplinary collaboration between experts in social sciences, technology, medicine, architecture, psychology etc. relevant to the ageing and the aged
- Incorporate aspects of social sciences into COST activities related to the processes of ageing in order to encourage comparative research.

Additionally COST A5 intends to:

- Show how different countries cope with the ageing and the aged and search for the role which can be played by technology
- Explore and assess possible interventions and repercussions of these.

The elements of the project are illustrated in Figure 8. The focus of the project is the 3rd Age. The project has identified a two part gap between the needs for technology by the elderly and the range of suitable products and services available:

1. Many existing technologies have to be adapted for elderly users because perceptual, cognitive and mobility limitations that often occur with advancing age make today’s technology difficult to use effectively.
   - The problem to be addressed is not the function but the interface between technology and its user.

---

COST is a form of European co-operation in the field of scientific and technical research in an intergovernmental framework. Presently COST comprises 25 European member countries.

DATE: 28.11.96
2. Most existing technology is not aimed at solving the unique difficulties (illnesses and limitations of activity) or opportunities (time for new activities and interests) of the elderly today and in the coming years.

- The problem to be addressed is to adapt and develop new technologies oriented towards the aspirations and special characteristics of more mature populations.

The key element of success is user involvement. The project's solution to these is gerontechnology, a research, technical development and education program based on the following three concepts:

1. Age associated differences in functioning can be modified through technical modifications in the environment.

2. The level of human abilities relative to task demands increases from childhood to adulthood remains stable most of adult life and then declines in old age.

3. Greater exposure and hence familiarity with technology increases the utility and usefulness of those configurations for older individuals.

With the support of this project the 2nd International Conference on Gerontechnology was organised in Helsinki, October 15-17, 1996 with a participation of around 400 experts in the field. A plan is being prepared to launch an 'International society for gerontechnology'.

Furthermore, a continuation of the present COST A5 is in preparation. The current title of it is 'The triangle of social changes, technological innovations and adult citizens'.

Gerontechnology comprises three dimensions:

1. What are goals when a certain technology is being used: Prevention, Enhancement, Compensation, Service Provision, Research on Ageing.

2. What are the needs that a certain technology is fulfilling: Mobility & physical abilities, Communication & mental abilities, Housing & safety & security, Health care & nutrition, Education & recreation.

3. What are the solutions (technologies) for the above needs and goals: Transport & robotics, Information & communication technologies, Building & furniture & appliances.
Health & wellness & food technologies, Fun & hobby technologies, Assistive technologies

The gerontechnology model of the field is based on combining technology push with market pull (Figure 9). Key elements are user involvement in all stages and getting the needs of the elderly society recognised as a legitimate basis for design and architect. Technology demonstrators in the format of for instance test houses are necessary to carry out the dialogue and interaction of supply and demand.

COST 219 and 219 bis

COST 219 ‘Future telecommunication and teleinformatics facilities for disabled people and elderly’ started in 1986 and after an extension finished in 1996. The project has produced three books:

- Use of telecommunications: The needs of people with disabilities
- Issues in telecommunications and people with disabilities
- Telecommunications for all

which together with other COST 219 publications are available at the Web-site of the project (http://www.nta.no/cost219/frontpage.html).

COST 219 has been instrumental in getting the needs of the disabled and elderly addressed by the European Commission in its R&D programs (e.g. RACE and TIDE) and by ETSI and ITU in their standardisation efforts in the field of telecommunications. Additionally the project has worked directly with teleoperators and organisations for handicapped people to raise their awareness of the needs and possibilities offered by telecommunication technologies.

A memorandum of understanding has been signed on the launching of a new COST 219 action for five years (1996-2001). The title of this continuation phase is ‘Technological opportunities in the markets and care for older people’. The stated objectives are to

- Study, assess and propose solutions to problems encountered by older people when using general products and services
- Study, assess and propose solutions to problems encountered in the care of older people in order to reduce the cost of care, to improve quality of life, and to widen the availability of care
- Support co-operation between technical specialists from industry, standardisation, service providers, and specialists working with older people
- Evaluate new technical solutions to promote good design for all including older citizens and
- Promote research in this sector.

The continuation phase of COST 219 is targeting on the technological opportunities in the market and care of older people. It stretches from technologies supporting independence and remaining active to technologies used by the care sector. The key aim is to get both major and smaller manufacturers to enter this market segment and to produce solutions for older people.

The title of COST 219 bis reflects how the focus has changed over the years. In the beginning the approach was very much technology centred and also driven by the
'handicap' paradigm. Over the years the needs have been identified more clearly bringing the ageing population into the forefront together with industry, the market.

Other forums and joint activities

A number of international and European interest groups, societies and co-operation programs have been established over the years in response to the ageing challenge. These include

- Design 50+
- Eurolink Age
- Rehabilitation International
- World Federation for the Deaf
- ECART

USA & Japan

In USA awareness of the challenges is wide-spread. Older people are partners in the political decision making processes. White House Conference on Ageing has been run so far four times. The last of these meetings addressed a ten-year plan on the subject of ageing. These conferences are a recognition of the fact that older people have political influence, that they have access to considerable financial and other resources, that they are increasingly aware of their situation and their rights, and that they are well organised.

In Japan the traditions are different and consequently they are focusing on the 'Ageing in Place' concept which means defining and creating appropriate forms of accommodation for older people within the local community.
Ageing

Four major trends describe the demographic future of the European Union (European Commission 1995b):

- General, rather imminent fall in population;
- Decline in the number of children and young people;
- Significant drop in the number of people of working age and
- Explosion in the number of people approaching retirement and old age

These trends - if nothing is done - would have a double effect: The needs for care would continue to increase while the funding resources for it would decrease.

The demographics is as it is, it cannot be changed. Similarly, the funding resources will decrease. The only variable that can be changed is 'care'. Instead of looking at it from the traditional but narrow perspective, a wider perspective is needed to realise that there are a whole range of measures that should be considered. For instance:

- Will people accept more responsibility for their independence and health during the whole of their lifetime?
- What measures of prevention can be taken to delay the onset of the need for care i.e. to extend the 3rd Age and delay the onset of the 4th Age?
- What can be done to decrease the need for care, i.e. by using technologies to present and delay the decline of well-being and to compensate for declining abilities?
- Is it possible to provide care in new modalities more effectively and efficiently than before?
- Can technology and the manufacturing industry be a meaningful actor in providing new products to enable these changes?
- Can we learn to understand ageing processes better and thereby devise new solutions?

The problem most EU countries now face is having to offer more (health) care and welfare services at a lower cost. Solving this dilemma evidently calls for both technical and social innovation. It will simultaneously require development and implementation of new technologies, changes in (health) care structures and systems, reconfiguration of the relationships between customers, service providers and technology providers and development of care processes. The solution poses different challenges for the various actors involved. For instance, political decision-makers and health care administrators face pressures to redesign health care systems, trade unions of health care professionals need to consider threats and possibilities related to new employment models, citizens will need to be more involved in care processes, and technology providers face the challenge of developing technologies for new markets.
From company-centred to co-operative innovation

To solve the problem successfully, however, all aspects and all expertise must be integrated. The outcome will not be controlled by any single actor, nor is the solution a matter of decision; instead it is a process of continuous dialogue and negotiation between multiple actors. Successful solution requires that innovation is perceived as a social process where different aspects (social, technological, economic, cultural and educational) are integrated (See Annex 1).

If we think about the Ageing & Technology development, in terms of the value star of Annex 1 we can draw Figure 10 to describe the actors - involved to a varying degree - who are shaping the market and who constitute the service & product development network, as well.

![Figure 10. Stakeholder view of the Ageing & Technology marketplace](attachment:image)

The most obvious stakeholders are the citizens, service providers and manufacturers, of course. But Ageing & Technology market is shaped also by the interests and perspectives of political decision makers, policy makers, standard setting bodies, different interest groups, distributors, financial sources and suppliers, as well.

The manufacturers and service providers in Europe need to respond to the changing needs of welfare and health by creating novel combinations of products and services that will improve the overall quality of life in Europe. The policy makers, politicians, legislators, standard setting bodies and interest groups need to respond pro-actively in order to encourage and not to inhibit these innovation processes. Finally, the key actor - the European citizen - needs to be empowered by information, education and other means to be an active partner in this ‘value-star’.

When developing new products to new markets companies need to be aware of the need to create a market place for their products. This means that an institutional network which enables the selling and purchasing of the product may need to be developed. Together with several other actors the innovative companies play crucial roles in the construction of the market place. In order to avoid ungrounded conclusions about the demand the company now needs to develop the product in constant dialogue with the other stakeholders.
In the Ageing & Technology domain an additional challenge is the innovation process. A well known fact is that you cannot design (force) an innovation. Instead you must take care that the environment is positive for innovations to take place. How to get the research groups involved in this domain each in its own discipline (e.g. combining ageing related medical, social and psychological research, with engineering disciplines, industrial design and architecture) to collaborate in order to create functioning multidisciplinary research teams? COST A5 provides one model of this and has accumulated a lot of experience in it. The TIDE program is another example although on a limited scale as it is concentrating on the technical solutions.

Transfer of results and ideas into commercial products and services is essentially a communication task. It mediates the feedback of the users' needs and the value of the product from the point of view of the various stakeholders. It simultaneously establishes the network of actors which forms the market. After all, the development of new products is not a temporary event, but requires a series of learning processes in which the technology itself and its social and physical environment are mutually adapted.

The key actors forming the market vary depending on the product. Their roles and relationships keep also changing depending on the product's life-cycle (see Annex 5 and 6). The 'star' is a process that takes new forms all the time. The identification of the crucial actors in a particular market and at a particular time will enable the manufacturer to evaluate whether the infrastructure needed to support its new product exists and whether the different institutions are prepared to accept, support and use the product. Naturally, the other stakeholders can draw different value stars from their point of view respectively.

The identification of the key actors is not an easy process. Even definition of the customer is not self-evident. In fact, the existence of different tiers of customers is a specific feature of health and social technology in general which make customer definition often difficult. Typically in this sector the people to whose benefit the technology is used, the users of the products, purchase decision makers and the payers are different actors.

In the following we will propose a framework to organise Ageing & Technology markets by the customer structure. To facilitate the analysis of the Ageing & Technology market the domain is organised along three dimensions.

1. **Goals**: Distinction is made between (1) technology aiming to prevent the problems related to ageing and (2) assistive technologies that are targeted for elderly people with special needs to support their independent living or for the use of care providers. It is important, however, to note that the preferences, needs and requirements of the elderly should also be taken into account in the design of mainstream products (Ekberg et al. 1995).

2. **Customer structure of Ageing & Technology products and services**: The specific feature of Ageing & Technology is that actors can play simultaneously many roles. Especially the citizen who can be a subject and object of care, purchaser and payer all at the same time.

3. **Key service and product technologies**: In the Ageing & Technology domain services are combined with products. These services are provided by the individual her-/himself or by a provider organisation. The products can be products of mainstream pharmaceutical, electronics and other engineering industries. In many cases, however, they are produced by small and medium sized industries operating in a geographically limited market space.
Domain of Ageing & Technology

Ageing & Technology as defined in COST A5 is technological research and development intertwined with research on biological, psychological, social and medical aspects of ageing. It aims to create preferred living and working environment and adapted medical care for the elderly. The difference between normal ageing and falling ill is recognised as important. Because ageing may be accompanied by illness, illnesses of the elderly cannot be separated from Ageing & Technology. Special issues for Ageing & Technology are those where an illness occurs mostly in the elderly or where it has special effects on them. (Graafmans et al. 1994).

The target group for Ageing & Technology is the elderly population. The elderly people, however, do not form a homogeneous group. One should take care not to typecast 'elderly as a homogeneous group'. Age is often not the determinant factor. Still, some age-graded classification may be useful to organise this target group. Graafmans et al. (1994) divide the elderly into three rough categories:

- The more or less healthy persons up to about 75 years of age comprising about 90 % of the elderly who would benefit from adequate consumer products and services that enhance work and from new technology that would improve performance of leisure, work and family activities unique to this period of life.
- Those between 75-85 years of age who may need some assisted care to remain independent which could be met by technology.
- Those over 85 who would typically need more assisted living and medical care.

Graafmans et al. (1994) distinguish five categories of technologies for the aged citizens according to the ways technology addresses ageing (Table 10).

<table>
<thead>
<tr>
<th>Category of technology</th>
<th>Explanation of its contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Technology for improving the quality of research on ageing</td>
<td>The technology that aids the elderly indirectly by improving the quality of research on ageing refers e.g. to technology for imaging organs and tissues or non-invasive biochemical measures of biological and physiological processes of ageing.</td>
</tr>
<tr>
<td>2. Technology to enhance the performance of new roles provided by ageing</td>
<td>Refers to new work, leisure, living and social situations. This domain is not well developed, yet.</td>
</tr>
<tr>
<td>3. Technology for preventing or slowing of the decline in physical and mental strength, flexibility and endurance that are commonly associated with age</td>
<td>Technology for prevention of the decline in physiological, social and psychological functioning to development and utilisation of modern technology assisting in maintaining a good health status. This includes equipment for exercise or systems for monitoring physiological functioning and assessment of progress.</td>
</tr>
<tr>
<td>4. Technology to compensate for declining capacities of ageing</td>
<td>This is the most developed area and includes, for instance, products and techniques to compensate for sensory losses or loss of strength and ability.</td>
</tr>
<tr>
<td>5. Assistance for caregivers who care for impaired elderly persons</td>
<td>This covers, for instance, technology for lifting and transporting persons who are incapable of moving themselves.</td>
</tr>
</tbody>
</table>
Categories 2 to 4 form a continuum in terms of time horizon of effects. Categories 2 and 3 represent preventive technologies whereas categories 4 and 5 relate to problems that have already occurred. The conventional approach has put most emphasis to the last two. However, to alleviate the problems caused by the ageing Europe more attention needs to paid to developing preventive technologies.

**Market segments in Ageing & Technology**

On a very rough level we can describe the markets of Ageing & Technology by dividing their customer structure into three groups:

- Users the products
- Purchasing decision makers of a certain product and
- Payers for the purchases.

In the other dimensions the different products can be presented using the five categories of above. The resulting matrix is given as Table 11.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Preventive</th>
<th>Assistive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ageing research technology Per/ormanc e enhancing technology Wellness &amp; health technology</td>
<td>Compensative technology for caregivers</td>
</tr>
<tr>
<td>User</td>
<td>Researcher</td>
<td>Citizen</td>
</tr>
<tr>
<td></td>
<td>Citizen</td>
<td>Citizen</td>
</tr>
<tr>
<td>Purchase decision maker</td>
<td>Hospital or university administration</td>
<td>Citizen</td>
</tr>
<tr>
<td>Payer</td>
<td>Public health care system / education system</td>
<td>Citizen</td>
</tr>
</tbody>
</table>

The markets for preventive technologies are pure consumer markets where the elderly citizens use the products and make the purchase decisions and payment themselves. The products cover equipment for exercise and monitoring physiological responses but also e.g. multimedia systems for hobby and leisure. For many products in this domain the market needs to be developed. This may entail e.g. that the manufacturing company in interaction with some other actors provides or supports educational activities to increase the awareness, among elderly people, of the need to take responsibility for one's own health, and develops skills which are needed for maintaining one's own health or taking new roles. In these domains the manufacturing companies and service providers need to seek close connection to elderly people's needs and life situations to be able to combine products and services in a
suitable way. The products need to be designed for non-professional use and they need to be offered at a reasonable affordable price.

The markets of technology for ageing research and assistance for care providers, in turn, can be described as 'institutional' in the sense that these technologies are normally used by professionals in an institutional setting. In these domains users are typically health care specialists or specialised researchers. Purchase decisions are made by health care experts and public administrators, and the public or private health care or educational institution is responsible for payment.

However, the assistance for care providers - category covers also assistive technology for the home setting like active and passive security alarms designed particularly for the care of elderly people (e.g. system for monitoring movement of demented people). For some (many?) of these products there is a consumer market as well.

In the domain of compensative technology for declining abilities the companies are operating in two kinds of markets: the consumer market and the institutional market. Partly communities provide care for their older citizens. However, some products in this sector are such that citizens will have to make the purchase decisions and payment privately.

Another distinction that can be made concerning the markets is that between public and private. In most OECD-countries the public sector (the public health and social welfare system) forms the most important market for health care products, although in all countries there is room for private market, too. Here, the markets are, however, not analysed along this dimension.

Combined products and services

Analysis of Ageing & Technology market according to the main product technologies and services involved provides a more concrete understanding of the product and service combinations in each segment. A typical feature in Ageing & Technology is that it is a multidisciplinary market integrating various fields of technology, health care and social welfare. Table 12 gives a rough description of the types of technologies in use in different areas of Ageing & Technology.

Table 12.
Main product technologies in Ageing & Technology.

<table>
<thead>
<tr>
<th>Technologies</th>
<th>Preventive</th>
<th></th>
<th>Assistive</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ageing</td>
<td>Research</td>
<td>Wellness &amp;</td>
<td>Compens-</td>
</tr>
<tr>
<td></td>
<td>Performance</td>
<td>enhancing</td>
<td>health</td>
<td>sateve-</td>
</tr>
<tr>
<td></td>
<td>technology</td>
<td>technology</td>
<td>technology</td>
<td>tcy for</td>
</tr>
<tr>
<td>Fitness devices</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Measurement devices</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Diagnostic systems</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Assistive devices</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Aids for daily living*</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independence and security</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Telematics</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Pharmaceuticals</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

DATE: 28.11.96
Market segmentation by need

Another, rough segmentation of the market for the aged and ageing can be made in social and economic terms. While in the past it has been customary to describe the over 65 years old as one group the demographics described in section II clearly indicate that in fact we have two groups. This new classification (e.g. European Commission 1995b, p.5) distinguishes between

1. 3rd Age referring to retired people who are alert, in full possession of their physical and mental capacities and who are well integrated in the economy as consumers and as part of the informal economy (exchange of goods and services), and

2. 4th Age referring to those persons who really are biologically aged, with reduced functional autonomy and dependent on external resources in order to be able to ensure good living conditions.

Again, there is no specific age at which one passes from one group to another. The boundary varies, but it could be basically defined as the age at which, on average, there are only a few years left to live. Generally speaking, in Europe the 4th Age includes the majority of people aged over 80, and especially those over 90.

To organise the market of technology for the elderly we can try to identify specific needs based on the abilities of the Age groups above and link them with concrete technologies. One of the problems in this task is, however, the fact that the potential customers especially in the 3rd Age have not only one but multiple needs in terms of technology. The elderly are typically in simultaneous need of various kinds of preventive and assistive technologies. So the customer segments are partly overlapping which may provoke the challenge of integration between different types of technologies.

Although it is not a universal law, in general, people need to have their existence-related basic needs filled at least to some extent before they will be motivated by 'higher' needs (Alderfer 1971). The existence needs refer to the need to eat and drink and the need for security (to get physical shelter, protection from pain and fear). After that, in the 'need hierarchy' come the relatedness needs i.e. the need to feel love and togetherness. The growth needs (need for self fulfilment and development) are usually referred to as the 'higher' needs.

The fundamental issue for the future will be whether the existence-related needs of the ageing population is Europe can be satisfactorily met. Well-being in the ageing societies will basically depend on overall economic, social and environmental development. For that reason the issue of the ageing of population needs to be integrated in European economic, social and environmental policies. The interdependent nature of well-being emphasises the importance to involve broad segments of society in these issues. However, the report will not strive to cover the whole complex issue. The report covers issues that are more connected to meeting the needs of relatedness and growth.
A great number of people in the 3rd Age are not in need of any specific technologies for the elderly. However, there are several kinds of specific needs that may be typical in this group provoking challenges for technological development:

☆ Need to perform new activities, need for educational services and pleasure activities.
  Meeting these kinds of needs calls for development of products and services enabling and enhancing the performance of new roles and activities.

☆ Need to maintain a good state of health, and to evaluate and lower risk for getting specific diseases related to old age. This may be facilitated by systems for monitoring physiological states and functioning, technology for exercise, and educational services to provide the users with needed background information and skills to use the technology (Wellness technology).

☆ Need to continue independent living even after declining capacities, need for security.
  This is facilitated on the one hand by technologies that compensate for declining capacities but also communication technologies.

☆ Need to treat chronic illnesses at home. This may call for e.g. communication technologies designed for care of illnesses.

In the 4th Age people are more seldom capable of living alone. More often they live in institutions or with their families. What separates this group from the former is the fact that their technological needs typically relate to compensating for declining capacities and assistance for care givers than performance enhancing or preventive technologies. Also their technological needs are often related to health care:

☆ Need to treat chronic illnesses at home

☆ Need to keep in contact with family, caregivers etc.

☆ Need for medical care (of mainstream medical technology)

☆ Need for caregivers for assistance in caring for impaired elderly persons (both in their homes and in institutions).

Annex 4 gives two examples of integrated approaches to the needs of people either in the 3rd or 4th Age. The first one is only a list of needs and possible technologies that can meet these needs. The second is an experimental home which has completely been architected and designed for the elderly.
VIII OPPORTUNITIES AND RECOMMENDATIONS

Technology is a social construction

Technological progress is not determined by its own laws. Instead it is shaped by people, organisations and groups whose conceptions of its meaning vary. All actors involved strive to shape technology according to their own desires, needs and interests. Therefore, technological and social aspects of technological development cannot be separated.

Technology is not neutral: its implications are not generated only in the implementation stage. The implications have been built into a product or system already in the development stage.

From this point of view the shaping of Ageing & Technology should not so much focus on specific recommendations or directives of technical features of products and technical systems. It may be more important to focus on the process of technological development. Who is involved in development and planning process and how? What is the conception of user / customer? How is the user involved? How do use-related meanings evolve in the interaction between different actors?

Furthermore, attention should be paid to the development of technology assessment processes that view technology as an outcome of social negotiation process (Bijker et.al. 1990, Östlund 1995).

Development of arenas for dialogue

In industry there is an increasing awareness of the potential markets of older people as users and customers of technology. More information is needed about the different types of technology markets and their consequences for different stakeholders. Social professionals have difficulties in conveying their approaches to the technical experts. Dialogue needs to be facilitated. The role of policy makers could be that of a catalyst or a bridge builder between technology and service providers and elderly citizens arranging and organising arenas for dialogue between various care professionals, political decision makers, technology producers and elderly citizens. Dialogue on the various interests and perspectives related to Ageing & Technology conveys understanding on users' points of view and political aspirations and priorities to product developers and information on technical possibilities to political decision makers and citizens. This kind of dialogue could, from the industry point of view, facilitate the strategy formulation of technology providers and contribute to the development of products with social demand.

Developing the concepts in use

Ageing & Technology is a vague and wide conception referring on one hand to satisfying the needs of rather healthy elderly people whose needs are shared by other groups in society as well, and on the other hand with very specific needs of people with effects of ageing. From the market point of view those two segments are totally different. How does Ageing & Technology relate to the principle of "technology for all" i.e. that the needs and requirements of the elderly should be taken into account also in the design of mainstream products? Is Ageing & Technology a perspective to technological development in general,
or do we, by Ageing & Technology, refer only to technology targeted particularly for elderly people with special needs to support their independent living and for the use of care providers? A shared understanding on Ageing & Technology is clearly needed.

**Interactive strategies to cope with societal change**

Societal changes and business transformation calls for rethinking of the business logic. Business and societal relationships have become more complex, multi-directional and simultaneous. More interactive business strategies are needed. Instead of a technology provider innovating new products and selling them to their customers, innovative processes need to be built on continuous co-operation with subcontractors, political decision makers, policy makers, service providers and customers whereby the different interests and perspectives will be incorporated in the products and services.

**Combination of products and services**

Instead of selling simply products or services to the customers, the companies and service providers need to combine their competencies in novel ways to be able to offer new kinds of combinations of products and services.
IX CONCLUSIONS

The foremost reason for the emergence of Ageing & Technology as a multidisciplinary field are the challenges Europe is facing when its population is ageing and the cost of the health and welfare systems in respective EU countries is becoming intolerable.

The fact that Europe is ageing is not only a challenge it is also an opportunity for Europe. Ageing is a problem in all industrialised countries and it will become a problem in the developing countries. Therefore the European solutions should find markets also elsewhere and thereby contribute towards the improved competitiveness of European enterprises against those in USA, Japan and other countries.

The main conclusions are summarised below.

**Double Ageing**

Europe is ageing quickly (Table 13). When now the numbers of those over 65 and those over 75 years old respectively are 57 million and 23 million, in 2025 these numbers are projected to be 81 and 37 million respectively. In percentages this is an increase of 42% and 61% respectively. At the same time the number of persons in the working age is decreasing. The consequence is that while today there are sixteen adults of working age per person aged 75 years or over, in 2025 the ratio is expected to be ten. A decrease of nearly 39%.

Total social expenditure in relation to GDP over the European Union as a whole has gone up from 24% to just under 28% between 1980 and 1993. In all EU countries without exception, social expenditure has increased in relation to GDP between 1990 and 1993.

Applying the ageing trends linearly on the expenditure numbers in 2025 total social expenditure would exceed 40% of GDP. Respectively health care spending would consume roughly 15% of GDP. Clearly, linear measures in responding to this challenge will not be enough.

*Table 13.*

<table>
<thead>
<tr>
<th>Key indicators of the Ageing Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>------------------------------------</td>
</tr>
<tr>
<td>persons 65 years and older</td>
</tr>
<tr>
<td>persons 75 years and older</td>
</tr>
<tr>
<td>ratio of working age adults over</td>
</tr>
<tr>
<td>persons 75 years and older</td>
</tr>
<tr>
<td>social expenditure (of GDP)</td>
</tr>
<tr>
<td>health care expenditure (of GDP)</td>
</tr>
</tbody>
</table>

* (linear estimation)

The actual age of a person, however, is no clear indicator of anything more than age itself. In fact this is best described by the metaphors of 1st, 2nd, 3rd and 4th Age (youth, working age, retirement, frailty and death respectively). Being retired in the modern society by no means implies frailty or loss of independence. These are present only in the 4th Age which in the case of a single person can happen at any moment of time and may last for any duration.
Ageing & Technology is, therefore, addressing the needs and solutions of two groups of people, i.e. the 3rd and 4th Age, with different needs and therefore also different solutions.

Ageing & Technology - What is it

As a rule, it is futile to discuss terminology because what is important is not what an item is called but what it means or contains. Especially in new emerging fields names are invented and 'owned'. The same applies to the domain which in this report is named Ageing & Technology. It is addressed by many other ‘names’ e.g. social technology, health (care) technology, wellness technology, technology for independence and security, and gerontechnology.

For the purposes of this report ‘Ageing & Technology was found to be the best descriptor (at this moment of time) on the one hand of the challenges posed by the ageing of European populations and on the other, of the solutions that can be provided through the innovative use of present and emerging technologies.

Market

The market is segmented in many directions:

- There are two different groups of elderly people with different needs, i.e. the 3rd and 4th Age populations
- There are industrial products and services based on the use of these products
- The users of the products and/or services can be either the elderly citizens themselves or service providers
- There are several purchasing decision makers; citizens themselves, service providers both private and public, and third party payers (e.g. insurance companies)
- Technologies can be segmented into at least five categories: (1) Performance enhancing technology; (2) Wellness & health technology; (3) Compensative technology; (4) Technology for care givers; and (5) Ageing research technology. Of these 1 & 2 are directed to the 3rd Age population and 3 & 4 for the 4th Age population.

As Ageing & Technology is an emerging market it has proven impossible to get estimates of the size of the market. However, in terms of purchasing power the elderly population is a market that industry cannot ignore. It has been estimated that in 2025 the elderly population which at that time is about 1/3 of the total population controls roughly 70% of the money (disposable income + fixed assets).

The projection of the demographic trends on the social expenditure and health care funding indicate that social and health policies and strategies must be reoriented towards decreasing the rate of increase of these expenditures. Examples of the means that are currently being explored include

- Restructuring of the care-mix by shifting care out of institutions to ambulatory settings and to the homes of individuals
- Improving the effectiveness and efficiency of services themselves
- Placing more emphasis on prevention, well-being and healthy life styles
- Expecting citizens to take more responsibility for their mental and physical well-being, e.g. life style changes promoting wellness, fitness, nutrition and clothing
• Using 'Information Society' and telematics as a strategic change agent in launching change processes, networking care providers and customers and empowering local innovations for new products, services and care-mix.

**Independence and empowerment**

We need to set up a positive vision what it means to be old and living in the future Europe. In the last 150 years we have gained 30 life-years. Consequently, the main aim of Ageing & Technology is to empower the ageing population to maintain their autonomy and dignity, to pursue self-fulfilment, to lead an independent life, to care for their well-being, and continue to be members of the society.

This calls for action in three areas:

• Development of products and services

• Providing information of what is available (e.g. knowledge about health, prevention of illnesses, care possibilities),

• Organising the 'delivery' of these products and services to the customers

**Social dimension**

In contemporary society we cannot speak only of social ageing (social gerontology) but also of technological ageing. If technologies which we have learnt to use turn out to be obsolete, the social skills interrelated to these technologies will also become obsolete. Technologies and persons' relationships to them are in a continuous state of change. For keeping elderly people integrated in the social life, it is, therefore, important to study elderly people's attitudes towards technology and their ability to adopt it in their everyday life.

Technological innovations have a profound influence on life styles and life situations. Changes of family structures have influenced the provision of services. The use of new technology may again increase the role of families and other close helpers. It is probable that in the future the provision of services for elderly people will be a mix of different types of informal and formal care.

Gender is another relevant issue mainly because the majority of the elderly are women. Also formal and informal care work in western societies is mainly done by women. Thirdly, on the basis of recent knowledge on gender and technology we can assume that similar problems are faced in Ageing & Technology as in other fields of technology as well. Women are weakly involved in the development of technologies and, thus, their needs and perceptions for example due to involvement in caring work are not well incorporated. One can assume that due to their weak involvement in the development of technology women's resistance for new technologies may be stronger than men's.

The social perspective is valuable in enforcing research and industrial actions. Technology should serve the needs not establish 'needs'. Instead of letting technology lead we need to build also the social structures at the same time.

**Complexity**

The challenge posed by double ageing is in itself simple. The solutions, however, require a combined approach as shown for instance by the multitude of directions by which this market can be segmented. The complexity is due to the mixed market place, the number of
stakeholders and the need to create new markets and the need to engage in a dialogue involving all stakeholders including the elderly citizens.

As technologies are shaped by people, organisations and groups technological and social aspects of technological development cannot be separated. Technology is not neutral: its implications are not generated only in the implementation stage. The implications have been built into a product or system already in the development stage.

From this point of view the shaping of Ageing & Technology should not so much focus on specific recommendations or directives of technical features of products and technical systems. It is more important to focus on the development process itself:

- Who is involved in development and planning process and how?
- What is the conception of user/customer?
- How is the user involved?
- How do use-related meanings evolve in the interaction between different actors?

**Encourage the process**

As described above the Ageing & Technology is a complex environment of a number of stakeholders with varying interests. It is not feasible to build a top-down action program with a vision, mission, strategy, policies and projects that will guarantee results. But it is not wise either to leave it on its own to find its solutions by trial and error.

The 'middle road' is to accept its complexity and instead for trying to control it, encourage the process of research, development, piloting, evaluation and implementation of Ageing & Technology. Additionally some ground rules should be established to point the direction.

One of these ground rules is the fact that the responsibility for the development of the infrastructure on which the Ageing & Technology products and services will exist remains with the society. Similarly social and health policies will determine the incentives for industry and service providers. Thirdly, consumer power should be brought to bear on this domain as well.

**Innovation**

All actors are involved in shaping the outcomes of innovation processes *regardless of the awareness of these actors* (not using one's possibilities fully is also participation). It is, however, in the interest of every actor to be aware of the prospects related to taking an active part in the process. Success in solving the ageing related challenges calls for a higher awareness of value formation as an interactive dialogue from the part of all key actors (called 'value star').

**Work force**

Some of the consequences in responding to the ageing challenge will be work force related. For instance in the Nord-Rhein-Westphalen region it has been estimated that ageing would produce a 3x growth in the number of persons involved in public and private services. As mentioned above this is clearly not possible. New services and products supporting these must be innovated. A new service-mix must be innovated which among other things puts more emphasis on citizens for their well-being and health. Care structures must become
'lighter' implying a shift of work force from institutional to ambulatory care. New products and services call for different training and education.

New incentives

The speed at which the Ageing & Technology market will develop and the directions of its growth will depend on how the different stakeholders experience and view the incentives. Therefore the 'ground rules' mentioned above are highly important. Issues to be considered include:

• Shaping of the public funding and service provision systems to foster a welfare-mix public and private services co-existing with a consumer market of technological devices and systems used by the citizens themselves (e.g. the use of 'service cheques' given by the public sector and which can be 'upgraded' with private money to buy a product or a service)

• Involve mainstream industry and SMEs to invest in research and development of Ageing & Technology on a large scale, for instance through an action program run by the industries

• Similarly involve service providers both from the public and private sectors

• Needs must be in the 'driver's seat'. Technology has to fulfil a need, if not it will be rejected. However, also new services will have to be created to take advantage of the technology potential

Agenda for actions

A number of European and European Union actions are already ongoing in Ageing & Technology. However, the ageing challenge Europe is facing combined with social changes of e.g. the new role of the family, cultural differences across Europe, competitiveness of European industry etc. a more holistic approach is needed focusing on the following issues

• Awareness of the challenge

• Involving mainstream industries and SMEs, and service providers both in the public and private sectors

• Involving other stakeholders, especially European citizens and other end-users

• Education on all levels to influence general attitudes towards ageing and to educate and train citizens and service providers in the use of the new technologies

• Dissemination of information

• Initiating in the 5th Framework Program specific actions on Ageing and Technology

Additionally, at the national level

• Social and health policies will have to be shaped to be an incentive for the other stakeholders to develop solutions

Specific actions on Ageing & Technology at the EU level

The double ageing challenge facing all European Union countries requires joint actions which must start now not later. In meeting this challenge through Ageing & Technology opportunities exists for new employment and new services for preserving our European
way, values and cultures. Ageing & Technology also provides a way to improve the competitiveness of European industry in this domain and to take a global leadership role in this emerging large market.

For the 5th Framework Program two basic strategic options exist: (1) Integrate Ageing & Technology into all programs in accordance to their specific goals and work plans, or (2) set up a specific actions with goals, work plans and budgets to address the challenge in a holistic way.

The approach of this report is to combine these two, i.e. integrate Ageing & Technology into the technology programs of the 5th FP AND additionally set up specific actions to

- Increase the co-ordination of efforts.
- Implement lead pilots to act as spearheads where the new concepts of products and service-mix are demonstrated, validated and evaluated in real-life situations
- Mobilise other funds from regional and other European sources to support these pilots, especially for the infrastructure investments
- Invest into understanding the social side of this and into education and awareness.
REFERENCES

9. COST 219 Final report, 1996
10. COST 219 bis, Memorandum of understanding, 1996
12. COST Draft Memorandum of understanding, Triangle of social changes, technological innovations and adult citizens, 1996.


28. OECD Health Data 1996.

29. Szeman, Z. and Gáthy V. (Eds.), Exploring old age in east and west, COST A5 Ageing and technology, STAKES, Finland, 1996.


35. Östlund, B., Gammal är äldst. En studie av teknik i äldre människors liv (Diss.). Linköping Studies in Arts and Science. (in Swedish, summary in English).
VALUE-STAR FRAMEWORK

In a period of fundamental industry transformation, which is now going on in industry in Western societies, companies can no longer keep on developing products internally and then selling them to the market. This is because the companies cannot trust that their conventional markets continue to exist when the roles and relationships between actors are constantly reconfigured. In this situation the shaping of technologies has to be co-ordinated with the shaping of new markets based on new services and new ways to operate and compete on these markets. In the domain of Ageing & Technology, manufacturers equally need to change their innovative behaviour.

Current management practice and research on management of innovation assumes implicitly that product development processes and their outcomes are primarily in management control. In management practice this is manifested in rather infrequent inclusion of external actors in the development processes. Management thinking can be described by reference to the value chain metaphor: the company buys an item, adds value to it, and sells it to the next link. In mainstream research on management of innovation the company-centred approach is manifested in research design: the studies strive to map success factors in internal product development processes. Another problem relates to the assumption that all actors involved in product development processes have shared values, interests and targets.

Although there have been studies challenging these assumptions (e.g. von Hippel 1976, Burgelman 1983) and although the views of technology as a societal process have been well developed in the sociology of technology (e.g. Green 1992), management researchers have only recently started to promote the idea that the development of technology needs to be perceived as an interactive process between several actors or a network (Normann and Ramirez 1994, Hamel and Prahalad 1994, Biemans 1992).

It has been general knowledge that innovations are typically generated in the interaction of actors possessing different expertise and experience. The essential point is that these actors may also be external (from the company point of view) and that their actions are guided by differing interests and points of view. Competition and co-operation are inherent elements in innovation. Innovation is always a political and tension-laden process.

A value star metaphor (Figure A1.1) has been offered to replace the value chain mind set (Normann and Ramirez 1994). The basic idea behind the value star is that the partners in the production of a product or service create value together by inventing new relationships. Consequently, the border between a company and its market gets less distinct.

The most obvious stakeholders are the producers and the customers. But the Ageing & Technology market is shaped also by the interests and perspectives of political decision makers, policy makers, standard setting bodies, different interest groups, distributors, financial sources and suppliers, as well. The producers include in addition to the manufacturers the service providers working in the open and closed sectors. Similarly, the customers are in some case the individuals and in some cases the service providers. This ‘mix’ is due to the fact that some of the industrial products are used by the service providers.
and some by the individuals. This rough sketch of the actors and their links already shows the complexity of this domain.

Figure A1.1.
The value chain and value star metaphors

Similarly, the innovation & development of products is inherently coupled with the process of developing services. Therefore the traditional cycle (Figure A1.2) from research & development to production utilisation and evaluation has two loops; one for the products and the other for the services as demonstrated in Figure A1.3 below.

Figure A1.2.
Traditional product development cycle
Figure A1.3.
Modified development cycle based on the value star
| Private funding will rise as healthier expenditure will outstrip economic growth | Funding from the public sector is expected to decrease, while funding from private insurance, company schemes and household spending is expected to increase. |
| People will be more responsible for their health care | Based on the above citizens will have a greater financial responsibility of their own health care. Citizens concern for the healthiness of their individual lifestyles will increase. A greater involvement in health care decisions is also expected. |
| Governments will continue to guarantee access and quality while controlling costs | Access to a specified minimum level of care will be guaranteed. Resources will be shifted towards primary and community care. Cost containment strategies will emphasise controls and managed competition. Patient case types will be taken into use to analyse hospital cases and to better understand costs and improve quality. |
| The shift to primary / community care will continue | Resources will be shifted from inpatient care to primary, community and outpatient care. The elderly with long-term care needs and non-acute illness will be increasingly health with in alternative care settings (e.g. day care and home care). Primary care doctors will have a broader responsibility in health care delivery both as guides and 'gate keepers' to specialised care and by participation into the delivery of that care. |
| 'Managed' competition will increase | Governments intend to create internal markets for selling and buying health care services in order to increase flexibility and efficiency. Clients will have increased freedom to choose between public and private health insurance. |
| Hospitals to undergo significant change | The number of inpatient beds will continue to decline. Outpatient services will grow. Decentralisation will continue. Co-operative groups of hospitals will be created and specialisation within hospitals will continue. Competition between hospitals will be based on costs and quality. Information technology, efficiency drives and re-engineering of hospital processes are the tactics. |
| Doctors will assume broader responsibilities | Doctors will increasingly weigh cost as well as quality in making resource and treatment decisions. Doctors' freedom to make decisions will be constrained by the need to operate within budgets. |
| The European Community's role in health care will increase | EC will probably assume a role of a health promoter and develop international standards for measuring clinical quality. |
Information technology will bring significant benefits.

IT is expected to result in major improvements by providing information that supports decision making from the care process to management of funding and measuring performance. IT networks will be implemented to communicate between hospital departments, to share information between health care professionals and to focus on providing the right treatments to the patients at the right time.
TIDE PROJECTS

Below is a list of the projects in the TIDE program (Technology Initiative for Disabled and Elderly people). The first list is for the pilot phase, the second the bridge phase. As part of the Telematics Applications Program (TAP) of the 4th Framework Program and new TIDE is being launched. At the time of the writing of this report the new projects selected for the program are still being contracted. Therefore a list of these new projects is not included into this report.

Technology Initiative for Disabled and Elderly People - Pilot Phase

<table>
<thead>
<tr>
<th>Project name</th>
<th>Acronym</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Application of Computer-based systems to Training in IT</td>
<td>(ACT-IT)</td>
</tr>
<tr>
<td>2. Adaptable Smarter Homes for Residents who are Elderly or Disabled People</td>
<td>(ASHORED)</td>
</tr>
<tr>
<td>3. Audio description of television for the visually disabled and elderly</td>
<td>(AUDETEL)</td>
</tr>
<tr>
<td>4. Communication and access to information for persons with special needs</td>
<td>(CAPS)</td>
</tr>
<tr>
<td>5. A kitchen management system for people with a mental handicap</td>
<td>(CHEF)</td>
</tr>
<tr>
<td>6. Consensus creation and awareness for R&amp;D activities in technology for disabled and elderly people</td>
<td>(CORE)</td>
</tr>
<tr>
<td>7. Future alarm and awareness services for the disabled and elderly</td>
<td>(FASDE)</td>
</tr>
<tr>
<td>8. General purpose portable communicator</td>
<td>(GPPC)</td>
</tr>
<tr>
<td>9. Textual and graphical user interfaces for blind people</td>
<td>(GUIB)</td>
</tr>
<tr>
<td>10. Horizontal European Activities in Rehabilitation Technology</td>
<td>(HEART)</td>
</tr>
<tr>
<td>11. Interfacing disabled people with industry-standard computing environments</td>
<td>(INDICES)</td>
</tr>
<tr>
<td>12. Development of a CAD/CAM system for manufacturing customised insoles for shoes</td>
<td>(INSCAD)</td>
</tr>
<tr>
<td>13. Communication aids for the handicapped</td>
<td>(KOMBE)</td>
</tr>
<tr>
<td>14. An intelligent interface for the rehabilitation environment</td>
<td>(M3S)</td>
</tr>
<tr>
<td>15. Manipulative automatic reaction control &amp; user supervision</td>
<td>(MARCUS)</td>
</tr>
<tr>
<td>16. Modular environmental control and communications system</td>
<td>(MECCS)</td>
</tr>
<tr>
<td>17. Modelling for the disabled in working environments: a multi-perspective approach</td>
<td>(MODEMA)</td>
</tr>
<tr>
<td>18. Multilingual multimedia speech aid for the hearing and</td>
<td>(MUSA)</td>
</tr>
</tbody>
</table>
Technology Initiative for Disabled and Elderly People - Bridge Phase

<table>
<thead>
<tr>
<th>Project name</th>
<th>Acronym</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Development Platform for Unified Access to Enabling Environments</td>
<td>ACCESS</td>
</tr>
<tr>
<td>2. Advanced Language Device for Interaction</td>
<td>ALADIN</td>
</tr>
<tr>
<td>3. Gait Assessment Manumitted from the Biomechanics Laboratory Environment</td>
<td>AMBLE</td>
</tr>
<tr>
<td>4. Autonomous System for Mobility Orientation, Navigation and Communication</td>
<td>ASMONC</td>
</tr>
<tr>
<td>5. A Friendly Multi-functional Interface For Disabled And Elderly Security Management</td>
<td>AURORA</td>
</tr>
<tr>
<td>6. Travail à Distance : Telework and People with Disabilities</td>
<td>AVISE</td>
</tr>
<tr>
<td>7. Concept of Automation and Services for People with Special Needs</td>
<td>CASA</td>
</tr>
<tr>
<td>8. Cost-Effective Rehabilitation Technology through Appropriate Indicators</td>
<td>CERTAIN</td>
</tr>
<tr>
<td>9. Corporate Marketing to Overcome the Barriers Facing Disabled Teleworkers</td>
<td>COMBAT</td>
</tr>
<tr>
<td>10. Modular Software for Augmentative Communication Aids and Access Systems</td>
<td>COMSPEC</td>
</tr>
<tr>
<td>11. Disabled and Elderly People Flexible Integrated Environment</td>
<td>DEFIE</td>
</tr>
<tr>
<td>12. Development of an Interactive Communication Training System Using Interactive Media</td>
<td>DICTUM</td>
</tr>
<tr>
<td>13. EMG Signals from Paretic Muscles Controlling Electrical Stimulation of the Same Muscle</td>
<td>EPCES</td>
</tr>
<tr>
<td>14. Evaluation of the Prototype and Improvements to RAID Robot Workstation</td>
<td>EPI-RAID</td>
</tr>
<tr>
<td>15. European Sign Language Interactive</td>
<td>ESLI</td>
</tr>
<tr>
<td>16. Interactive Pseudo Graphics Braille Printer with Erase Capability</td>
<td>ETRE</td>
</tr>
<tr>
<td>17. Functional Electrical Stimulation to Improve Value and Lifestyle</td>
<td>FESTIVAL</td>
</tr>
<tr>
<td>18. Focus On the Central Position of Users in Integrated Systems</td>
<td>FOCUS</td>
</tr>
<tr>
<td>19. Horizontal Action for the Harmonisation of Accessible DATE: 28.11.96</td>
<td>HARMONY</td>
</tr>
<tr>
<td>Structured Documents</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------------------------------------</td>
<td>---</td>
</tr>
<tr>
<td>20. An Autonomous Speech Rehabilitation System for Hearing Impaired People</td>
<td>(HARP)</td>
</tr>
<tr>
<td>21. Hearing Aid Research with Digital Intelligent Processing</td>
<td>(HEARDIP)</td>
</tr>
<tr>
<td>22. Handicapped Elderly Lonely Person's Multimedia Equipment</td>
<td>(HELP-ME)</td>
</tr>
<tr>
<td>23. Home Environment Private Help Assistant for Elderly &amp; Disabled</td>
<td>(HEPHAIATOS)</td>
</tr>
<tr>
<td>24. Home Systems - Access of Disabled and Elderly People to this Technology</td>
<td>(HS-ADEPT)</td>
</tr>
<tr>
<td>25. Human Resources and Management Product Interface</td>
<td>(HYPIT)</td>
</tr>
<tr>
<td>26. Image Based Interactive Device for Effective Communication</td>
<td>(IBIDEM)</td>
</tr>
<tr>
<td>27. Integrated Multimedia Social Alarm System</td>
<td>(IMSAS)</td>
</tr>
</tbody>
</table>
28. An Integrated NetSystem for Infoservice to Disabled and Elderly People
29. Laser Mouse
30. Definition of an Environment to Maximise the Market for Telecommunications-Based Rehabilitation Technology
31. Horizontal Action on Market Awareness of Technology for the Care of Older People
32. Mathematical Access for Technology and Science for Visually Disabled Users
33. Mobility of Blind and Elderly People Interacting with Computers
34. Mobility and Activity Assistance Systems for the Disabled
35. Motorized Upper Limb Orthotic Systems
36. Office Wheelchair with High Manoeuvrability and Navigational Intelligent for People with Severe Handicaps
37. Orientation by Personal Electronic Navigation
38. Optimal Speech Communication Assistance for Residual Abilities
40. Profound Deaf People Rehabilitation with New Speech/Sound Processing Systems
41. Smart Card and Terminal Usability Requirements and Needs
42. Safety Call and Location of Elderly and Disabled People
43. Sensor Aided Intelligent Wheelchair Navigation
44. Signal Conditioning Communication Aids for the Hearing Impaired
45. The Development of a Printing System for Sign Languages
46. Development of Multimedia Signed Language Databases
47. Multilingual Speech to Face-Movements Transformation for Use as a Training System in Lip-reading and Language Acquisition and as a Basis for a New Telecommunication Service
48. Tactile Acoustic Computer Interaction System
49. Technology Transfer in RT for SMEs
50. Transport Using Rehabilitation Technologies Leads to Economic Efficiency
51. Usability Requirements Elaboration for Rehabilitation Technology
52. Voices, Attitudes and Emotions in Speech Synthesis
53. Virtual Environments Technologies in Rehabilitation: A New
Approach to Motor Dexterity Disabilities

54. Vocational Integration through Computer Assistance for Intellectually Disabled People (VICAID)

55. New Forms of Working Plans and Test Plans for Intellectually Disabled People (WANTED)
EXAMPLES OF TECHNOLOGIES FOR AGEING

Below two examples are provided of technologies for the aged and ageing citizens:

1. A summary of examples provided by Prof. Bouma in his keynote address in the 2nd International Conference on Gerontechnology, Helsinki, 15-17 October 1996

2. My Home a concept house architected by Ritva Routio in which a number of technologies are provided as an integrated package
DR. BOUMA’S CLASSIFICATION OF NEEDS AND SOLUTIONS
NEEDS OF THE AGEING

Suitable housing; Supportive for activities of daily living (ADL), Secure from intruders; Safe against accidents; Healthy inner climate (physical, biological); Healthy outer climate (pollution, noise); Supportive of activities of choice; Answering demographic needs

Easy access to wanted information; Shielded from unwanted information; Wanted communication with people; Easy access to useful ‘electronic’ services (shopping, banking, ...); Information-ADL; Interactive learning; Hobbies and entertainment

Freely moving within the house, ADL; Freely walking, cycling around the house; Easy driving of private car; Easy access to public transport (bus, train, plane, ...); Proper integration of private and public travelling modes (also with luggage)

Prevention: Good nutrition, Daily exercise, Regular mental activities, Social interests, Healthy indoor climate, Healthy outdoor climate; Care: Counteracting handicaps, Optimizing life-with-disease, Remaining independent; Optimizing intramural care;

Diagnosis & Cure: Efficiency, Proper instruction and information

Sustained training; Sustained job rotation; Job adaptations; Adapted working schedules
SOLUTIONS FOR THE NEEDS

Adaptable room division & function; Provisions for safety and security; Automated control systems (domotics) for security, indoor climate, lighting, energy; Integrated user interfaces; ADL ergonomics; Incorporation into building requirements

Keeping track of useful applications; Telephone, TV and PC services for direct communication, information services, electronic shopping, banking, remote home control, personal telephone, social alarms, video telephone, entertainment, video disks, video-on-demand, access to email, access to information networks; distance learning

Adaptation of private and public transportation vehicles and infrastructure; System integration for door-to-door mobility; Information system; Route finding systems

Sensors & systems for health and mobility parameters; Indications of health risks; Home care technology; Medical technology

Adapted working place; Automatic trainers for skills; Monitoring of health and skill parameters

3rd Age 4th Age
“MY HOME” was designed by Chief Architect Ritva Routio of STAKES and built by the Pori Technology College. The project has also involved some twenty Finnish suppliers of building materials, furnishings and technology.

MY HOME
THE ADAPTABLE SMART HOME
Natural Daylight Lighting - special illumination, which resembles natural daylight - fittings of indirect daylight lighting in the living room, bedroom, kitchen and bathroom.

Johanna furniture especially designed for the needs of care - in the living room and dining room.

Accent - a flooring which is hard-wearing, high quality, easy to clean and heterogeneous - in the living room, dining room, kitchen and bedroom.

Eminent Multisafe - non-slippery alternative flooring for wet areas - in the bathroom.

“MY HOME” was designed by Chief Architect Ritva Routio of STAKES and built by the Pori Technology College. The project has also involved some twenty Finnish suppliers of building materials, furnishings and technology.

MY HOME
THE ADAPTABLE SMART HOME

MY HOME is the home of the future for the elderly and disabled. It is a service apartment that can be adapted to suit the individual preferences, life style and physical condition of the occupant.

What makes the home so smart is the fact that technological innovation can be added with ease at any time, because apart from the normal electrical fittings, each room in the apartment is also wired up for a data network or “home bus”.

The furnishings further permit varied arrangements to create a cosy atmosphere and to allow for the use of technical aids. The absence of the thresholds common in Finnish houses makes moving around easy.

MY HOME
THE ADAPTABLE SMART HOME

C/o STAKES
P.O. Box 220, 00531 HELSINKI, FINLAND
TEL. +358 9 39671, FAX +358 9 3967 2054

DATE: 28.11.96

PAGE 63
THE LIVING ROOM

The living room is furnished in conventional style with a suite, TV and video. The sofa and armchairs are comfortable and the arm provide good support for standing up. The room has an electronic device for the visually impaired that reads aloud from newspapers and magazines in electronic form.

The resident can from any point in the apartment (from a wheelchair, for example) remote control the radio, TV, video and many other items in the system; in other words, open and close windows and doors, pull the curtains, and switch lights on and off.

- PIKOSYSTEMS Oy • Butterfly - Environment Control Systems for disabled people to control windows, TV, telephone, lights etc.
- FÖRBUNDET FINLANDS-SVENSKA SYNSKADADE • Braille display
- Telesensory, Speech synthesizer Infovox, Scanner HP and Braille printer Index
- ERGOTEKNIKKKA Oy • Vela Uni-7f - working chair

THE DINING ROOM

There is room for wheelchairs round the dining table. Attention has been paid in choosing the fittings and materials both to comfort and to the safety and practicability particularly important to the disabled. The dining room is equipped with a home-secure system. The system includes among others a wrist held, physical condition monitoring device for elderly, disabled, chronically sick and out-patients which does not need any action by the patient for sending the alarm.

- IST International Security Technology Oy • WristCare - Intelligent physical and health condition monitoring device
- MultiLink - Intelligent personal health care and home alarm communication unit
- Intelligent Pill Dispenser
- MultiControl - Intelligent home alarm centre
- ERGOTEKNIKKKA Oy • Vela Uni-E1 - working chair
- AD-Lux Oy • Light therapy unit, table model

THE KITCHEN

The furniture and fittings in "MY HOME" were designed by Sirkka-Liisa Keiski and are extremely practicable for the elderly and disabled.

The cooking utensils are easy to reach and the work tops and fittings can be adjusted to the best ergonomic height. The work top has a hand rail round the edge for good support and is ideal for everyday meals.

- MARTELA Oy • X-Kitchen is a new tailor-made kitchen system. Martela’s X-Kitchen based on modules and its height is easily adjustable among 90-73 cm. It is easy to sit or stand at the kitchen. X-Kitchen is the first kitchen which meets the individual requirements of the user.

THE BEDROOM

The adjustable bed means residents can go to bed and get up when they please without any help. There are two bedside tables one for the good lighting needed and the other for magazines and books, medicines, the safety alarm system and videophone.

The bedroom has "natural light" fittings creating an impression of real daylight. These lights are less dazzling than ordinary ones and make colours look natural. Instead of an ordinary alarm clock, residents can set the lighting to gradually increase at a given time.

- PIKOSYSTEMS Oy • Prote 2000 Home Care Telephone - calls up and transmits an alarm code via an internal or public telephone network (different types of alarms)
- SARJALAITE Oy • Adjustable intelligent bed with night stands
- AD-Lux Oy • Wake-up lighting resembling a sunrise with birds singing
- Table lamps with daylight

BATHROOM

The bedroom leads straight into the bathroom, which is again designed to take a wheelchair. The sliding door is easy to open and close and is not in the way. The plastic floor covering has a slightly knobbly surface providing a good foothold and thus preventing slipping. The bath tub has been replaced by a safer shower. The toilet is high and fitted with hand grips. The fittings can be varied, and more rails and grips added according to need. The washbasin is a good size and its height can be adjusted. There is one cupboard for dirty laundry and another with shelves.

- IDO BATHROOM Ltd • High-quality sanitary and bathroom porcelain • Washbasin for the disabled • Adjustable wall stand for washbasin • Trevi E, WC-seat with arm rests, concealed outlet, higher model
- ORAS Oy • Taps for the bathroom
Pilot experiences from Adaptable Smart Homes

Ritva Routio, Chief Architect, Jan Ekberg, Research Professor
STAKES The National Research and Development Center for Welfare and Health
Finland

Background

The Finnish Adaptable Smart Homes project by STAKES will develop the building process and the use of domestic equipment in improving the independent lives of the elderly and the disabled persons. A new goal is to improve the accessibility of environment. This is a goal which concerns all the residents. On the other hand, the estimated increase in number of elderly persons in decades ahead means increasing challenges to the planners of habitation, services and technology aimed for elderly persons. Another self-evident goal is the right to self-determination of elderly and disabled persons. The "smartness" of a home indicates its elastic structure and easy adjustability in accordance with the inhabitant's way of living, likings, and capacities for action.

The aim of the Adaptable Smart Home Project is to promote accessibility and adaptability of the environment, this to achieve a barrierfree living environment. Another requirement is that, when the life situation of the resident changes, the home should adapt to the new situation, e.g. devices assisting the activities of daily living and remote health care can easily be installed.

Other aspects of a good living environment for the old or disabled inhabitants are to obtain the necessary services, and the possibility to participate in the social life of the community. Therefore the project will promote the viewpoint of the inhabitants in the planning of the housing and the new technology. The concept of the project includes in the context of everyday life:

* Architecture and building technologies, including the community infrastructure
* Home and social environment, social services, neighbours and relatives
* Provision of social and health care services
* Utilisation of the new technology
Method and Results

The STAKES' Adaptable Smart Homes project includes experimental construction sub-projects. The new approaches here are that the users' requirements are respected more than normally, and that the buildings are designed and constructed to provide for new telematic systems.

The stages of the project are: The option of sub-projects, Defining the user requirements in sub-projects, The building processes, The evaluation method, The evaluation, and The reports.

The most important building project is the new suburb Marjala, with some 1250 homes and infrastructure, now under construction in the city of Joensuu, in Eastern Finland. Marjala shall produce an environment for the activities of all people. The requirements set down for the achievement of a barrierfree environment in Marjala are stricter than elsewhere in Finland. Marjala is a start of something new.

In Marjala, each home will be adaptable to the needs of any kinds of residents. Each house is built as a so called "lifestyle house", which is a new trend in housing. This indicates housing which is suitable for all the different phases in human life-cycle, with the most elastic adaptability. No specific homes for elderly or disabled people will be built in the suburb, as each home will be planned and constructed in a way enabling disabled persons' living.

In Marjala, residents can live, move around and work as freely as they wish. The multi-service network and the Marjala Multi-service Centre with its staff are a point the clients can visit, or contact via their computers. The flexible work and telework implemented in the area supports people who have difficulties to reach their working site. These services are based on the Integrated services digital network, ISDN. Also the public telecommunications services, information services or teleshopping should be accessible to all.

The homes are equipped with heavier power and telecommunication network that the current instructions require. The environmental control system for the different users, disabled or not disabled, normally includes door locks, windows, lights, television and radio, and security alarm systems. Other examples are the local videotelephone system and infrared locks.

The other sub-projects in the Adaptable Smart Homes project are the construction of service centres and apartments for the elderly or disabled people.

Evaluation

The evaluation of the environments by the interest analysis method is based on the assessment of the residents and the users. The evaluated environmental factors are: The built environment, The nature, The social environment, The environment of doing and influence, The services and the technologies, The work and the flexiwork.

My Home
The exhibition of Gerontechnology Second International Conference in Helsinki 1996 was a showcase for a typical adaptable smart home of tomorrow, the exhibit home named "My Home", which is a result of the Adaptable Smart Homes project of STAKES. The intended message to the visitors is that with the help of technology and building the lives of the elderly and of people with disabilities can be improved.

REFERENCES

ASHoRED, Adaptable Smarter Homes for Residents who are Elderly or Disabled people, The Final Report of a TIDE Pilot Phase Project which ran from January 1992 to March 1993, Proceedings 1993


LIFE-CYCLE OF THE VALUE-STAR

Below a simple application of the value-star framework on the Ageing & Technology market is presented. Before entering into it two disclaimers are necessary:

1. Restricting to a single product provides too narrow a perspective. Instead, we consider development processes in longer term and focus on product families or businesses - not on single products or innovations.

2. An innovation process does not consist of sequential, separate stages. Instead, technical innovation and market building should be perceived as interactive and simultaneous processes and evaluation needs to be involved in all phases of the process.

However, the analysis below tries to capture the changing interests and roles of the stakeholders in the innovation and market building process by looking into it as if one could divide it into stages such as multidisciplinary research -> innovation -> evaluation -> marketing -> utilisation.

Initial stage

- Co-operation with research institutions to secure the technological progressiveness of the product
- Co-operation with lead users. The understanding of the user needs is of crucial importance right from the beginning to secure prospects for demand.
- Different groups within the manufacturing company (R&D, marketing, production, different levels of management) need to be convinced of the intended innovation's viability to get all support that is needed
- Preliminary arrangement of supplier relationships.

Further development

- The social-institutional conditions (market space) need to be developed or secured. A network of institutions - enabling, selling and buying - has to exist. Even though the "need" for the product is identified it is not enough in the absence of an appropriate institutional market structure. The interest of various key actors need to be aroused. Does the product meet the requirements of the regulatory system? Does the use of the product depend on somebody's or some institution's recommendation? Who informs the customers of the product? Who establishes the prices? The standards and quality requirements that need to be met?
- Building a network of distributors and relationships with them.
• Identifying competitors, building strategic alliances or other co-operative arrangements. Building the necessary product and service portfolio for credibility and image.

Finally

• Mobilising other related actors and processes.

• Developing awareness e.g. of the possibilities of the new technology to meet existing needs.

• Providing educational services to support implementation and utilisation of the new technologies. Furnishing the customers with the skills and support services needed.

• Gathering information on the value of the product, further development of the technology

• Developing new combinations of product and services.
STAKEHOLDER INTERESTS

(Kivisaari 1996)

Technology providers should not conceive their market formation in terms of user needs alone. This is obvious in the case of completely new products. But also in a period of fundamental industry transformation it is important for all companies in the field to identify the constituencies of their market, and to understand the institutional conditions for launching their new products. The market is created and maintained by a network of key actors.

The key actors in Ageing & Technology market formation, in general terms, can be divided into two groups: societal stakeholders and organisational actors having a business relationship with technology providers. Potential key societal actors may be policy makers, standard-setting bodies and organised social interest groups. Among potential key actors with a business relationship to the technology provider are customers, various internal personnel groups, suppliers, distributors, external sources of finance and medical research institutions.

Potential societal key actors

The social welfare and health care systems are basically formed by political decision makers. The structures and organisation of care set conditions for technological development and technological development sets conditions for the possible care structures. Moreover, in most industrialised countries public officials play a central role in regulating the operation of health care businesses. GMP quality certificates and ISO certificates are generally required for operation in the US and European markets. In the field of health these quality requirements must be met. The rather recent EU directives concerning medical devices provide an example of policy makers' influence.

In addition to the 'de jure' standards mentioned above, which are absolutely necessary for operating in health care there are certain 'de facto' standards which are critical for success in this business. Meeting standards may be useful for the technology producer because often a critical mass of customers may not be reached unless there are common standards. The role of standard setting bodies is particularly relevant for the producers and users of network systems where the usefulness of the product may depend upon the possibility of connecting it with other systems. In terms of technology provider's success, it is important to understand the emerging standards in time.

Different societal interest groups are often involved because the introduction of new technologies sometimes has implications for the content of work, skill requirements and benefits of different professional groups. Therefore, the approval of trade unions and other similar interest organisations may be important for the successful commercialisation of a new product.
Key actors having a business relationship with the technology provider

Customers, the elderly citizens, are naturally key actors in shaping the market. In order to be successful, companies must understand what kind of needs and preferences their customers have. The companies need to adjust their business aspirations to customer needs. Other important actors, however, are also involved in shaping the market.

First of all, there are different groups within the organisation itself. The various personnel groups may hold conflicting views about the direction of technological development. The different functional backgrounds or hierarchical levels may generate different values and preferences in relation to technological development. The groups often legitimise their opinions by interpreting information acquired from external sources on market development or the strategies of competing companies.

The suppliers of complementary products, as for instance software suppliers and multimedia producers, have their roles in shaping the market as do teleoperators in building the technological infrastructure. Innovators of health technology have an interest in gaining some control over the complementary products. Alliances of various kinds provide some means to achieve mutual benefits.

Government agencies, investors or joint venture partners are examples of external sources of finance with an impact on the market. While there is considerable public funding available for supporting industrial R&D, a major problem for small companies in this sector continues to be the funding of expensive marketing efforts and distribution.

For small and medium-sized producers, sales through distributors are often a necessary prerequisite for entering global markets because establishing a separate global sales organisation is slow and expensive. Apart from marketing and selling the distributors often operate simultaneously as installers and providers of maintenance services. Distributors must be well informed and motivated to market the products if commercialisation is to succeed.

As the business builds on the integration of technological competence and present understanding on the needs of elderly population, it is essential for technology providers to maintain close contact with researcher institutions not only in the field of technical sciences but also social and medical sciences. This will help them to adapt their technology to state-of-the-art understanding.

Companies need to identify the actors crucial to their particular product markets and to be in constant dialogue with them to understand the changing configuration of roles and relationships and to be an active partner in the change process. The identification of the constituencies of the market enables the company to evaluate whether the infrastructure needed to support its new product exists and whether the different institutions are prepared to accept, support and use the product. It is important to perceive the social construction of the market and the need to link the product development process into dialogue with the constituencies of the market.
PREPARATION HISTORY

This report has been contracted to VTT Information Technology by the Institute of Prospective Technology Studies (IPTS) on behalf of the Research Committee of the European Parliament. The person responsible for the project has been Professor Niilo Saranummi. Respectively, the person in charge of the contract at IPTS has been Ms. Paola di Pietrogiacomo.

To carry out this project effectively within the narrow time span given VTT Information Technology has accessed expertise in this domain that exists in other institutions especially in VTT Group of Technology Studies, National Research and Development Centre for Welfare and Health (STAKES) and the Centre for Biomedical Engineering and Gerontechnology at Eindhoven University of Technology (EUT-BMGT). Consequently this report is a result of collaboration between the experts representing the organisations mentioned above. Through these persons additional expertise was made available. Of these the most important ones were Dr. Vappu Taipale, Director General, STAKES, Ms. Anja Leppo, STAKES, Prof. Jan Ekberg, STAKES, Ms. Päivi Topo, STAKES and Prof. Herman Bouma, EUT.

In addition to building the report on an analysis and synthesis of existing material and information, group meetings and especially electronic mail have been used. Also two formal review meetings with outside experts have taken place. The first one was organised by IPTS with the title ‘Ageing of society and gerontechnology’ and it took place in their premises in Sevilla on October 4, 1996. The participants of that meeting were

- Mr. H.J. Allgeier, IPTS, Spain
- Mr. J. Graafmans, EUT - Centre BMGT, The Netherlands
- Mr. K. Beese, IPTS
- Mr. P. Marset Campos, Member European Parliament, Spain
- Mr. G. Mezelas, IPTS, Spain
- Ms. P. di Pietrogiacomo, IPTS, Spain
- Mr. N. Saranummi, VTT Information Technology, Finland
- Mr. F.M. Solis Cabrera, Junta de Andalusia, Spain
- Mr. J. Vera Vera, Fundacion Gerontecnologica International, Spain

A second meeting for which an early draft of the report was made available to the participants before the meeting was organised in conjunction with the 2nd Gerontechnology Conference in Helsinki as a peer review meeting on October 15, 1996. The participants of that meeting were

- Ms. Francoise Bouchayer, MIRE Mission Recherche, France
- Mr. Herman Bouma, EUT Centre BMGT, The Netherlands
- Mr. Nicola Fabris, Italian National Research Centres on Aging, Italy
- Mr. Jan Graafmans, EUT - Centre BMGT, The Netherlands
• Ms. Sirkku Kivisaari, VTT Group of Technology Studies, Finland
• Ms. Anja Leppo, STAKES, Finland
• Ms. Heidrun Mollenkopf, WZB / FU, Germany
• Mr. Richard Pieper, University of Bamberg, Germany
• Ms. Paola di Pietrogiacomo, IPTS, Spain
• Ms. Elly Plooi-van Gorse, Member EP, The Netherlands
• Mr. Raymond Puig de la Bellacasa, DG XIII / TIDE, EC
• Mr. Niilo Saranummi, VTT Information Technology, Finland
• Mr. Tuomo Särkikoski, STAKES, Finland
• Ms. Vappu Taipale, STAKES, Finland
• Ms. Britt Östlund, University of Linköping, Sweden