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Report

Active and Healthy Ageing – A Long-term View up to 2050

Updated with results from the expert workshop on
"Active and Healthy Ageing"

(31.01.2011, Brussels)

European Foresight Platform, 2011

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Active and Healthy Ageing - A Long-term View

0. Introduction

Although getting older is considered desirable, being old is seen as a problem. Over the last centuries average human life expectancy has risen dramatically. An increasing number of people are reaching increasingly higher ages. What would have been seen as a blessing a century ago is today considered as a curse by some people: the ageing society. Labour market shortages, overpopulation, youth unemployment, increasing retirement age, financial problems in pensions, health insurance and social security systems, rising medical costs, generational conflicts, immigration, shortage in nursing personnel, "Planet Alzheimer's" and economic difficulties and the development of controversial developments in science and technology are aspects that are commonly attributed to the ageing society.

But aren't the chances and opportunities that are associated with a higher life expectancy actually immense? Thus the major issue is not getting old(er) as such but getting old(er) in an active and healthy way. In the same way as many different factors contributed to the immense increase of life average expectancy within the last century – factors included better hygiene, medical innovations, improved nutrition, improved safety and work-place environments, economic wealth, more time for recreation and wellness, preventative measures etc. – a large variety of social, psychological, economic and biological factors also impacts the quality of our ageing process. The achievement of active and healthy ageing is therefore a complex enterprise which necessitates inter- and multidisciplinary approaches and cooperation.

Therefore the European Foresight Project (EFP) has dedicated to conduct its first major analysis and policy/expert workshop on the topic of "active and healthy ageing" which also relates to the "Pilot European Innovation Partnership on Active and Healthy Ageing" initiated by the European Commission[1]. This report is based on literature and desk research about challenges and latest developments in R&D related to the "ageing challenge" as well as insights and results gained from an expert-policy workshop on "active and healthy ageing" conducted by the EFP consortium on January 31, 2011 in Brussels. 21 participants[2] attended the workshop, representing policy makers and policy advisors, European Commission representatives, scientific experts and industry representatives. This paper has first been drafted as input paper for the workshop and later been revised to this version by taking workshop results into consideration.

The topic of "active and healthy ageing" is of such importance that one workshop participant even proposed to create a ministry solely dedicated to the multidisciplinary area of age-related challenges, innovations and social, technical and economic solutions.

[1] http://ec.europa.eu/research/innovation-union/index_en.cfm?section=active-healthy-ageing
[2] 16 of them were external experts not belonging to the project consortium

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This report is divided into 5 parts. The first part provides a general overview especially of socio-economic issues and challenges related to the rising life expectancy as well as related factors like declining birth rates and economic problems (e.g. unemployment, economic crisis) that are interrelated to the "ageing challenge". It gives and overview about trends in life expectancy, global economic and demographic changes that affect ageing in Europe, and finally some specific development in European countries related to ageing, labour markets, welfare systems and pensions.

The second part provides an overview of 10 major questions related to the "ageing challenge" and "active and healthy ageing" which also served as input for the expert workshop.

The third part reflects on some major challenges related to the ageing society as well as suggestions to tackle them. Here much of the contributions from the expert workshop have been incorporated. The chapter is divided into different topics related to socio-economic issues, care-taking and care, technologies for assisting elderly as well as care-taking and nursing personnel, medical developments and research and development.

Part four provides some examples of foresight studies related to the "ageing challenge" as well as information about some cutting-edge and 'frontier research' which may partially still be a bit outside the scientific 'mainstream' (as of the date of report production). However as EFP is a foresight project these topic have been chosen. This also relates to suggestions of experts at the workshop for opening up R&D to more novel ideas as well as the generation of new research questions as well as socio-ethical and legal considerations.

The final part is dedicated to conclusions based on the EFP workshop results and closes with some annexes of original transcribed material from the expert workshop and additional information about the workshop.

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1. Trends in Life Expectancy

"In the long run we are all dead" runs the famous quote from economist John Maynard Keynes. Or will we be still alive? Life expectancy has drastically increased until now. In Europe (average) life expectancy at birth has risen from around 45 years in 1900[3] to 65.6 years in 1950-1955 to 75.1 years in 2005-2010 and is expected to reach 81.5 years in 2045-2050[4].

If more and more diseases can be successfully treated (incl. cancers and severe injuries), what will remain to kill us may be old age. And even here some researchers suggest that even ageing as such could be slowed down, that signs of ageing could be reversed (as it has been shown in some animal studies) or that the ageing process may even be stopped altogether – and with this the ultimate cause of death (cf. e.g. Nature 2010[5]). Areas like cancer research and regenerative medicine, for example, are also closely linked to unlocking the secret of ageing.

Europe
Life expectancy at birth by sex (years)
Medium variant
1950-2050

Period	Both sexes combined	Male	Female
1950-1955	65.6	63.0	68.0
1955-1960	68.0	65.2	70.6
1960-1965	69.7	66.6	72.5
1965-1970	70.4	67.0	73.5
1970-1975	70.8	67.2	74.2
1975-1980	71.2	67.3	74.9
1980-1985	71.7	67.7	75.5
1985-1990	72.8	69.0	76.5
1990-1995	72.6	68.3	76.8
1995-2000	73.1	68.9	77.3
2000-2005	73.8	69.6	78.0
2005-2010	75.1	71.1	79.1
2010-2015	76.1	72.3	79.9
2015-2020	77.1	73.5	80.7
2020-2025	78.1	74.6	81.4
2025-2030	78.9	75.6	82.1
2030-2035	79.6	76.4	82.7
2035-2040	80.2	77.1	83.3
2040-2045	80.9	77.8	83.9
2045-2050	81.5	78.5	84.5

Source: UN population statistics

[3] Data example for Germany, source: http://www.dkv.com/kunden_lebenserwartung-bevoelkerungsstruktur-demographie_63_12215_12230_85921.html
[4] UN population statistics http://esa.un.org/unpp/p2k0data.asp
[5] http://www.nature.com/nature/journal/v469/n7328/full/nature09603.html

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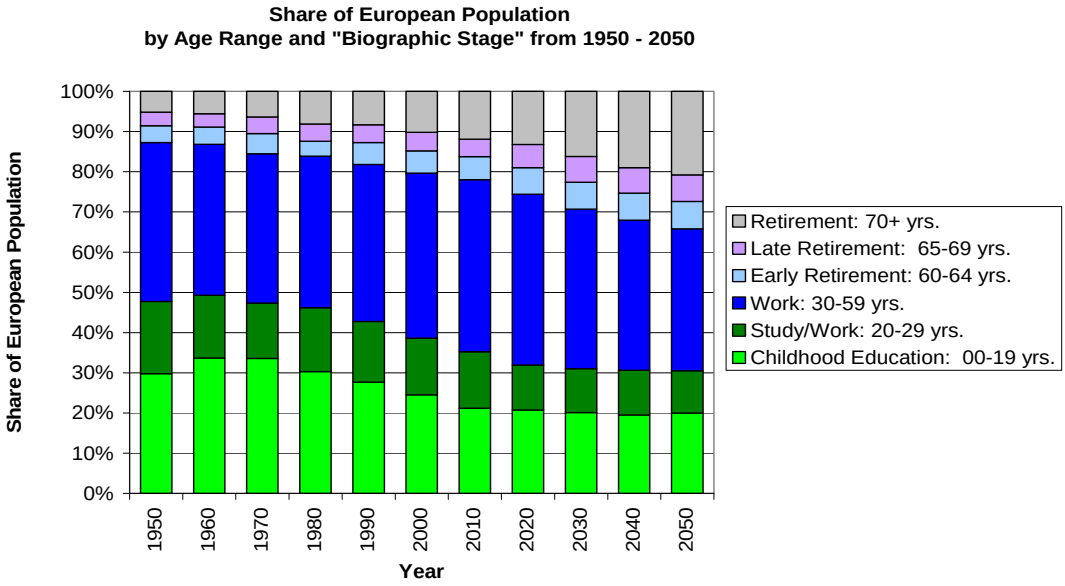

Source: UN population statistics

As life expectancy increases, one needs to ask if people also remain healthier for a longer time. This question is important since failing health and age-related diseases put considerable burdens on the quality of life, economic prosperity and social security systems (financing of pensions and healthcare). But is life expectancy really increasing? Some projections even suggest that life expectancy may decrease due to life-style related diseases such as those related to obesity[6].

Other studies, however, point to a tendency of increasing life expectancy perhaps even at a faster rate.

> *"Life expectancy for women in 2008 ranged between 77.0 years in **Bulgaria** and 84.9 years in **France** (in 2007), and was higher than for men in all Member States. […]*
>
> *In 2030, life expectancy at birth in the **EU27** is expected to rise to 85.3 years for women and 80.0 years for men, a difference of 5.3 years. […]*
>
> *This rise in life expectancy will be reflected by an increase in the proportion of women aged 65 and over: in 2008, a fifth (19%) of women in the **EU27** were aged 65 and over, while this share is expected to increase to a quarter (26%) in 2030."*
>
> *Eurostat 2010 (http://epp.eurostat.ec.europa.eu/cache/ITY_PUBLIC/1-05032010-AP/EN/1-05032010-AP-EN.PDF)*

[6] http://www.berlin-institut.org/online-handbookdemography/overweight.html other sources

In response to the challenges of the ageing population in Europe, the European Commission has set up an innovation partnership with "[t]he overall goal of the Innovation Partnership is to increase the average healthy lifespan by two years by 2020" (cf. Dalli, 2010[7]; European Commission's Health and Consumers DG, 2011[8]). Not only healthy ageing, but a general improvement of one's health (e.g. in regard to life-style-related diseases that negatively impact people's health in younger and older years) may become even more important within the current and future socio-economic settings.

Taking a long-term perspective on active and healthy ageing requires us to look beyond what the individual can do to promote his or her health and lifestyle for healthy ageing and to include a number of broader trends at international and national levels in the analysis which relate to impacts associated with rising life expectancy.

1.1 Socio-Economic changes at the global level

Big changes are happening in the world which will affect the way we live and work in Europe in the future. These include the rapid rise of Asian economies, global demographic changes and growing resource scarcity. They are discussed briefly here as they determine the context for ageing on a national level.

The 21st century marks a shift of economic and political power from the United States and Europe towards the "emerging" economies of Asia. China in 2010 officially became the world's second largest economy and is expected to overtake the USA as the world's largest economy sometime around 2025. While there is a broad consensus that the shift of economic and political power towards Asia will have major consequences, there is wide disagreement both about the details of what exactly the 'Asian century' will entail and about its specific consequences for Europe. Some see the growth of Asia as a threat for Europe, as economic activity moves to Asia and Europe may become more dependent on Asia. Others see the rise of Asia as a major opportunity with new markets for products and services.

A major uncertainty is that the shift of global economic weight towards Asia is occurring at a time of unprecedented demographic change. In Europe the ageing of population will soon start to have a major impact as the post World War II baby boomer generation will start to retire. As the baby boom retirees outnumber new entrants to the labour market, labour shortages will increase. This is one of the reasons why there are calls to raise retirement ages and to increase labour participation of older workers (the precarious government budget situation in most European countries following the 2008/9 financial crisis is another reason).

Demographic change is not limited to Europe. Japan is already an older society than Europe, Russia will be faced with a major fall in its population over the next 30 years, and even China will also soon start to experience the effects of ageing as a result of its one child policy. On the other hand countries as diverse as India and the United States, as a result of higher birth rates and immigration

[7] http://ec.europa.eu/commission_2010-2014/dalli/docs/speech_ageing_en.pdf
[8] http://ec.europa.eu/dgs/health_consumer/consumervoice/cv_12011_en.pdf

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(in the case of the USA), will start to experience the effects of ageing at a later time and will be able to benefit longer from the demographic dividend[9].

1.2 Socio-Economic changes in European countries

Economic and demographic changes will have a major impact on our societies. Events like the global financial crisis can put additional burden on the already stressed pension and social security systems. Growing unemployment leads to more welfare payments while at the same time fewer people are employed to pay contributions, and payments like unemployment support are competing with pension payments. Also lower wages have a negative impact on pension and health care systems. Demographic changes like declining birth rates ("degreening") also lead to a shrinking number of working people being able to pay contributions for pensions, healthcare insurance and other social insurance. As some European governments are facing grave problems in regard to public finances, pensions, healthcare systems and welfare are also jeopardized.

According to Neelie Kroes Vice-President of the European Commission, "[t]oday in Europe there are still 4 people in employment for every retired person" but it is estimated that "by 2025 this will drop to 3 to 1 and by 2050 to only 2 to 1"[10]. If of those in employment a considerable share is also required to work in care for the elderly the problematic consequences for the economy and society in general are not hard to imagine.

Following the financial crisis many European economies are characterised by lower levels of economic growth, pressure on wages, and high unemployment. Social security systems are getting increasingly stressed and are at risk of entering in a vicious circle: less income, less contribution to social security systems, less tax income, more spending for welfare. If in addition, more resources need to be spent on pensions and medical care for the elderly, financing problems are getting increasingly severe as spending gets higher while incomes are being reduced.

Especially in countries with pay-as-you-go pension financing, declining birth rates have a negative effect on the system since fewer working people exist to support a growing number of retirees. The problems get even more severe if unemployment is high and incomes are low. Currently there seems to be a contradicting situation where there is talk of labour shortage on one hand while at the same time youth unemployment remains a problem and healthy people in legal retirement age find it difficult to get a job if they want to continue to work[11].

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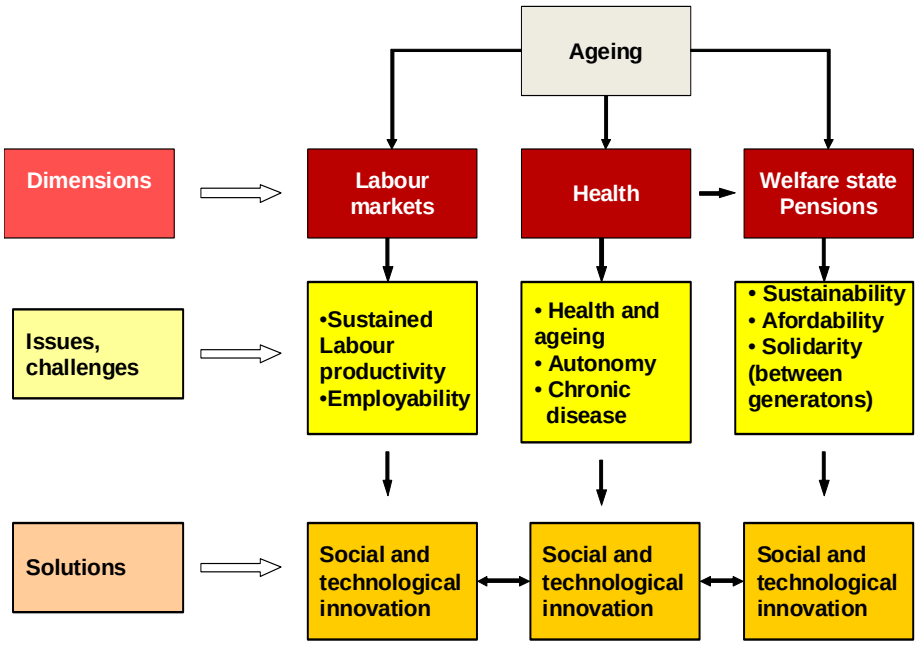
[9] The demographic dividend refers to a population structure characterised by a large percentage of the population in the economic active age group (15-64 years) and a percentage of people in a situation dependency (younger and older citizens).
[10] Address from Neelie Kroes Vice-President of the European Commission - AAL Forum 2010 Odense, 15 September 2010: http://www.europa-nu.nl/id/viimi743yyy9/nieuws/vice_voorzitter_van_de_europese?ctx=vhsjd8w6pdvc&start_tab0=40
11 http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Employment_statistics) (http://www.urban.org/publications/412283.html)

Also the need for more workers taking care of the elderly could challenge economic prosperity and growth as the number of people being active in research, development, engineering and the industry may even decline further. Immigration is considered as one solution for compensating for a shrinking labour force and filling the growing demand for care-workers. However, immigration also comes with societal challenges and recruiting nurses and care workers from developing countries could have negative impacts and lead to shortages ("brain drain") in these regions[12].

When looking at possible solutions to address problems caused by demographic changes, healthy ageing needs to be seen in a broader context as shown in the figure below. First, healthy ageing is related to developments in the labour market. Questions about the future of labour markets relate to the possibility of providing new jobs for older workers, and how to ensure that workers remain productive and enjoy work until later in life. With ageing there are also fundamental questions about the future of the welfare state and of the sustainability of pension systems, which in turn raises questions about retirement age and intergenerational solidarity.



[12] http://www.afrol.com/articles/12798

2 Questions for the "Ageing Challenge"

Healthy ageing – or more precisely: the reduction of the amount of unhealthy life years[13] (independent of ones life expectancy), or put differently: living disease-free as long as possible[14] - may be the only solution to ensure the sustainability of social security systems and pensions while also improving the quality of life at the same time. As many severe age-related diseases and disabilities occur in very late stages of life – at the age of around 80 years – and an increasing number of people in modern societies are now surviving until this age, more people will be suffering in this regard[15]. Assuming that the maximum life expectancy of humans is fixed, it may be desirable to "cram" the diseased period into the very final years of ones natural life time. This idea is termed "compression of morbidity", i.e. raising the average age at first infirmity resulting in a shortening of a age-related diseased life span (cf. James Fries, 2005[16]), under assumption of no increases in human maximum (and average) life expectancy. This question in how far this could be achieved is still unclear and requires further scientific evaluation, e.g. with the help of medical, statistical analysis and (bio)gerontology studies. Although the idea of "compression of morbidity" has been regarded as desirable, experts at the EFP workshop have expressed scepticism about its feasibility.

Tackling the issue of healthy ageing and developing policy strategies depends on several factors which also include scientific facts as well as individual life style choices and economic circumstances that are generally related to health but also touch on issues like personal freedom.

Some key questions that also relate to the goal of the innovation partnership with "[t]o increase the average healthy lifespan by two years by 2020"[17] refer to the feasibility of this objective and the assessment of pathways for potential achievement as well as socio-economic implications if this goal may be reached or not. The following will sketch out some major question related to the "ageing challenge" and "active and healthy ageing".

[13] This reflects what is often referred to as "compression of morbidity" (cf. Fries, 2005), i.e. that the amount of years with age-related illness/disability would be compressed into a shorter time period (e.g. from 6 years with such disease/illness/disability to 3 years).
[14] Cf. Crimmins/Beltrán-Sánchez, 2010 (http://psychsocgerontology.oxfordjournals.org/content/early/2010/12/06/geronb.gbq088.full)
[15] Cf. Freie Universitaet Berlin (http://www.elfenbeinturm.net/archiv/2004/01.html)
[16] http://www.milbank.org/quarterly/830427fries.pdf
[17] http://ec.europa.eu/dgs/health_consumer/consumervoice/cv_12011_en.pdf

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2.1 What is exactly meant by the goal of "increasing the average healthy lifespan by two years"?

Expert participants at the EFP workshop about active and healthy ageing generally agreed that an increase of the average healthy life span by two years may be feasible, but it remained unclear if this would also automatically imply a reduction in the amount of unhealthy life years. One, for example, may live in relative good health until the age of 82 instead of 80 and then experience considerable health problem until the end of life at 92 instead of 90.

The goal of increasing the amount of healthy years while reducing the number of unhealthy ones is related to the (theoretical) concept of "compression of morbidity". However workshop experts have been skeptical about the feasibility of "compression of morbidity". On the other hand, if one would assume a general maximum life-span limitation in humans of around 122 years, a general further delay of the onset of 'morbidity' would – if possible – thus automatically lead to a "compression".

The next question, however, relates to possible effects of increasing ones healthy life span (e.g. by two years), and if this would or would not affect the maximum possible life-span in humans (e.g. enabling humans to get significantly older than around 122 years). The research about the underlying biological mechanisms of ageing is still rather in its beginning and some (preliminary) research – also in the context of regenerative medicine – hints that there may be possible relations between regeneration and healthy ageing and positive effects on life span[18].

2.2 In how far can "healthy ageing" be achieved and what may it depend on?

Life-style choices are often mentioned as an important and sufficiently proven factor for better general health and thus healthy ageing. As it has also been mentioned by many expert workshop participants: "healthy ageing starts from birth". Such generally accepted choices contributing to better health and better ageing include refraining from smoking, moderation in alcohol consumption and a balanced, healthy nutrition. But also socio-psychological factors like stress reduction, mental and physical activity and societal integration have positive impacts. In this sense, industries, employers as well as individuals also need to be made more responsible for enabling and fostering healthier living and ageing. But in how far can we expect people to comply with suggestions for healthy life styles in a society that values personal freedom?

Also biological and genetic dispositions are thought to impact the quality of ageing as well as the disposition to some health conditions (e.g. weight gain[19]) that could have some general impacts on healthy ageing. Here, however more research and scientific clarity is needed. More

[18] E.g. refer to: "Telomerase reactivation reverses tissue degeneration in aged telomerase-deficient mice" http://www.nature.com/nature/journal/v469/n7328/full/nature09603.html as well as a proposed relation between telomeres and life-span and even life-span extension (http://www.nature.com/nature/journal/v464/n7288/full/nature08980.html#B68)

[19] http://www.healthy-ageing.nl/index.cfm?p=A5F1A8D4-9932-697B-2737C3B87D0A06CE

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(interdisciplinary) research is needed to gain further important insights from biological[20], medical[21], sociological[22], behavioural[23] and psychological perspectives[24].

Advances in medicine and technology have certainly led to the current situation of a rising life expectancy, but they are also causing rising costs. Modern medicine manages to keep people alive for a longer time, but not necessarily contributes to significantly improving the quality of this life. In the US for example, the last years or even months in life are often the most expensive[25]. This raises the question about what medicine can and should do and where reforms may be considered and where priorities should be set. It also raises questions about the costs of research and development and medicines as well as distribution and insurance schemes.

2.3 What would the implication be if two more healthy years could be added to life?

If the envisioned goal of "increasing the average healthy lifespan by two years" would be achieved indeed, changes in regard to the job market and insurance systems may be needed in order to take full advantage of the improved situation. If people, for example, are able to remain longer employed due to better health, a sufficient number of suitable jobs needs to be created and people need to be given the incentive to remain economically active for a longer time. As older people may remain longer within the workforce, younger generations should not get disadvantaged through this. The direction of the aging situation (healthy vs. unhealthy) thus greatly impacts the future of health care, pension and social security financing. But advances in science and technology also require favourable socio-economic framework conditions like job availability and accessibility to innovative solutions for health improvements.

2.4 What would be if the goal is not achievable?

If healthy ageing may not be achievable, ways need to be found – even more seriously and pressingly - how to deal with challenges like rising health care costs, financing of pensions, workforce decline and shortages in care personnel. In this sense one can not solely rely on the assumption that science, technology and life-style changes will necessarily lead to the envisioned improvements. Also ethical controversies about the reason for 'artificially prolonging life with serious illness through modern medicine' may more prominently enter the debate.

[20] E.g. biogerontology, biological studies about ageing
[21] E.g. tackling age-related diseases
[22] E.g. in relation to social integration, economic situations, care etc.
[23] E.g. life-style choices
[24] E.g. wellbeing, social contacts, the role of spirituality etc.
[25] http://www.kaiserhealthnews.org/Stories/2010/March/09/fiscal-times-end-of-life.aspx

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2.5 Raising retirement age? Doesn't it depend on prospects of health of the elderly?

Life expectancy has been increasing especially for older people. If, however, a "compression of morbidity" is not possible – as it has been regarded with quite scepticism at the EFP expert workshop - and there may be no strategies against deteriorating health (for example in the case of workers with a history of physical work), raising the retirement age would not make much sense since people would not be able to work much longer anyway and may also consider it to be their right to enjoy a couple of work-free (retired) years within still acceptable health conditions. Especially dementia could be a considerable problem as it severely affects the ability of economic contribution and requires large amounts of care and financial spending.

2.6 Priority setting in strategies for curing age-related diseases and disabilities – what are the most problematic conditions?

Tackling major disabling age-related diseases such as dementia and severe physical deterioration could enable people to stay active for a longer time. Here it needs to be assessed which age-related diseases are considered to be the most severe and disabling and which age-related diseases could be medically tackled easier and have higher prospects for success in finding potential cures. So the question arises in which areas of R&D to invest. It could be argued that mental disability would deprive a person more from being socio-economically active than (certain kinds) of physical disability (e.g. being unable to walk). Also technologies to compensate for physical disabilities are currently more advanced than assistive technologies for mental disabilities.

2.7 Could the prospect of "compression of morbidity" raise questions about healthy life extension controversies?

If a "compression of morbidity" is possible, societal acceptance the degree of potential controversies will likely depend on the biological/medical circumstances how this has been achieved as well as the question if the strategy is also associated with an increase in maximum and average life expectancy. If different strategies may be feasible in this regard, decisions may need to be made if an increase in maximum/average life expectancy would be a desirable solution or not. In general, healthy life extension as a goal in itself (independently of the health dimension) is currently looked upon with controversy within many European countries. Although the idea sounds generally desirable, workshop experts have been sceptical about the feasibility of achieving this.

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2.8 If ageing would be considered as a disease which new legal implications would arise?

Looking at the disabling effects of age-related diseases and failing health for the individual (decrease in quality of life) and society (investments of time, money and human resources for elderly care) the question may even rise if ageing as such should be considered as a disease[26] as the disabling effects are causally related to becoming older[27]. If ageing would, however, indeed be considered as a disease, it may have considerable impacts on the medical system and research and development (incl. legal issues for the development of "anti-ageing" medications[28]).

2.9 If nothing can be done about age-related health problems, how can we balance efficiency with good care?

If nothing can be done to improve the health situation of 'average' aged people, the focus indeed needs to shift more towards improving care for the elderly, but also on the financial aspects of these requirements. This could lead to a delicate balancing between improving efficiency in care (e.g. through technological solutions such as tele-health, telemedicine, care robots etc.) and the desire for the human factor of care and "ageing in dignity" (which necessitates more human resources and investment in time and money).

2.10 Should we strive for an overall improvement in health?

Finally, the problem may actually not even rest in the challenge of ageing and tackling age related diseases but in the requirements for general improvements in health throughout the whole society. As some projections suggest in relation to life-style related diseases (e.g. associated with obesity), failing health in younger years can be as burdensome (or possibly even more burdensome) as failing health in old age. If, however the call for general improvements in health gets louder, new social and ethical considerations may arise, e.g. in relation to personal freedom of choice (e.g. choices for an unhealthy/risky life style), potential discrimination of unhealthy people or those (genetically) more prone to disease as well as solidarity in regard to welfare etc.

If an overall improvement in individual's health would be considered generally desirable for society, many different actors will be involved with regards to prevention, e.g. the food and beverage industry, workplaces, general industrial production, parents and teachers, medical professionals and many others.

[26] http://www.reuters.com/article/idUSTRE64I6HV20100520

[27] In the same way as the disabling effects of a sore throat are causally related to having a cold. If age-related disease symptoms show in young people, they are considered as a disease (Progeria).

[28] Drugs can only be developed for a specific disease (indication). Since currently agingageing as such is not considered to be a disease, no drugs can be developed that may specifically tackle the agingageing process/agingageing as such.

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3 Suggestions for tackling the "Ageing Challenge"

3.1 Introduction: Major challenges with ageing

Although a long life is generally regarded as something good – and at first glance these developments look positive – they also come with huge challenges. These challenges basically have to do with the health related problems that become increasingly probable to occur with the progressing of ageing. Physical frailness and especially cognitive decline and dementia (e.g. Alzheimer's disease) are the greatest issues since they lead to an inability of the affected person to perform productive work as well as the requirement for care-giving. Especially dementia is a large problem within the so-called knowledge society, where knowledge and mental capacities are the main resources for economic growth. Whereas physical disabilities (e.g. physical frailness, inability to walk etc.) can be compensated quite well with modern technology, cognitive decline cannot.

According to the World Alzheimer's Report 2010, "[t]he total estimated worldwide costs of dementia are US$604 billion in 2010" and that the current (2010) number of "worldwide 35.6 million people living with dementia" could increase to "65.7 million by 2030 and 115.4 million by 2050[29]. People suffering with dementia can have a life expectancy with the disease up to 10 years[30].

> *"If dementia care were a country, it would be the world's 18th largest economy, ranking between Turkey and Indonesia. If it were a company, it would be the world's largest by annual revenue exceeding Wal-Mart (US$414 billion) and Exxon Mobil (US$311 billion)".*
>
> World Alzheimer Report, 2010
> http://www.alz.co.uk/research/files/WorldAlzheimerReport2010.pdf

This puts a socio-economic strain on social insurance systems, health costs and leads to personnel shortages of care givers or prevents relatives from being able to be otherwise economically active because they are needed to provide care.

The following points could summarize the problem, especially from the perspective of socio-economic challenges:

- Increase in population share of elderly people who are alive for a longer time who:
  - Are physically and/or mentally unable to work or actively participate in social life (reduction in quality of life)
  - Who are physically and/or mentally unable to work and require care
  - Who are retiring early although they would be able to be active in insurable employment

[29] http://www.alz.co.uk/research/files/WorldAlzheimerReport2010.pdf
[30] http://alzheimers.org.uk/site/scripts/documents_info.php?documentID=101

- Increase of health and pension expenditures due to:
    - An increase of people eligible for receiving pensions
    - Growing health costs due to increasing health problems with higher age
    - Increase in need for care (need for more personnel, facilities, medication)
    - Progress in medical technologies that lead to higher medical expenses

- Decrease in share of population who is able to finance the pensions and health/care costs for these elderly people due to:
    - Declining birth rates (less younger people)
    - Early retirement of people who would be able to be active in insurable employment
    - Elderly people seeking a job often have difficulties in finding one (ageism[31])
    - Relatives who have to quit their regular work in order to care for elderly people
    - Possibly lower wages (e.g. if young immigrants who could compensate for declining birth rates have lower paying jobs)
    - Emigration of highly qualified and wealth people to countries outside Europe/EU27 (decline in income from taxes and social insurance contributions)
    - Economic crisis and unemployment can worsen the situation

Additionally, there are also other second-order issues that could arise within the context of unhealthy ageing (i.e. prolonged period of age-related disease/illness/disability). One could be organ shortage within the context of transplantation medicine, especially in regard to the effort of preventing more accidents due to improved safety technologies and general medical progress that increases the survivability rate (of younger people).

The ageing issue and the related socio-economic strain also bring in new socio-ethical controversies such as euthanasia and the topic of high end-of-life costs (e.g. in the US)[32]. In Europe, this problem seems to be comparatively less serious. However it also needs to be asked what is actually driving medical costs and in how far cost-reductions would be economically feasible and socially and ethically acceptable?

A decline in religiosity could also contribute to an increase in related problems since religious institutions often perform care activities for free or low costs out of altruistic/religious motivation.

However, ageing does not necessarily equal bed-ridden, demented, frail and unproductive. There are also examples of people who have remained active and considerably healthy throughout their long life. Observations also suggest that people who live very long (up to 90 and beyond) generally seem to he healthier than those elderly who died younger and also die from other diseases and

31 http://forums.ec.europa.eu/debateeurope/viewtopic.php?p=204285&sid=abd883e717ef52c341810c5bc9f9c9a7

32 http://www.reuters.com/article/idUSTRE69C3KY20101014

complications[33]. This phenomenon may require further in depth scientific analysis since the question about what distinguishes healthy agers from unhealthy agers (e.g. in regard to life-style, personal circumstances and biological/metabolic/genetic factors) may hold a key to healthy ageing strategies.

Currently, reliable strategies for "healthy ageing" in the sense of increasing the share of healthy years in old age or respectively decreasing/compressing the number of years with age-related disease/illness/disability are not available. However, it is suggested that certain especially life-style related practices like eating habits, physical and mental activity etc. can contribute to general health improvements. In face of challenges to pension, health and social insurance systems, the "Ageing Society" has already become an important topic which led to proposals for changes in pensions, retirement age, nursing, care and health insurance.

Many suggestions have already been made in order to tackle this growing challenge. The first section will deal with socio-economic suggestions while the latter part will focus on scientific and technological solutions.

3.2 Socio-economic suggestions – pensions and employment

3.2.1 Raising the retirement age

Most European countries have already raised the retirement age or perform deductions from pension payments in case of early retirement. Some countries also consider(ed) a reduction in pension payment or at least a freezing of raises. Both suggestions, however, have caused and are causing resistance from large parts of society. Also raises in retirement age are not suitable for some jobs, especially those that require physical activity (e.g. building and construction)[34]. Increasing the retirement age as such may also be no solution if age-related health problems are prevailing. If the retirement age is being increased, it also needs to be ensured that there are enough jobs available for elderly people.

If healthy ageing would be possible indeed, changes in regard to the retirement age need to be implemented, whereas then, however, there also need to be enough jobs for the elderly. As unemployment (or low incomes) - especially youth unemployment may prevail - generational conflicts could be the result and financial burdens may only be shifted instead of being resolved.

Within the workshop, the issue about retirement and working elderly has been discussed. On the one hand it has been stated that staying active with old age positively contributes to healthy ageing and that retired people should to be integrated on all levels. Also the expertise and knowledge of elderly should be better recognised, their social integration should be improved and people should also have higher expectations from the elderly, e.g. in regard to their competences and abilities.

[33] http://news.bbc.co.uk/2/hi/uk_news/magazine/6587309.stm
[34] Time online: http://www.time.com/time/business/article/0,8599,2002296,00.html and refer to the latest protests in France upon the proposal to raise the retirement age from 60 to 62 (http://www.eurofound.europa.eu/eiro/2010/07/articles/fr1007021i.htm?utm_source=France&utm_medium=RSS&utm_campaign=RSS)

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However there may exist the problem of youth unemployment as hindering factor as well as public acceptance.

Workshop participants have also suggested to create new wage and reimbursement schemes for elderly workers or to integrate them better into voluntary work. However there has been some ambivalence about the feasibility as well as desirability of such options. "Work until you die", however, has been considered as neither feasible nor desirable. As hindering factors for changes in work-life-balance related issues traditional career systems as well as labour-market related particularities have been named.

During the workshop, an emphasis on more general factors like a healthy work environment and an early start for creating a good work-life balance has been put forward. Also here there seems to be room for much research ideas (e.g. in relation to occupational health) and organisational innovations (e.g. work-life balance, work satisfaction and ways for keeping the elderly integrated).

In this respect, the workshop yielded that social responsibility of firms is a crucial factor in improving the working opportunities and conditions for older workers but also for younger ones since ageing has been repeatedly referred to as as something that needs to be taken care of from young age on. This needs to be initiated and supervised EU wide.

Policy requirements as stated by experts from the workshop:

- Improvement in working-time regulations and work-life balance
- New schemes of social rewards (beyond professional activity)

Policy challenges:

- Older people still have more problems in finding a job, although the situation has improved[35], but unemployed older workers still face difficulties[36].
- How to create jobs for the elderly in face of considerable unemployment rates of younger people?[37]
- Is early retirement contradicting the goal of raises in retirement age?
- In how far are people able (and willing) to work longer? For people to stay longer in employment they need to be able to do so (sufficiently healthy) and from an individual perspective have the prospect of still enjoying a sufficiently long healthy time in retirement.

[35] The EU-27 employment rate for older workers (aged between 55 and 64) reached 46.0 % in 2009, compared with 45.6 % in 2008 (source: Eurostat http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Employment_statistics)

[36] According to research by the Urban Institute (US) "[w]orkers in that age group who have lost their jobs in the recession are one-third less likely to find new work than their counterparts age 25 to 34. And workers over age 62 were half as likely to be re-employed" (http://www.urban.org/publications/412283.html)

[37] "Rises in youth unemployment in the EU also continued to ease in January. Unemployment for this age group expanded by a modest 22 000 (or 0.4 %) to 5.5 million, with the unemployment rate for youth increasing by a mere 0.1 pps to 20.9 %. Nevertheless, even if the rises in the youth unemployment rate have weakened recently, they are still higher than the recent more limited increases in the rate for adults, which stabilised in January."
(source: http://ec.europa.eu/youth/news/news1724_en.htm)

- If birth rates are declining, fewer resources need to be spent on children – in how far could this compensate for the increase in older people?

3.2.2 Jobs for the elderly

If a raise of the retirement age is considered desirable, it needs to be made sure that there are enough and suitable jobs available for an ageing workforce. In some areas, especially which involve physical abilities, workplace-adjustments may need to be implemented.

Some companies, e.g. BMW[38] have developed schemes to better integrate older workers and keep them longer within their workforce, which sometimes also requires redesigns in the work environment (e.g. the installation of chairs and magnifying glasses as shown in the example cf. footnote) or the creation of new activities more suited for elderly people.

There could also be the possibility to actively create jobs for elderly people and utilise their competencies. Both practices are however especially difficult in case of cognitive decline and dementia and challenging for people with considerable age-related physical disabilities/health problems.

As is has already been mentioned previously and in the workshop, social as well as physical factors play an important role. From a social and psychological perspective, it is important to keep elderly integrated within social and economic activities to positively impact their healthiness of ageing. Elderly should not be written off and firms and society should better recognise their knowledge and experience. However, the ability to stay active closely relates to their physical and mental condition. Therefore it is important to promote and support health consciousness and healthy and active life-styles as well as occupational health from an early age on.

Policy requirements as stated by experts from the workshop:

- Fostering social responsibility in firms (firm-wide) on an EU-level also in regard to occupational health
- EU-wide Promotion of professional health + safety + environment inspection

Policy challenges:

- Creating incentives to keep and employ older workers
- Support for retraining, re-skilling and life-long-learning
- In how far should governments be involved or in how far should employment decisions be left to the market?
- Should different insurance schemes be implemented for elderly workers?

[38] http://www.zdf.de/ZDFmediathek/beitrag/video/1011306/Arbeitsmarkt-Fit-fuer-den-Job-im-Alter#/beitrag/video/1011306/Arbeitsmarkt-Fit-fuer-den-Job-im-Alter and cf.: http://www.eurofound.europa.eu/areas/populationandsociety/cases/de020.htm

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- Improvement of the (social) integration of older workers and the prevention of "ageism" (discrimination due to age)
- How to balance the goal of reducing unemployment of younger people with keeping older people employed for a longer period?
- Healthy ageing is a precondition to longer work-life – how can this be achieved?

3.2.3 Changes in social security schemes

Some countries also have changed their social security financing schemes, either by more emphasizing the need for additional private insurance and pension savings or by raising contributions to social insurance (health, pension) or taxes. All suggestions, however, are criticised by employers who are confronted with higher financial burdens and higher personnel costs (which could challenge price competitiveness) or employees who need to pay more for insurances and have less net income available. Especially current young generations may be double-burdened since they still need to finance the pensions for current retirees but are also required to take care of their own future pensions to a considerable extend. According to projections, by 2025 there will only be 3 people employed for every retired person as compared to 4 employed people in 2010, a situation that is expected to decrease to 2 employees per retiree in 2050[39]. This situation which is the result from a combination of higher life expectancy and declining birth rates puts stress on the financing situation of pensions. Even more challenges will arise if unemployment figures are high or overall income is low. Immigration is also considered as an option to compensate for the declining birth rate, but this also comes with challenges since most immigrants are likely to come from non-European countries which may impose additional cultural problems.

The idea of linking pensions to the respective health engagement of individuals has been regarded as neither feasible nor desirable by experts during the workshop. However, the need has been expressed that new forms of insurance systems and funding schemes may be necessary. But issues like equity and generational burdens need to be taken into account. Also new forms of working biographies which allow for more socio-economic activities until older ages will positively contribute to financing.

Policy challenges:

- How should the financial burden be distributed? (Sharing the burden between young and old)
- Is there a pension guarantee also for future generations?
- How to enable and motivate the current generation of young people to save for their pensions? (May also require related education and reliable support and information providing[40]).
- How can people improve their financial situation for medical costs during retirement?
- Assessment of economic effects related to social security, insurances and pensions in view of income and the creation of jobs

[39] Address from Neelie Kroes Vice-President of the European Commission - AAL Forum 2010 Odense, 15 September 2010: http://www.europa-nu.nl/id/viimi743yyy9/nieuws/vice_voorzitter_van_de_europese?ctx=vhsjd8w6pdvc&start_tab0=40

[40] http://www.moneyobserver.com/news/10-10-26/young-people-need-change-their-attitude-towards-retirement-saving

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- How to improve immigration policy and balance integration of migrants with cultural diversity?
- Could there be the danger of a growing divide between rich and poor people in regard to health-care, pensions and living standards after retirement? And if so, how can this be avoided?

3.3 Care-taking and care

3.3.1 Relatives as caretakers

If the current trends in ageing patterns continue, a severe shortage in care-workers for the elderly is expected as "By 2020 there will be a shortage of approximately 1,000,000 healthcare workers in the EU"[41]. Thus it is suggested that relatives should get more involved in care-taking[42]. This could, however, prevent people from being active in (higher paying) insurable employment. If the cases are severe (especially with dementia or severe disability), non-professional relatives may not be able to cope with the situation and may need to seek professional assistance. According to a 2009 Eurobarometer survey "[t]wo-thirds of Europeans feel that people who care for elderly relatives are let down by social services"[43]. Taking care of ageing relatives can also be a physical and psychological challenge and may have negative effects on family life (mothers may thus be responsible for taking care of their parents as well as their own family/children). The situation may get more problematic as the number of life years in dependency of care may increase.

During the workshop, especially social environments that better integrate the care for elderly have been mentioned as desirable and necessary. One example has been to foster trans-generational living where younger and older generations live together and also take care of each other (e.g. grandparents taking care of grandchildren, children of grandparents etc.). Here social responsibility as well as solidarity have been mentioned as keywords, where education also plays an important role. In South Korea, for example, school children already get classes in taking care of demented people[44].

Additionally it has been mentioned at the workshop that new education and skills requirements may be necessary for family-care workers and that thus training programs should be available.

Policy requirements as stated by experts from the workshop:

- Education plays a central role for providing family care-takers with the necessary skills for elderly care as well as for education in the context of civil society in relation to solidarity and respect for elderly.

[41] http://ec.europa.eu/health-eu/newsletter/54/newsletter_en.htm
[42] http://www.eurofound.europa.eu/areas/populationandsociety/family.htm
[43] http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/09/206&type=HTML
[44] http://www.nytimes.com/2010/11/26/health/26alzheimers.html?pagewanted=all

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Policy challenges:

- In how far should family care-taking be supported by the government, e.g. financially or through professional support?
- Better support for people who are taking care of ageing (or disabled/permanently ill) relatives through social services (incl. e.g. better support for child day care etc.).
- Training and qualification of family care-takers
- Tackling financial issues related to taking care of relatives (lacking time for regular employment, lacking income, financial needs for care-taking)

3.3.2 Elderly taking care of the even older people

Another suggestion that is already being discussed (and possibly practiced) is the concept of elderly taking care of other (even more) elderly[45]. This could decrease the need for additional care personnel as well as nursing costs, whereas here, professional supervision is likely needed, but to a lesser extent. This could also create the opportunity for activities for retired/elderly people or even create new jobs for them.

One model that is for example provided in Hogewey/the Netherlands is that of community living of elderly people, in case of Hogewey even people with dementia[46]. Here demented elderly are living together and are assisting each other within a home-like environment with the supervision of professional caregivers.

The idea of elderly taking care of the very old also relates to the comments from workshop experts that elderly should remain active and integrated as long as possible. Even though elderly may not be able to perform physically challenging tasks associated with care, they could provide valuable contributions to the socio-psychological wellbeing of other old people as well as for themselves and thus reduce challenges related to time- and financial pressures of elderly care and improve the quality of care in general.

Policy requirements as stated by experts from the workshop:

- training of professionals training of non-professionals, create new skills requirements, reskilling, new skills sets

Policy challenges:

- Regulatory issues and support

[45] http://www.associatedcontent.com/article/336779/seniors_caring_for_seniors_pros_and.html?cat=12
[46] http://www.zdf.de/ZDFmediathek/beitrag/video/1011306/Arbeitsmarkt-Fit-fuer-den-Job-im-Alter#/beitrag/video/1139064/Alzheimersiedlung-in-den-Niederlanden and http://www.vivium.nl/index.php?p=271

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- In how far should governments be involved in supporting/setting up required structures and networks or should this be left to the market and social initiatives?
- Should institutions that provide such care structures get some benefits (e.g. in regard to taxation etc.)?

3.3.3 Nursing homes

The classic model is nursing homes, whereas here personnel shortages seem to be a problem which also affects the quality of care. Here also increases in patients as well as constraints in budgets and personnel (or decreasing affordability) are issues. Community living as it is provided in the example of Hogewey (cf. above) could provide a new model for improvement in quality of life, whereas cost considerations may play a (restricting) role.

Within the expert workshop, participants made the suggestion that the boundaries between home and hospital should become less obvious. This can imply both directions: increasing the possibilities of providing (medical) care at home as well as improving the atmosphere of hospitals and care facilities/nursing homes to make patients/residents feel more 'at home'. This would also necessitate training of non-professional care-givers (e.g. relatives) or social and organisational innovations in hospitals and care facilities, which, however, currently very often suffer from chronic shortages in finances and human resources. Also 'integrative care' has been mentioned as important, which includes many different dimensions ranging from the physical to the spiritual. It has also been criticised that current services are too fragmented and not collaborative enough.

Social aspects have been very much emphasised by workshop participants which included to "give more incentives to families to live together with ageing members of the families" and "putting the human into the centre" as well as more real-life orientation.

Policy requirements as stated by experts from the workshop:

- Create room for experimentation in real life situations with business models + practices to create evidence-base
- Provision of financial incentives with underlying quality incentives

Policy challenges:

- Who should be in charge of quality control in nursing homes?
- Improvements in possibilities for hiring and training foreign care-takers/nurses and accept foreign certificates
- Financing of nursing-home care
- Balancing economic considerations and rationalisation with the wish for good and humane care
- Implications for the economy if more and more people are needed in the nursing profession

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3.3.4 Immigrants for healthcare

The Philippines, India and Cuba, for example, have already discovered the need for care personnel in Europe and other (post) industrialised countries where the ageing society is rapidly causing a challenge. Thus, the Philippines (and other alike countries) are already training people as care workers for the elderly who will then emigrate to Europe or elsewhere to work there in elderly care either at home or in care facilities[47]. Although this option has been assessed as feasible by the experts at the workshop, its desirability has been considered rather low.

However, the situation may also depend on the clients requiring these services. A German initiative, for example, is actively promoting the practice of culturally suitable care "Kulturgerechte Pflege"[48], which are especially sensitive to cultural, habitual and religious particularities of elderly (with migration background). Here, of course, foreign care-workers with the first-hand experience and cultural knowledge would be very welcome.

Policy challenges:

- Adaptation/improvement of immigration policy (desirable?)
- Training and certification as well as acknowledging foreign certificates and diplomas
- Negative effects of migrating medical personnel from developing/emerging countries for their home countries and their domestic development

3.3.5 Retirees going abroad

Other countries, e.g. Thailand[49], are actively advertising for retirees to go abroad (e.g. to South East Asia) in order to receive an affordable retirement life and care. However a number of elderly actually would like to stay within the place they live for a long time – or at least remain in their country. Cultural aspects could here also be a hindering point.

Policy challenges:

- Issues regarding visas, insurance, registrations etc.
- Funeral regulations (transfer after death to home country etc.)

3.3.6 Palliative care, dying in dignity and euthanasia

Palliative care does not focus on curing a disease (because it is incurable with today's methods) but on reducing the symptoms and suffering and improving the quality of life of the diseased. Especially in regard to the high costs in end-of-life care and possibly "unnecessary" prolongation of life in suffering (e.g. 'dying in the sterile environment of a hospital with machines instead of friends and family') without hope for improvement, palliative medicine and care gets increasing attention. Pain

[47] http://www.migrationinformation.org/feature/display.cfm?ID=271
[48] http://www.dsk-rv-worms.de/Weiterer-Service/Kulturgerechte-Pflege-Seite-1334.html
[49] http://internationalliving.com/2009/02/chiang_mai/

management as one central element in palliative care has only recently got more attention in research and development and hospital practice, but still needs improvement in many cases[50].

Palliative care is also related to a certain view about death as a natural process, but also closely related to the controversial topic of euthanasia. Euthanasia is a taboo topic within most countries, but discussions are growing, especially within the general public and among ethicists[51]. One major aspect that is frequently mentioned in this context are high end-of-life costs (especially in the US, to a lesser extend in Europe) as well as the bad quality of life for some people who spend their last days in intensive care units at hospitals. However, as it has also been mentioned by experts in the workshop, the right to choose when and how to die can also be seen as an integral part of liberal values and freedom of personal and individual choices.

> *"In 2002, The Netherlands legalized euthanasia including physician assisted suicide. The law codified a twenty year old convention of not prosecuting doctors who have committed euthanasia in very specific cases, under very specific circumstances. The Ministry of Public Health, Wellbeing and Sports claims that this practice "allows a person to end their life in dignity after having received every available type of palliative care."*
>
> *Dutch Ministry of Health, Welfare and Sports (http://english.minvws.nl/en/themes/euthanasia/)*

But the question about dying in dignity – which also includes the question about euthanasia – is becoming an important topic[52]. But it is not only about what is considered as "active euthanasia" (still a very taboo topic) but about the question what kind of treatment (or discontinuation of treatment) should be provided under which circumstances and where should a person spend the last days of one's life. Also society may need a broader discussion about different opinions about death, dying as well as the prolongation of ones life as personal choices and how to deal with such differences in preferred choices.

As a side effect, these considerations have also spurred the discussions about the definition of death (which is far from clear and far from being defined in a unified and biologically sound way), which also affects the issue of organ transplantation, coma patients, the possibility of measuring brain death, the reversibility of some signs of death due to modern technology (e.g. resuscitation)[53] and has called for more scientific research about the process of dying (thanatology)[54]. This, in turn also encouraged the (biological) science about the process of ageing (biogerontology)[55].

[50] http://www.bbc.co.uk/news/health-11728163
[51] http://www.futureagenda.org/?p=944 and http://ccforum.com/inpress/cc3894
[52] E.g. http://www.medscape.com/viewarticle/719493 and http://www.scottish.parliament.uk/business/bills/pdfs/mb-consultations/Dying%20with%20Dignity%20Consultation%20paper.pdf
[53] http://ccforum.com/inpress/cc3894
[54] http://en.wikiversity.org/wiki/School:Mortuary_science_and_thanatology
[55] http://www.bg-rf.org.uk/news/press20090821.html

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Policy challenges:

- Taboo topic
- Legal challenges within EU countries (euthanasia is considered illegal)
- Can end-of-life medical costs be reduced in an ethically acceptable manner?
- Ethical concerns
- Prevention of misuse
- Issues regarding the right for self-determination
- Conflict between self-determination of patients and ethical standards/practices within medicine
- Diverging definitions (e.g. of death) and medical practices (e.g. when to start an intervention and when not)
- There could be a thin line between "compression of morbidity" and discussions about euthanasia which may cause socio-political controversies

3.3.7 Life Style

In general, life style choices and practices like good nutrition, physical activity (jogging, yoga, swimming etc.), preventing obesity, mental activity (e.g. through mental training and practice but also by keeping a wide spectrum of interests etc.), well-being (stress reduction, meditation etc.) as well as moderation of alcohol consumption and no smoking and the avoidance of toxic and cancer-causing substances are considered to contribute to a generally healthier life style and thus also to healthier ageing.

There is also a variety of dietary and life-style-related suggestions for fostering healthy ageing, i.e. trying to prevent or minimize the negative side effects of ageing and age-related diseases. Physical and mental activity, yoga and meditation as well as balanced and healthy diet with fewer calories (e.g. Okinawa diet or (CRON) caloric restriction[56]) are being suggested. Research suggests, however, that many factors – genetic, biological and life-style related – are coming together to influence the trajectory of one's ageing path: healthy vs. unhealthy.

There is also growing interest in finding pharmacological solutions for preventing, slowing down or countering/reversing cognitive decline, especially in the elderly. Many, often natural substances like ginseng or ginkgo biloba and foods like berries and red wine are suggested to have positive effects in this regard, whereas many of them are scientifically unproven, disputed or even disproved (as in the case of ginkgo[57] and recently in regard to resveratrol[58]).

There is also research being conducted in regard to the effect of so-called nootropics (e.g. Ritalin, Modafinil and others), i.e. medication that can positively influence cognitive abilities like concentration and wakefulness on elderly and demented patients.

[56] E.g. CRON diet, cf. also: http://cordis.europa.eu/fetch?CALLER=EN_NEWS&ACTION=D&RCN=31993
[57] http://www.medscape.com/viewarticle/714476
[58] http://www.sens.org/node/1759

Here the question arises, who should be responsible and how to provide incentives for favourable healthy life styles with potential positive effect on healthy ageing? How much self-responsibility should individuals take and how much responsibility should be taken up by industries, e.g. the food industry or producers of consumer goods (e.g. in regard to toxicity, ergonomics etc.)? Which incentives and rewards should be given for adhering to a healthy life style (e.g. in regard to insurance schemes) and who assesses reliably which life styles, products and activities are really beneficial for one's health and healthy ageing? If looking at the large amount of products that are marketed to be allegedly beneficial for health and disease prevention (incl. “anti ageing”), it is doubtful if the consumer can make informed choices and distinguish between reliable information and fraud.

As it has also been mentioned at the workshop, life-style choices are often not ones really chosen objectives. People are dependent, for example, on given environments on the work place (physical and organisational) as well as products on the market. In addition to this, insufficient knowledge as well as financial constraints could prevent people from making the most favourable choices.

Some major points have been mentioned as very important by the experts at the workshop: education for a healthier life style, the creation of working conditions favourable for healthy living and ageing, finding ways to better integrate elderly into work and social life and incentives for industries to develop and market generally healthier products.

Policy requirements as stated by experts from the workshop:

- Seek business investment (employer-employee relation) health conditions of employees
- Start early with work-life balance policies
- “Voluntary work” after retirement
- Providing industries with incentives to generally produce and market healthier products

Policy challenges:

- In how far would incentives for healthier life styles conflict with a person’s freedom to choose?
- How to provide incentives for industries to produce products more beneficial for health and how to (scientifically and objectively) assess such claims?
- Should the development of products with the aim of being beneficial for healthy ageing be supported by governments and public moneys?
- What kind of research and definitions of “ageing” are necessary to develop according products?
- How to ensure equal access to beneficial products?
- How should access and availability be financed?
- More focus on preventative measures?
- How to avoid life-style-related diseases such as obesity-related problems and who is responsible for their occurrence/avoidance (individuals, industries, public health?)
- Regulations on medicine and drugs

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3.4 Technological suggestions

3.4.1 Assisting technologies for the elderly

Researchers and industries are already developing technologies that can be used for assisting elderly people in better performing their day to day activities in a (maximal) independent manner. Suggestions range from intelligent household devices (incl. sensors, cameras, communication systems and home automation) over tele-health and health monitoring devices (incl. intelligent clothing) to care robots. Such technologies can mostly assist in performing routine (physical) tasks (e.g. mobility assistance, fetching objects, doing errands), monitoring activities to improve safety (household appliances, intake of medicine and food etc.), monitor vital signs to alert medical personnel in case of emergencies and remind of schedules and assist in some administrative tasks (e.g. managing doctor's appointments, reminding of payments etc.)[59].

The current stand of technology and Artificial Intelligence is still not advanced enough to perform sufficiently reliable tasks autonomously in cases of higher care needs or in case of demented patients. Also interfacing still seems to remain a challenge since elderly people often have declined motoric skills (e.g. for using keyboards), speech and hearing difficulties (in regard to giving commands/speech recognition and hearing instructions from the system), declined vision (reading texts and instructions) and strength and/or reaction time/mental alertness (to manage the machinery in case of accidents/malfunction). Improvement in autonomous systems performance requires interdisciplinary research[60]. In general, however, a broad variety of different technologies have already been developed or is under development that can support elderly especially in health and mobility-related tasks and thus allow them to live in higher autonomy for longer time. Developments include ambient living environments, tele-health monitoring, intelligent household appliances and security systems as well as devices and services that improve social connectiveness.

There also arise ethical as well as legal issues in regard to (semi-) autonomous machines in the area of care giving. Also studies, even in technology-loving Japan suggest that care robots and machines may not get the sufficient acceptance from the (current generation of) elderly[61].

Within the workshop, experts have emphasised that it is important to involve the elderly as well as care-givers themselves much more within the product development process. Also certain framework-conditions like fast network/internet infrastructures, security/privacy protection measures and standardisation need to be available or improved to make good use of technological possibilities. Other benefits not even address technology as such but things like product design, e.g. packaging that is easy to open (by possibly physically impaired persons) or appliances that are easy to operate, handle and to clean as well as affordable.

[59] The TNO report "Robotics for Healthcare" provides a substantial overview about latest and envisioned developments: http://www.tno.nl/downloads/TNOKvL_report_RoboticsforHealthcare1.pdf
[60] Cf. e.g. http://robotics.usc.edu/~tapus/publications/tapus_RAM2007.pdf
[61] http://www.bbc.co.uk/news/business-12347219

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Policy requirements as stated by experts from the workshop:

- Finding ways to integrate elderly and care-givers more within the product development process
- Target health services research and product development more on the perspective of the elderly and users (e.g. care-workers)
- Support the availability of fast broadband internet connections and affordable devices and services
- Harmonisation of technologies, services and enabling infrastructures

Policy challenges:

- Necessary regulatory issues and changes (standards, safety/safety certificates, building regulations etc.)
- Addressing liability questions in regard to autonomous systems (e.g. care-robots)
- Who should provide the communication and security infrastructure (e.g. in regard to tele-health)?
- New job requirements (e.g. in regard to tele-health applications)
- What kind of R&D is necessary to improve such support systems, where to invest, how to train people and how to get the needed human resources (e.g. engineers etc.)?
- Implementation of infrastructures more suitable for the elderly (ramps, size of letters on signs, visual and acoustic support etc.); who should be responsible for the implementation and financing?

3.4.2 Assisting technologies for caregivers

Another line of technologies is rather designed in order to assist the helpers, especially in regard to errands (fetching and bringing things) as well as activities that require physical strength (e.g. lifting patients). Lifters, automated beds, robots for performing errands (e.g. bringing food, water and medication) and even so-called exoskeletons belong to the line of innovations. Physical assistance seems to be of relevancy, especially since a considerable share of care-workers is women. However, also here, technical challenges in regard to reliability, safety and hygiene (especially in case of exoskeletons and mobile robots) remain[62].

Here also the involvement of care-workers should be put even more into the focus on product development and the creation of new services.

Policy challenges:

- Financing and financial support?
- Reliability issues
- Attracting more males for care-taking professions?

[62] http://www.tno.nl/downloads/TNOKvL_report_RoboticsforHealthcare1.pdf

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3.5 Medical suggestions

3.5.1 Neuroscience

Much R&D activities are being conducted in order to tackle major disabling diseases and conditions associated with ageing, e.g. motor-neuron diseases (e.g. Parkinson's), but especially cognitive decline and dementia (e.g. Alzheimer's disease)[63] which is also an (official) driver behind the so-called "blue brain" project[64].

If looking at scientific research projects especially in the area of neuro- and bioscience, a large part of the descriptions refer to age-related diseases, especially dementia/Alzheimer's disease. The task of developing medication to counter or prevent dementia/Alzheimer's disease is being pursued within a large number of research projects and industries.

This also goes together with basic research in neuroscience in relation to finding the causes for dementia/Alzheimer's disease, which could be genetic, influenced by life style or related to metabolic processes (or failures of metabolic processes).

So-called plaques as well as protein misfolding[65] belong to the theoretic explanation models of (some forms of) dementia. The understanding of causes and mechanisms could lead to effective medication, but many issues are still unclear und still remain subject to basic research and animal studies.

Within the workshop, experts agreed that dementia is a serious issue and that different approaches for tackling this problem should be tried. These include preventative measures as well as psychological approaches, medical developments and assisting technologies. Research in dementia and working on treatments or preventative measures has been seen as one of the priorities.

Policy challenges:

- Assessment of research projects in regard to their probability for success
- Priority-setting for R&D (what should be R&D priorities in relation to "healthy and active ageing"?)
- More support for "Frontier Science" (i.e. new approaches and breakthroughs, high innovations, not to be confused with "fringe science") and widening the scope of the FET-Flagship initiatives beyond ICT (e.g. more integration of biology, neurosciences and medicine)?
- How to improve the effectiveness of the research systems?

[63] E.g. http://www.sfn.org/index.aspx?pagename=brainBriefings_10_unravelingalzheimers
[64] http://sv.epfl.ch/page-26599.html
[65] http://www.sfn.org/index.aspx?pagename=brainBriefings_10_proteinfolding

3.5.2 R&D on other age-related diseases

Other medical developments aim at other kinds of diseases and disabilities that more likely occur with ageing. Examples are cardiovascular and pneumatic diseases, infections, eye diseases, hearing loss and loss of muscle and bone mass, resulting in higher risk of fractures. Here prosthetics as well as envisioned regenerative medicine and gene therapy (e.g. for the regeneration of organs, eyesight and muscle/bone loss) are topics in research and development. Other innovations relate to health monitoring and early diagnostics (e.g. in regard to the formation of blood clots leading to heart attacks or strokes), where for example miniaturised sensor systems or even micro/nanobots for in-vivo monitoring are being envisioned as future solutions, e.g. for detecting removing plaques that could lead to dementia. Also biotechnological and pharmacological solutions (e.g. AGE inhibitors like Metformin) or specific enzymes that clear up accumulating harmful "metabolic waste" (which may also be related to diseases like diabetes) are being envisioned[66].

During the workshop, especially cancer testing and research has been named (e.g. early cancer detection via blood FSH measurement) to be practically and theoretically beneficial for active and healthy ageing. It has also been mentioned that animal studies with aged animals should be encouraged, which would have several benefits, incl. more data on age-related diseases, ageing mechanisms as such, long-term studies, information about reactions of elderly towards medicines and treatments and could also be beneficial for lab animals (less animals needed for research and lab animals would not need to be eliminated after a certain research period). In general the need for more long-term cohort studies and specific funding for studies on aged animals (and humans) has been suggested.

From a more social-related view, it has also been generally suggested in the workshop to further assess possible relationships between occupations and age-related diseases. In relation to scientific practice, more openness has been demanded that also allows for the scientific consideration of new scientific approaches, 'frontier science' and innovative ideas to enter the established mainstream.

Policy requirements as stated by experts from the workshop:

- EU funding also for new ideas, innovative approaches and 'frontier research' on ageing and age related diseases
- Specific funding for research on aged animals (and humans)
- Re-thinking of patent policies since an extension of the duration of patents could serve as incentive for investing more into long-term and innovative R&D. This idea is however disputed

[66] http://www.sciencedirect.com/science?_ob=MImg&_imagekey=B8CX1-4YMJWMV-D-1&_cdi=40073&_user=603085&_pii=S1262363603727931&_origin=search&_coverDate=09%2F30%2F2003&_sk=999709995.7997&view=c&wchp=dGLzVzz-zSkzV&md5=a904774b237470417ec031dcf9b7fb03&ie=/sdarticle.pdf

Policy challenges:

- Support for R&D that could also be beneficial for healthy ageing, e.g. regenerative medicine, tissue engineering, cancer research, smart diagnostics?
- More support and funding for research especially addressing the issue of ageing (e.g. (bio)gerontology)?

3.6 Scientific Understanding and Tackling of the Ageing Process[67]

Whereas the suggestions mentioned so far are mostly focussed on impact minimising or countering specific problems and effects, another research trajectory aims at understanding the ageing process as such. A better understanding of the ageing process itself could also lead to improved and earlier interventions to prevent the negative effects of the ageing process. This kind of research trajectory includes general theories about ageing, studies in biology, metabolism etc. as well as studies of healthy aged people (e.g. supercentenarians) and animals who possess what is called "negligible senescence" (no ageing) such as turtles[68] and animal studies on healthy ageing and healthy longevity.

All these research trajectories derive from the premises that the ageing process as such is the reason for the physical and cognitive problems that occur with progressing age and that the ageing process as such is the root issue to be tackled. A better understanding about the ageing process itself could thus lead to better strategies to counter its negative effects. However, this research field of biogerontology is still young and only slowly gets recognised by an increasing number of biologists and interdisciplinary researchers, e.g. through the Max Planck Research Network on Ageing[69].

Research on ageing as such is a rather novel discipline but is gaining increasing acceptance within the scientific (mainstream) community. It has also been mentioned by experts at the workshop that the general public should also become more involved in the scientific communication about ageing research and applied ageing/longevity studies. Also in general, more communication between different scientific institutions and research areas would be beneficial, which also requires better coordination, possibly even on the EU level.

Policy requirements as stated by experts from the workshop:

- Have a ministry of "Ageing & Health Breakthroughs"
- Facilitate possibilities for better public understanding of research into ageing
- Create the framework for innovative strategies for engaging the population in applied research

[67] Examples of research findings can be found here: http://quemot.wordpress.com/tag/life-extension/
[68] http://www.agelessanimals.org/
[69] http://www.maxnetaging.mpg.de/

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Policy challenges

- Should ageing itself be defined as a disease[70]? And if so, new (legal) possibilities may open up for the pharmaceutical/medical industry as well as the food/beverage industry.
- Development, introduction and support of new research areas and study programs dealing with the science of ageing?
- Assessment of social and ethical considerations if ageing itself would be considered as a disease.

[70] "Nir Barzilai of the Albert Einstein College of Medicine at Yeshiva University in New York, says one way of trying to face down this enormous burden of disease is to look at the biggest risk factor common to all of them -- aging ageing.

"There's one thing everybody is missing," he said. "Aging "Ageing is common for all of these diseases -- and yet we're not investigating the common mechanism for all of them. We are just looking at the specific diseases."“
(source: http://www.reuters.com/article/idUSTRE64I6HV20100520)

4 Examples: Foresight Studies and ("frontier") R&D

4.1 Foresight Studies

Many foresight studies dealing with the issue of ageing and healthy ageing focus on statistical projections about e.g. age distributions and figures for expected expenditures, cases of diseases (e.g. dementia) and a lack of care-personnel.

Especially the rising expenditures for health care, medicine, elderly care/nursing and pensions as well as severe shortages in nursing/health-care personnel are featured in many foresight reports, projections and forecasts. Although reforms of the health and pension systems are considered as necessity and healthy ageing is thought to be crucial for tackling the socio-economic challenges associated with the ageing society, no real concrete suggestions are being made about how to achieve this goal.

Examples:

- World Economic Forum (2008): The Future of Pensions and Healthcare in a Rapidly Ageing World (http://www.weforum.org/pdf/scenarios/Transforming-Pensions-Healthcare.pdf)
- AARP International (2007) Major Developments and Trends in Global Ageing (http://www.aarpinternational.org/usr_doc/unbsproceedings.pdf)
- Welsh Institute for Health and Social Care (2007) Nursing: Towards 2015 - Alternative Scenarios for Healthcare, Nursing and Nurse Education in the UK in 2015 (http://www.nmc-uk.org/Documents/Research%20papers/Nursing%20towards%202015%20full%20report%20.pdf)
- Olshansky (2007) Pursuing the Longevity Dividend Scientific Goals for an Ageing World (http://deepblue.lib.umich.edu/bitstream/2027.42/75679/1/annals.1396.050.pdf)
- The Danish Council for Strategic Research (2006) Danish national foresight study "The Ageing Society 2030" (http://en.fi.dk/publications/2006/the-ageing-society-2030/the-ageing-society-2030.pdf)

In regard to science and technology, many foresight studies are presenting future technologies associated with age-related care which mainly include topics like care-robotics, ambient/smart living, health surveillance technologies, prosthetics and technical aids and tele-health and e-health systems relying on ICT and Artificial Intelligence. Many of the suggestions look technically feasible and much progress is already being made in these areas in reality, but some may come with legal challenges (liability issues in regard to autonomous systems) as well as questions about societal acceptability. Finding technological solutions for improving the quality of life and autonomy of the elderly also seems to be a considerable driver for industries related to ICT and robotics.

Examples:

- Butter et al.: Robotics4Healthcare (http://www.tno.nl/downloads/TNOKvL_report_RoboticsforHealthcare1.pdf)
- Frog Design + Fast Company: The Future of Healthcare is Social (http://images.fastcompany.com/health-care/FC_FutureofHealthcare.pdf)

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- E&C, 2010: Intel Study Reveals Telehealth Will Dramatically Transform Health Care (http://www.euplus.com.sg/E&C_PDF/Page_16.pdf)

Another category of foresight studies goes much further and really tries to envision a future where healthy ageing has become a reality. Such studies often derive from the premises that it may be possible in the not too distant future to unravel the biological causes for age-related diseases/disabilities and even the mechanisms of ageing itself and find medical/technological strategies to counter negative developments of biological ageing. Such foresight studies often include visions of regenerative medicine, gene therapy, manipulation of metabolic mechanisms and bio/nanotechnologies for repairing organ failures, regenerating tissues, regrowing/restoring organs and cells and removing plaques and other harmful metabolic by-products. Some even envision healthy lifespans far beyond a century (as a result of strategies for healthy ageing) and general significant improvements in health and vitality.

Examples:

- Observatory Nano (2010) Focus Report Nanotechnology in Regenerative Medicine (http://www.observatorynano.eu/project/filesystem/files/Nano%20regenerative%20medicine%20technical%20economic%20-%20final%20-%2023%20April%202010.pdf)
- MaRS (2009): NEUROTECHNOLOGY: Focus on Ageing Industry Briefing Commercial opportunities and Ontario's strengths (http://www.marsdd.com/dms/reports/Neuro-June-17-Final/MaRS-Neurotechology.pdf)
- Moni Saha (2009) Nanomedicine: Promising Tiny Machine for the Healthcare in Future - A Review (http://www.omjournal.org/ReviewArticle/PDF/200910/RA_NanomedicinePromising.pdf)
- De Grey/Rae: Ending Ageing: The Rejuvenation Breakthroughs That Could Reverse Human Ageing in Our Lifetime (http://www.amazon.com/Ending-Aging-Rejuvenation-Breakthroughs-Lifetime/dp/0312367066)

4.2 Cutting-edge age-related R&D[71]

4.2.1 Example: Modelling Ageing as "System Failure"

Dr. Leonid Gavrilov for example, draws a unique comparison between reliability theory as used in engineering, ageing (as wear and tear within organisms), death (as catastrophic failure) and the difference between machine construction and biological systems. Whereas (classic) artificial machines are being build to function reliably with low fault tolerance, biological systems are not constructed very reliably but keep working due to high redundancy and high fault tolerance. Death can be regarded in this sense as the breakdown of all redundancy mechanisms. Gavrilov also discovered a parallel in failure schemes between machines and humans: machines as well as humans

[71] The research and findings mentioned in the following may still be seen outside the established mainstream research, but could be interesting in the context of foresight studies as well as the assessment of "frontier science", innovation and potential paradigm shifts. This information is based on a futurist conference on the topic of longevity held in Brussels in October 2010. New publications about the addressed research will be published soon in scientific peer reviewed journals.

either fail at in the early beginning (manufacturing errors / child mortality) and then reach a plateau of stable reliability (in humans approx. until the age of 20) and then the probability of failure accelerates exponentially (in humans and machines). Thus, ageing can be considered as also following the general reliability theory as expressed in mathematics[72].

4.2.2 Example: Does the human ageing process stop at a certain age?

A theory proposed by Michael Rose, for example, suggests that at a certain older age, the overall ageing process in humans is actually slowing down and even reaches a so-called "immortal phase" where further ageing processes stop, even in humans. The only reason why people degenerate and finally die anyway is, according to this hypothesis, due to the accumulated damage that has happened before. This theory, based on the interpretation of statistic findings, is however disputed within the scientific community and in a way contradicts the model by Gavrilov (cf. above). If there would turn out to be some real (less disputed) scientific evidence behind this theory, it could open up new ways for tackling the ageing process[73].

4.2.3 Example: Supercentenarian studies74

Stephen and Natalie Coles, for example, are doing research on Supercentenarian (people older than 110) in order to find patterns that led to their long life as well as problems that occur in the context of ageing. They think that a slow down of the ageing process at some point in time as proposed by Prof. Dr. Michael Rose is not true. The question still remains controversial within the scientific community.

Coles & Coles think that life style/environment as well as genetic factors play an important role in healthy ageing and long life. They have also observed that people who age unhealthy also die younger and that people who reach a certain old age (over 90) have a higher probability of making it to 100 and above. However, if being 100, the probability of dying the next year also increases with each year (this is one factor that leads to disputing Michael Rose's theory). They also dispute the theory of an unlimited human life span since the record of longevity – with the age of 122 years - is not being broken. Thus, "life extension" may be more about extending average life span (more people getting up to 80, 90 and 100+ years) than in maximum life extension (people getting far older than 122 years of age).

In regard to statistics, it is often difficult to reliably determine the age of supercentenarians because record from early times are often unreliable and some people are listed in records and statistics just because they have not been registered as dead.

[72] http://longevity-science.org/Aging-Theory-2006.pdf
[73] http://www.oup.com/us/catalog/general/subject/LifeSciences/EvolutionaryBiology/?view=usa&ci=9780195095302
[74] http://www.supercentenarian-research-foundation.org/organization.htm

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4.2.4 *Example: Metabolic research*[75]

Other research strategies aim at understanding metabolic processes and their contribution to (negative) ageing effects. Examples are Advanced Glycation End products (AGEs) which build up with time (ageing) and cause a loss of tissue elasticity, i.e. tissue stiffness, fractures, cataracts and thus damages internal organs. AGEs are also related to diseases like diabetes and (possibly) Alzheimer's disease (and other age-related diseases). Thus therapeutic strategies aim at countering/minimizing the related chemical reactions (glycation) or reducing the amount of AGEs[76].

If the metabolic mechanisms (e.g. breaking down of proteins, harmful metabolic side/end products, development of plaques) are better understood as well as the causes for failure of eliminating damaging and toxic end products, preventative strategies or reversal damage reversal mechanisms could be developed.

Other research aims at understanding damages to cells and DNA and finding protective solutions or counter measures to reverse (accumulated) damage. This research line is also closely related to cancer research but also to regenerative medicine.

4.2.5 Example: Regenerative medicine[77]

Regenerative medicine, which is very much envisioned in the area of finding alternatives to shortages of donor organs for transplant can also play an important role in healthy ageing. Especially in regard to neuroscience, the link between those two is already big[78]. But if new biological (and even recipient-identical) tissue and organs can be grown in the laboratory, age-damaged organs, body parts and tissue may also be "exchanged" for new and functional ones. In case of dementia, renewal and re-growth of neural cells could be a counter-strategy that is envisioned and already researched upon[79]. However, caution is needed when assessing online articles especially about stem cell treatments for Alzheimer's disease since most of them do not represent reliable information.

4.2.6 Example: Healthy Life Extension

Consequently, if looking at the aim of healthy ageing ideally envisioned as living up to a 100 in good health, the question about human life span arises. If strategies would be found to enable the large majority of people to grow old in good health, one may ask why people ought to "drop dead" with 100 then. An unanswered related question that occurs in this context is about the maximum

[75] http://www.internationaldiabetesmonitor.com/PDFs/828.pdf
[76] http://www.sciencedirect.com/science?_ob=MImg&_imagekey=B8CX1-4YMJWMV-D-1&_cdi=40073&_user=603085&_pii=S1262363603727931&_origin=search&_coverDate=09%2F30%2F2003&_sk=999709995.7997&view=c&wchp=dGLzVzz-zSkzV&md5=a904774b237470417ec031dcf9b7fb03&ie=/sdarticle.pdf
[77] http://www.alliancerm.org/mates_presentation_jan2010.pdf
[78] E.g. http://www.usuhs.mil/cnrm/
[79] E.g. http://www.emea.europa.eu/docs/en_GB/document_library/Presentation/2010/05/WC500090649.pdf

achievable life span of humans. Some researchers argue that although more and more people are living longer (increase of average life expectancy), the maximum life span to be achieved by humans has not been exceeded and remains at around 120 years of age[80]. Other researchers (among them perhaps most famously Aubrey de Grey), however argue that if real medical interventions are being developed that counter the development and accumulation of products and organic failures that cause age-related physical and cognitive decline, or if regenerative medicine would be available, also the maximum life span of humans could be extended (beyond the average 120 years) as it is the case with animals that exhibit negligible senescence (e.g. turtles[81])[82].

Recently, researchers succeeded in partially "[reversing] age-related degeneration in mice, resulting in new growth of the brain and testes, improved fertility, and the return of a lost cognitive function [...] by engineering mice with a controllable telomerase gene" (cf. Harvard Gazette[83]). There are currently conducted several scientific animal studies aimed at the goal of slowing down or reversing age-related degeneration or the ageing mechanism as such. At least within animal studies, results indicate the possibility of (at least limited) feasibility of this goal.

Although the socio-economic effects of healthy ageing are considered to be huge (cf. e.g. Olshansky[84]), healthy maximum life-span increases are causing more controversies, although demographic effects may be less dramatic than commonly assumed as it is shown by demographers Leonid A. Gavrilov and Natalia S. Gavrilova even in extreme longevity scenarios.

TABLE 1. EXPECTED SIZE OF SWEDISH POPULATION IN 2105 UNDER DIFFERENT PROJECTION SCENARIOS

Population projection scenario	*Projected population size in year 2105*	*Population change over a century*[a] *2105/2005*
No life extension interventions	6,064,750	0.6703
Negligible senescence after 60	10,998,418	1.2156
Negligible senescence accepted by 10% of population	6,558,104	0.7248
Negligible senescence initially accepted by 10% of population with growing acceptance	7,833,616	0.8658
Continuous rejuvenation after age 60 years (Gompertz $\alpha = -0.005$ per year)	11,032,385	1.2194
Continuous rejuvenation after age 40 years (Gompertz $\alpha = -0.005$ per year)	13,321,983	1.4724
Aging slow down (Gompertz α is decreased by one half)	6,942,963	0.7674

[a]The size of Swedish population in 2005 is equal to 9,047,752.

Source: Leonid A. Gavrilov and Natalia S. Gavrilova (2010) [85]

[80] http://www.prb.org/pdf06/nia_futureoflifeexpectancy.pdf
[81] http://www.agelessanimals.org/
[82] http://www.sens.org/sens-research/what-is-sens
[83] http://news.harvard.edu/gazette/story/2010/11/partial-reversal-of-aging-achieved-in-mice/
[84] http://www.aaas.org/spp/rd/Olshansky.pdf and http://deepblue.lib.umich.edu/bitstream/2027.42/75679/1/annals.1396.050.pdf
[85] http://longevity-science.org/Projections-RR-2010.pdf

If healthy life extension may turn out to be a side effect of healthy ageing strategies as well as regenerative medicine, questions arise about how to deal with such new developments. Even AXA research (the research institute from the AXA insurance firm) is considering the possibility of extended healthy ageing and advocates research for healthy ageing for improving quality of life and because of economic benefits[86].

> *"In recent decades, scientists have learned enough about the biological ageing processes that many believe it will become possible to slow ageing in humans. We contend that the social, economic, and health benefits that would result from such advances may be thought of as "longevity dividends," and that they should be aggressively pursued as the new approach to health promotion and disease prevention in the 21st century. The time has arrived for governments and national and international healthcare organizations to make research into healthy ageing a major research priority."*
>
> Olshansky et al. (2007) http://onlinelibrary.wiley.com/doi/10.1196/annals.1396.050/abstract

However, the idea of life extension, even though it may be achieved in good health, is causing some ethical controversies as, for example, expressed by Pope Benedict:

> "Modern medical science strives, if not exactly to exclude death, at least to eliminate as many as possible of its causes, to postpone it further and further, to prolong life more and more. But let us reflect for a moment: what would it really be like if we were to succeed, perhaps not in excluding death totally, but in postponing it indefinitely, in reaching an age of several hundred years? Would that be a good thing? Humanity would become extraordinarily old, there would be no more room for youth. Capacity for innovation would die, and endless life would be no paradise, if anything a condemnation."
>
> Vatican, 2010
> (http://www.vatican.org.es/holy_father/benedict_xvi/homilies/2010/documents/hf_ben-xvi_hom_20100403_veglia-pasquale_en.html)

Such controversies also closely relate to the question in regard to freedom of personal choice related end-of-life issues, which would include the right for euthanasia as well as the right for life extension to name the two extremes that are still publicly disputed. How should a society deal with ageing and death in which dying has become mostly invisible and confined to hospitals; where youthfulness is considered as an ideal, where ending ones life intentionally is considered immoral and sinful, but where on the other side also life extension (through artificial means) is regarded as unnatural, as a potential threat to human dignity and depriving life from being meaningful?

[86] http://www.axa-research.org/lib/rc/uploads2/communiques/AXA_ECHO_1.pdf

5 Conclusions and suggestions for policy considerations

5.1.1 Concluding summary

Although most people wish for a long life, a long life in good health is nothing that can be taken for granted. Although human life expectancy has dramatically increased over the last century, this new prospect of old age comes with a burden if accompanied by failing health and disease. In addition to an increasing life expectancy, declining birth rates put additional stress on pension and social security systems since fewer and fewer employees need to support one pensioner over a larger time span. If ageing is accompanied by failing health, more elderly care is needed whereas personnel shortages are already present today. The necessity for economic thinking and rationality in care-taking also conflicts with the desire for humane care and nursing.

The same medical progress that has caused the dramatic increase in life expectancy has also led to growing expenses in health care and medicine. In some countries, especially the US, the last months in one's lifetime are expected to be the most expensive in regard to medical costs. This of course raises the question about the necessity of some medical procedures. On the other hand, the conventional ethical considerations also do not allow for not trying everything possible to save a human's life. This is also the reason why euthanasia, for example, is such a controversial topic, although it is also perceived positively under some circumstances related to old age and severe illness.

Restructurings in pension systems, health care, insurance systems and social security are considered necessary in face of the expected demographic developments of higher life expectancy and declining birth rates with the result of a shrinking workforce able to finance the whole system. Raising the retirement is seen with controversy and protest by many retirees and many older people are not able to find a job or are not able to work due to age-related disabilities, physical and mental problems. The introduction of pension reforms that focus more on individual savings for one's own pensions also leads to an additional burden for younger people who still need to finance the current retirees but at the same time also need to save money for their own retirement.

One solution to improve the situation would be to shorten the number of years in failing health due to old age. The ideal situation would be to live a long life in good health followed by "sudden death", also proposed in theory as 'compression of morbidity' (James Fries). On second glance, one could ask, however, why a person should just drop dead while still being in good health and if such a situation would be desirable. Besides desirability, it is still scientifically uncertain and disputed if a strategy like the "compression of morbidity" (compression of the amount of years spent with age-related diseases) would be feasible and how it should be achieved.

Much R&D is already invested in tackling age-related diseases such as cardiovascular diseases and neurodegenerative conditions, which require interdisciplinary cooperation in many areas. However,

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some researchers like Nir Barzilai of the Albert Einstein College of Medicine at Yeshiva University even suggest that ageing as such should be looked at and tackled as a disease itself[87]. And indeed, some research is already being conducted in animal studies aimed at slowing down or reversing age-related degeneration as such or even the ageing process itself, e.g. as recently proposed in a research paper about a study with mice published in *Nature* by Mariela Jaskelioff et al[88]. Some organisms like turtles exists that display a natural negligible senescence (i.e. they do not age) or have the ability of self regeneration (e.g. starfish and some jellyfish).

In the meantime, much focus is also put on life-style related influences that positively/negatively impact the healthiness and quality of ageing. Healthy nutrition, exercise and physical/mental activity are considered as positively impacting factors. However, there is also the danger of false promises of "anti-ageing" products and scientific fraud in age-related research.

Coming back to the "overall goal of the Innovation Partnership […] to increase the average healthy lifespan by two years by 2020"[89], [90], the first set of questions need to address the concrete objective of this goal as well as scientific requirements and feasibility assessments for achieving this objective. What kind of knowledge is needed, what kind of R&D needs to be conducted and which framework conditions (e.g. socio-economic) need to be implemented?

It has become clear, also from the contributions from the expert workshop participants that active and healthy ageing needs to be tackled from a variety of different dimensions in a multidisciplinary way. Active and healthy ageing begins at birth and ageing is a life-long process which can also be positively (and negatively) influenced by life style choices. However not all life-stile related practices are actually *choices* because much also depends on given factors like the natural, social and work environment and the availability of (healthy or less healthy) products that are available and affordable. Tackling the ageing challenge requires the cooperation of almost all parts of society which include education, health care provision, economic and industrial actors and people acting themselves in self-responsibility.

Policy making can positively contribute in providing and supporting the necessary requirements, infrastructures, resources and coordination activities that foster the production of healthy products, socially responsible financing of healthcare and pensions, employment policies, support and initiatives for age-related R&D and creating favourable societal framework conditions that foster cooperation and solidarity.

Society needs to better integrate the elderly into work and social life and give them useful and responsible jobs and assignments. Respect for the elderly also includes respecting their knowledge and competences and practicing inclusion. Social innovation at homes, hospitals and work places has

[87] http://www.reuters.com/article/idUSTRE64I6HV20100520

[88] Mariela Jaskelioff et al.: Telomerase reactivation reverses tissue degeneration in aged telomerase-deficient mice http://www.nature.com/nature/journal/v469/n7328/full/nature09603.html / http://admbio.ccu.edu.tw/new/seminar_pdf/991/1224A2.pdf

[89] http://ec.europa.eu/commission_2010-2014/dalli/docs/speech_ageing_en.pdf

[90] http://ec.europa.eu/dgs/health_consumer/consumervoice/cv_12011_en.pdf

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been considered central within the workshop and elderly and care-givers should become better integrated into decision-making processes as well as product development and design. Many balances need to be found which, for example, include balancing care efficiency with humanness, distributing the financial burdens between the generations in face of increasing life expectancy and declining birth rates and dealing with the aim of fostering healthy life styles while respecting the personal freedom of choice.

Technological and medical developments should also increase their focus on are-related issues but should also take the elderly (as well as care-takers) into account during product development phases. Ageing science as well as technological and medical developments should be better shared with the general public in order to enable participation, evaluation and informed choices. Next to established research trajectories, the urgency of the ageing challenge should also lave more room and opportunities for new ideas and approaches as well as "frontier research". Also medical development should get more adjusted towards the elderly, which includes taking elderly better into account in regard to drug development and drug testing and foster studies on aged animals.

Ageing is a lifelong process and therefore healthy and active ageing requires the support from the whole society throughout every stage in ones life. Society may also need to dare a deeper reflection and open dialogue on topics related to ageing, the end of life, dying, euthanasia as well as life extension (possibly) to be seen as part of personal choices.

5.1.2 Summary: Policy proposals

During the workshop a variety of policy proposal have been suggested which relate to the four decided topics.

In regard to "***users, product and service design***" four major points have been mentioned:
1) The need for better standardisation of products and interfaces to allow for interoperability
2) The general development of more easy-to-use devices and products (incl. packaging)
3) A better involvement of customers in product development (user centred product development)
4) A greater focus on a general improvement of products and services in regard to health benefits

The major hindering factors that have been mentioned were insufficient funding for innovation and technology as well as a demand-supply gap for healthcare products and services. The latter aspect directly relates to the better involvement of consumers themselves.

As policy recommendations, a multi-stakeholder involvement – including old and young people as well as industries, healthcare providers, educators, insurance companies and regulators - has been suggested, also in relation to of product and service development, their implementation strategies as well as advertising. The use and fostering of information technologies has been mentioned as important as well as the creation of social responsibility and solidarity for elderly care. European policy should encourage open innovation and set standards and incentives for improved quality control and certifications for products in relation to health benefits and contribute to a general

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public education about healthy life-styles since healthy ageing begins at birth. Most suggestions would require guiding action on the EU-27 level with implementations on the national level.

"***Research on ageing as such***" has been mentioned as an important activity field complementing societal actions by aiming at gaining a deeper understanding about the mechanisms of the ageing process and finding medical strategies to counter its negative effects. Ageing research, especially applied research (e.g. involving laboratory and animal studies) is novel, but is also gaining increasing interest within the scientific community. To counter societal scepticism about such research a greater public dialogue is needed as well as changes in standard procedures within research in order to allow for further progress in established research areas as well as the entry of novel and 'frontier' ideas. Such suggestions include a better entry of new ideas into peer-reviewed studies as well as keeping older animals within laboratories to test medications on older animals and conduct age-related research. However, it is unclear in how far this would be something to be regulated on the policy level.

Another suggestion has been the extension of patents to at least 50 years (as it is the case with intellectual property in arts and media) to encourage long-term research and investments. Also the distance technology development and clinical trials should be reduced. These issues are much more related to policy decisions and regulations.

In regard to research policy it has been considered necessary to streamline different smaller projects and initiatives and make age-related research a real priority, e.g. by explicitly including it into schemes like the Future Emerging Technology (FET) funding schemes. In regard to policy/science coordination it has been suggested to create the post of a "Minister of innovation in ageing" and create positions for the task of evaluating and networking the different research areas of age-related research, science, technologies and product development.

The framework conditions for such policy initiatives should be provided on EU level with fine tuning and final implementation left to national governments.

To summarise the main policy suggestions:

1) Create the post of a minister of ageing innovation and positions that evaluate and streamline different age-related research areas and innovations
2) Increase the duration of patents or create other incentives for long-term investments in science and technology
3) Foster the development of new ideas and approaches in age-related research, e.g. through widening the Future Emerging Technology (FET) funding schemes towards age-related research
4) Open a public dialogue to create a better understanding about applied ageing research
5) Improve the incentives for animal studies with older animals (which would also reduce the practice to put down laboratory research animals prematurely)

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The topic "**work**" is a very important socio-economic factor in relation to ageing and especially the need for active and healthy ageing. This topic is also associated with many controversies, e.g. about the extension of ones work-life and later retirement as well as the financing of pensions and healthcare and generational solidarity. In general it has been emphasised that active and healthy ageing is not something for old age, but actually needs to be started from birth. In this sense, employers, for example, should take more responsibility for improving healthy working conditions and educators should provide the necessary knowledge for healthier life styles. In the same way as, e.g. ecological responsibility has become a competitive factor for industries, positive contributions to healthy and active ageing should also get into focus.

In regard to policy options, the following suggestions have been made:

1) Create incentives for industries to invest in active and healthy ageing practices for their employees (e.g. tax-related incentives, regulations, inspections, best practice encouragement)
2) Improve work-life balance practices and working hour regulations
3) Create other reward structures for remaining active within economic activities
4) Finding ways to fund and reward social activities
5) Restructuring work-biographies to adapt to demographic changes

"**Health care delivery**" may be one of the most challenging socio-economic issues related to life-span increases. This is especially the case if progress in active and healthy ageing is insufficient to allow elderly to stay active and healthy in older age. Such a situation would lead to stresses in health care financing, pensions and generational justice.

If the status quo in regard to the health situation of elderly people remains as it is, there is a significant lack of care and nursing personnel expected for the near to mid-term future. This challenge could be countered by technological innovations such as nursing aids to help care-takers as well as assistive technologies that allow elderly people to live with health problems independently for a longer time (i.e. requiring less nursing care). But although much technology is being developed in this context, many products lack sufficient user-oriented design. Thus, challenges may be more social-related than purely technological. Incentives are required, e.g. to allow for more interoperability between products and provide incentives for new business models in products and services aiming at improved support for the elderly.

In relation to policy options the following suggestions have been mentioned:

1) More funding for operations / outcomes and health services research especially taking into account the perspective of the elderly, also taking into account practical assessments and social framework conditions
2) Creating the post of a "social care-broker" and a "Ministry of ageing"
3) Creating more room for experimentation with different and innovative business models
4) Improving incentives for quality control and evidence-based practices
5) Improving technological framework conditions for eHealth/telehealth etc. (e.g. cheap broadband connections, ensuring security)

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6) Training schemes for age-related professions

Most of the suggestions may require triggering from the EU level with final implementations on the national levels. In general it has been emphasised that the individual should be in the centre of activities, research and product developments.

Annex: Workshop information

5.2 Workshop Agenda

Workshop Agenda	
Meeting	EFP European Policy Workshop
Date	January 31, 2011
Place	DG RTD, Square de Meeûs 8, room 3E – 1049, Brussels
Start / Close	10:00-16:30

Active and Healthy Ageing – a Long-term View up to 2050

The EFP European Policy Workshop aims to provide support to Europe's Innovation Union strategy by tackling the challenge of 'Active and Healthy Ageing' within the pilot European Innovation Partnership (pEIP). The pEIP shall be set up to promote the development of innovative products and services that will help older people stay healthy, active and independent for longer.

The partnership shall also help keep Europe's social and healthcare systems effective and sustainable, end encourage competitive markets, as a spur to innovation. In pursuing those aims, the partnership will focus on the three policy areas of prevention & health promotion, integrated health & social care, and independent & active living of elderly people.

Block 1: Introduction to the workshop and to the long-term view on active and healthy ageing

10:00	Susanne Giesecke, AIT - Welcome and introduction to EFP and to the workshop: Agenda, desired outcomes, chairing, rapporteurs
10:05	Tour de table - The participants' name, affiliation and relationship to the workshop issues
10:15	Domenico Rossetti di Valdalbero, DG RTD - Few words on the purpose of the EU forward looking activities
10:20	Miriam Leis, TNO - Presenting the background information on future oriented research associated with active and healthy ageing
10:30	Discussants giving brief feedback presentations (solution-oriented) to the background document: John Cleland, Hull University - Presenting the ageing challenge Maria Iglesia Gomez, DG SANCO (tbc) - Presenting the pEIP Industry offering out-of-the-box thinking and solutions for an active and healthy ageing: Beate Kettlitz, CIAA and Bart Schelfhout, Philips
11:10	Annelieke van der Giessen, TNO - Creative brainstorming to generate science, technology and innovation options and ideas to tackle the ageing challenge (longlist)
12:20	Working lunch

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Block 2: Actions and implications to tackle the challenge of active and healthy ageing up to 2050

13:30	Annelieke van der Giessen, TNO – Clustering options and ideas into three major Innovation Chain Clusters to tackle the challenge taking into account the background information
14:00	Rafael Popper, UNIMAN – Assessing the feasibility and desirability as well as enabling and hindering factors of the clustered options and ideas within small groups ➔ come up with ideas and proposals that are considered worthwhile to pursue with enabling and hindering factors and challenges, especially related to policy issues (e.g. required laws and regulations, need for more support actions, research support and funding)
15:00	Short break

Block 3: Goal-oriented assessment of proposals to tackle the core challenges of the pEIP

15:10	Vicente Carabias, JRC-IPTS - Assessing proposals (in regard to pEIP goals, to policy requirements at European level and/or to potential ethical/legal/societal issues) based on the previous session's results ➔ translating the shortlist of feasible and desirable ideas and proposals into proposals for policy making in short-, medium- and long-term as well as with implications for future STI policies at EU and MS levels, to serve as inputs for the pEIP roadmap (priority briefing)
16:00	Reporting back from the small groups - Summary of new insights, considerations and suggestions
16:20	Susanne Giesecke, AIT - Concluding remarks, next steps, feedback
16:30	End of the workshop

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5.3 Participant List

Participants:	
Anne Auffret	DG SANCO, Policy Analyst Strategies and Analysis
Luc Bonneux	NiDi, Netherlands Interdisciplinary Demographic Institute Projections, Migration and Health
Niels Boye	PREVE, Physician, specialist in Internal Medicine, Endocrinology and Health Informatics
Vicente Carabias	JRC-IPTS, EFP partner, Task leader EFP European Policy Workshops
Paraskevas Caracostas	DG RTD, Adviser "Structural aspects of ERA" for relations with social sciences and foresight
John Cleland	Hull University, Cardiovascular & Respiratory Studies, presenting the ageing challenge
Marian Deblonde	IST Institute Society & Technology, ICT for elderly people
Edouard Debonneuil	AXA Global Life, Head of R&D
Susanne Giesecke (chair)	AIT, EFP project coordinator
Annelieke van der Giessen	TNO, EFP partner, WP leader EFP Policy Workshops
Maria Iglesia Gomez	DG SANCO, HoU Strategy and Analysis, presenting the pEIP (tbc)
Beate Kettlitz	CIAA, Confederation of the Food and Drink Industries of the EU, Director of the Food Policy, Science and R&D, presenting reflection and feedback
Miriam Leis	TNO, EFP partner, background information on future oriented research associated with active and healthy ageing
Isabel de la Mata	DG SANCO, Principal Advisor with Special Interest in Public Health
Silas Olsson	AAL programme, Acting HoU Central Management Unit R&D funding programme addressing demographic ageing in Europe (AAL)
Rafael Popper	UNIMAN, EFP partner, mapping forward-looking activities
Domenico Rossetti di Valdalbero	DG RTD, EU forward looking activities, EFP project officer
Fabiana Scapolo	JRC Anticipation, Research Work Programme and Strategy
Bart Schelfhout	Philips Research Lab, Senior Manager EU Affairs - Health & Well-Being, presenting reflection and feedback
Horst Christian Vollmar	Group Leader at German Center for Neurodegenerative Diseases (DZNE) in the field of new health care strategies, technologies and therapies
Peteris Zilgalvis	DG INFSO, HoU ICT for Health

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5.4 Workshop approach

The workshop approach has been designed to incorporate structured elements and thematic focus as well as the possibility to foster creativity and new ideas by the participants. The goal of the workshop has been to come up with policy proposals for better dealing with the challenge of making active and healthy ageing a reality related to the pilot European Innovation partnership on Active and Healthy Ageing[91]. The objective has been to look at the issue from different perspectives accounting for research, science and technology, innovation options as well as socio-economic and ethical topics.

The starting point has been the background paper that has been sent to the participants in advance, highlighting statistical background information, socio-economic challenges and solutions as well as examples of latest science and technology developments related to ageing research, medicine and products to support active, healthy and independent living by the elderly. Additionally, some participants and project partners gave presentations focussing of specific issues and questions, e.g. elderly care facilities, product innovation or medical research as well as an overview of the background paper.

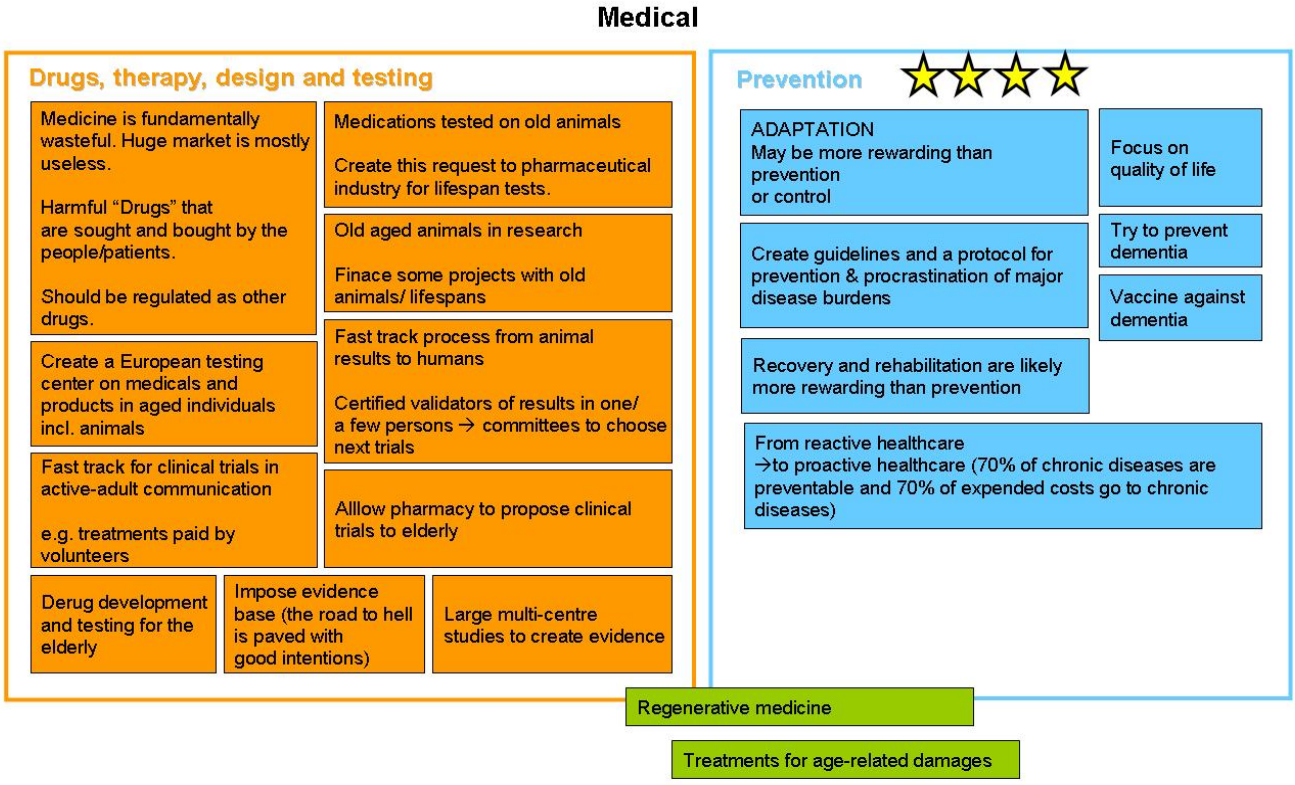
The first part involving active participant activity has been a creative brainstorming where workshop attendees were asked to provide their ideas and questions written on postits for tackling the challenge of active and healthy ageing along the thematic clusters of a) socio-economic issues, b) medical R&D, c) technology, d) scientific understanding of ageing and e) other topics. After this, during the working lunch, the ideas within the thematic clusters have been aggregated under different headlines and participants were asked to vote on the headline topics in regard to their perceived relevancy. Upon the vote, the four topics which received the most votes have been selected for further evaluation within the workshop. The chosen topics were:

1) User product and service design
2) Research on ageing as such
3) (Facultative) elderly work and implications for work and the labour market
4) Health care delivery

The participants were then divided into working groups focussing on one the four topics to add some new ideas and then assessing them in regard to their feasibility, desirability and identifying potential fostering and hindering factors as well as challenges. After this, attendees were asked to list policy requirements (in relation to the previous exercise of identifying the degree of feasibility and desirability of options as well as challenges), a timeline for realisation and the level of policy action (e.g. national or EU-wide). A summary of these can be found in chapter 5 of this document.

[91] http://ec.europa.eu/information_society/activities/einclusion/deployment/ahaip/index_en.htm

5.5 Transcripts of the workshop exercises



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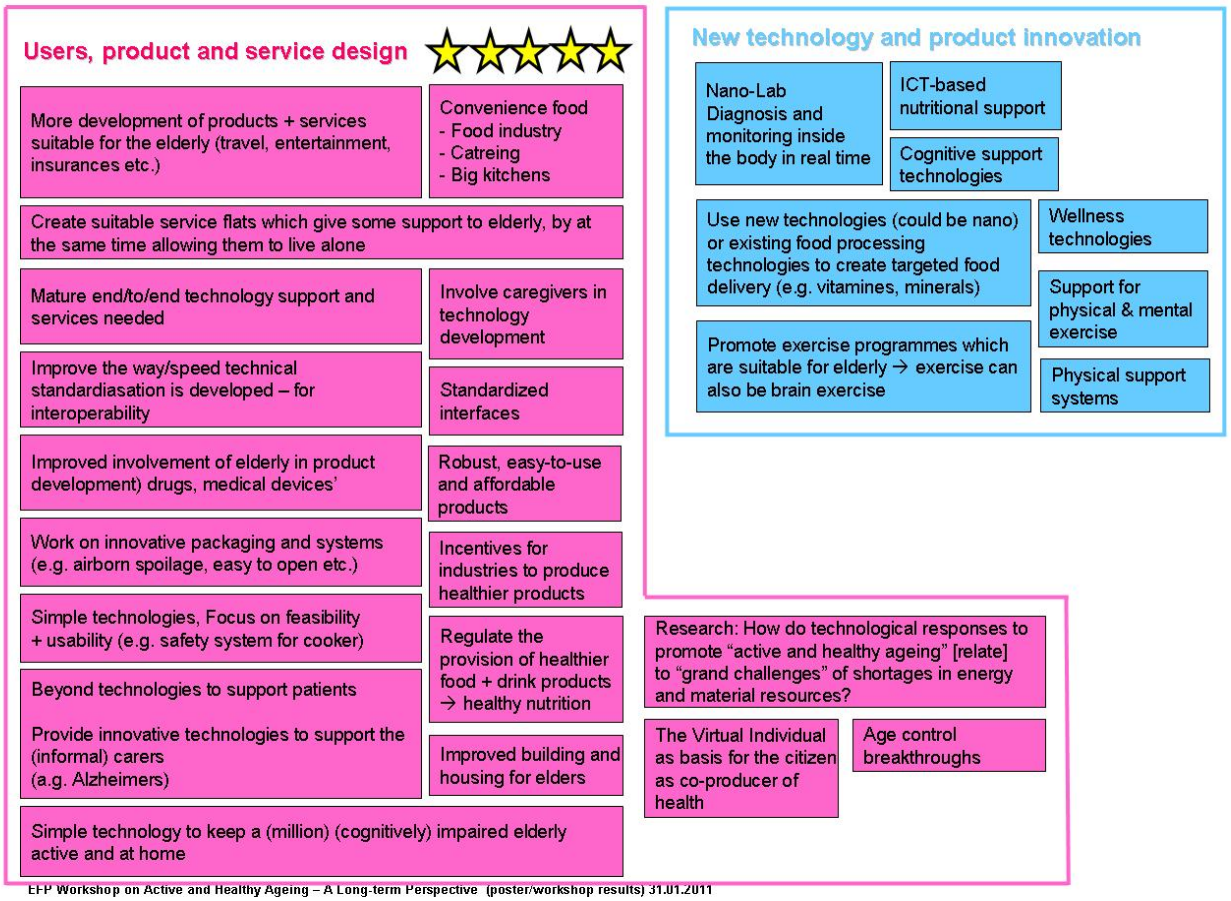
Technology



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Focus not only on basic + clinical science
but also on health services and outcomes research

Scientific Understanding

Behavioural

- Occupational research: under which conditions could elderly work longer?
- Explore personalised nutrition
  How to do that? Now already possible? In the future? What is necessary?
- Psychosocial Interventions -same effects like drugs, e.g. -in Alzheimer's disease
- Behavioural change Compliance and adherance
- Personalised healthcare

Resdearch on age-related diseases

- Krepte an EU-supported project for early cancer detection via blood FSH measurement
  Experts (INSERN France)
  Insurance Hospital Pilots
- Avoid cancer-causing products
- Genetic research
- Explore the science disciplines which can best contribute to prevent cognitive decline → explain progress in science in a way that regulators, academics and stakeholders can understand.
- Test impact of metformin on health and death for non-diabetic sub-populations
  E.g. 5-years study in "active adult" residencies (age - >55 yrs.)

Research on Ageing as such

- Only funding peer-reviewed Research
- Have a ministry of "Ageing & Health Breakthroughs"
- Technology very much ahead of clinical science
- Have a person form the European Commission travel to different ageing-science labs and propose key initiatives
- Research on centenarians
- Research: imact on various labour carrers on age-related diseases (Occupational Health)
- Old animals for research
  Favour the development of aged mice & mouse providers
- Ageing defined as disease?
- Tanatology
- Better understanding of drivers of cognitive decline (impact of retirement)
- Prolonged protection of intellectual property (50 years) (to give incentive to long-term R&D)
- R&D on age-related diseases and on preventing/curing them
- Research:
  -Too much "Chatter"
  - "Pilotitis"
  - Need for large coordinated research lead by clinical researchers with "MARS" outcomes
- Ageing = increasing experience ravaged by the body's inability to dispose of waste products & to repair DNA damage.Other diseases are superimposed on this background
- Deciphering ageing

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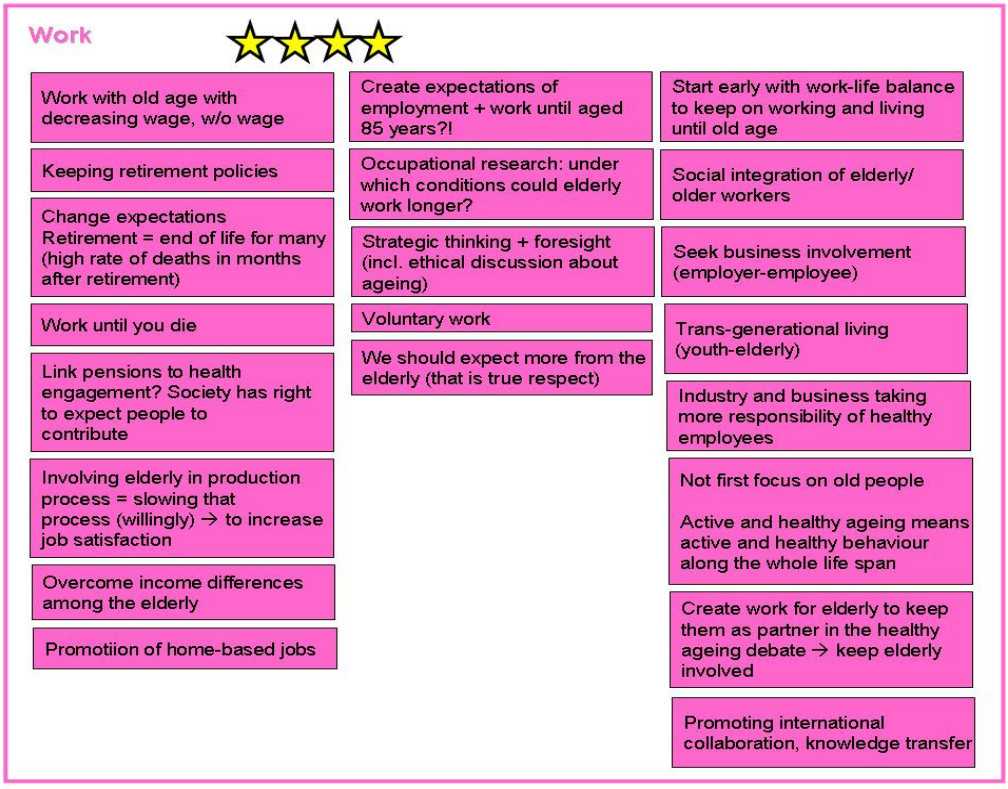
Socio Economic



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Other

Technology Transfer

Funding for:
- RTD
- Death Valley
-Market/Commerce

Effectiveness of New technologies e.g. AAL

Dissemination and implementation (macro, meso, micro-level)

Technology with good research will thrive with
a) good integration
b) funding
c) contained costs
d) adequate scale

Do not forget Japan, USA, Canada…

Governance of the Healthy Ageing Sector

Other:

How to make sure that a common vision on active and healthy ageing is really a common vision?

→who to involve in the process of constructing the vision?
→how to operationalise the process
→how to guarantee a public perspective and not a

Scaling-up across member states for critical mass economies of scale

Concerted efforts by various sectors + players with the financing of care

Take profit of European diversity

Regulatory → participatory
Free Enterprise → Regulated incentives

Study needed about the different legal frameworks in EU countries for innovations to reach market to get the base for improvement

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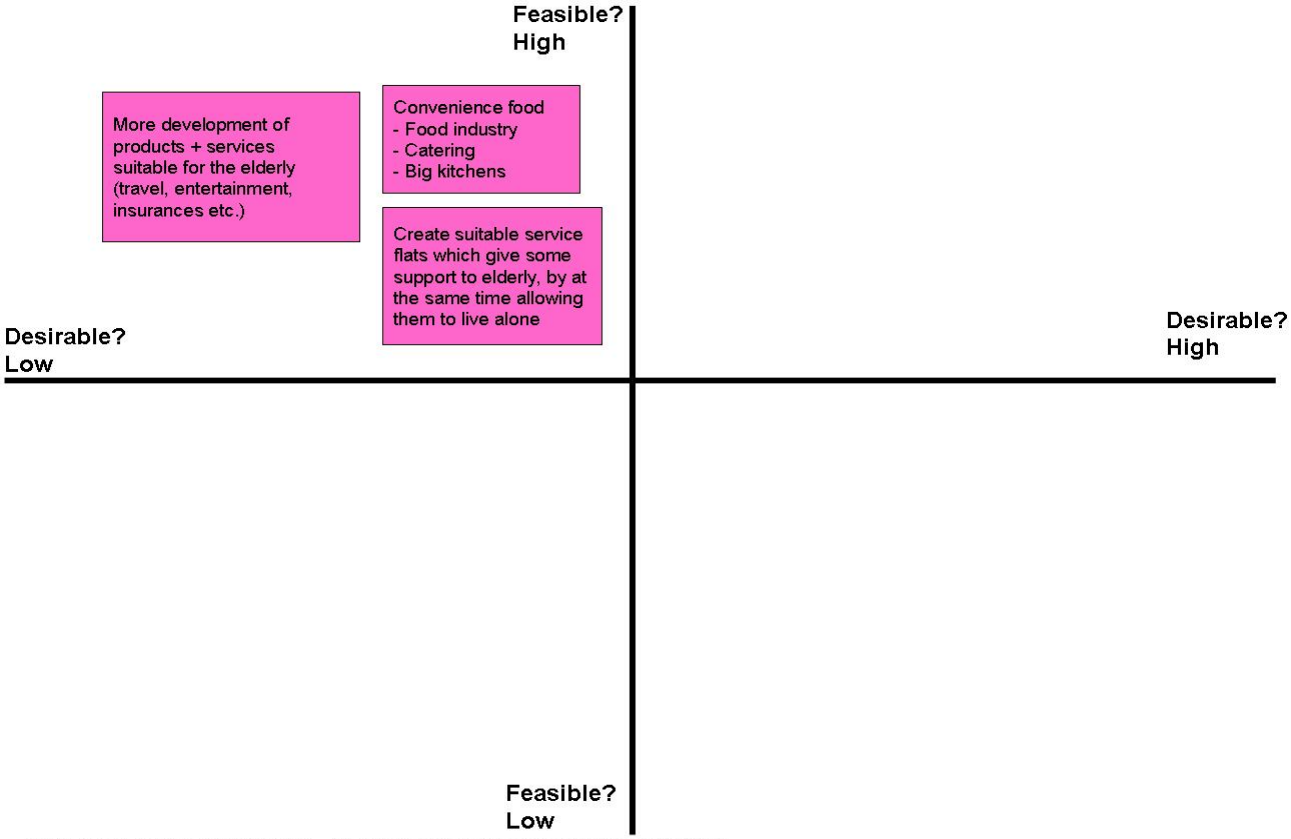
Cluster 1: Users, product and service design



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Cluster 1: Users, product and service design

Actions (Policy Proposals)	Enabling	Hindering	Challenges
Mature end/to/end technology support and services needed	**Systemic perspective**	Demand/Supply Gap for healthcare	Deployment
Improved involvement of elderly in product development) drugs, medical devices'	*Involve clients* in technology development	Not enough funding for innovation + technology development	Improve the way/ speed technical standardisation is developed – for interoperability = obligation
Involve caregivers in technology development	Standardized interfaces	Not offered yet	
Beyond technologies to support patients, provide innovative technologies to support the (informal) careers (e.g. Alzheimer's)	Market deregulation		Social responsibility to take care of elderly
Improved building and housing for elders	Personalised services + Technology		SOCIAL INNOVATION
Robust, easy-to-use and affordable products	Exchange of good practice		
Simple technologies, Focus on feasibility + usability (e.g. safety system for cooker)	Work on innovative packaging and systems (e.g. airborn spoilage, easy to open etc.)		EDUCATION "less salt, sugar fat in baby food"
Simple technology to keep a (million) (cognitively) impaired elderly active and at home		Advertising, Culture, image building	Information, Obligation, Product declaration
Incentives for industries to produce healthier products	Tax incentives		Regulate the provision of healthier food + drink products → healthy nutrition

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Cluster 1: Users, product and service design

Actions (Policy Proposals)	Policy Requirements	Time Line	Level	Reflection
Encourage participation in product and service development + implementation + advertising + use of • Individuals (young & old) • Industry • Healthcare providers • Insurance companies • Regulators	Regulatory framework Funding for European Tech. Base Pilot Project Change Choice Architecture	Short term Short term Short term Short-mid term	European	→Information Society in healthcare to overcome supply-demand gap
Adapt curricula towards more healthy and active living • Social responsibility to take care of elderly age-related solidarity	Educational authorities	Mid term	National	→Responsible Society
Encourage open innovation to develop + offer integrated products and services	Procurement rules Certification Quality control	Mid term	EU	

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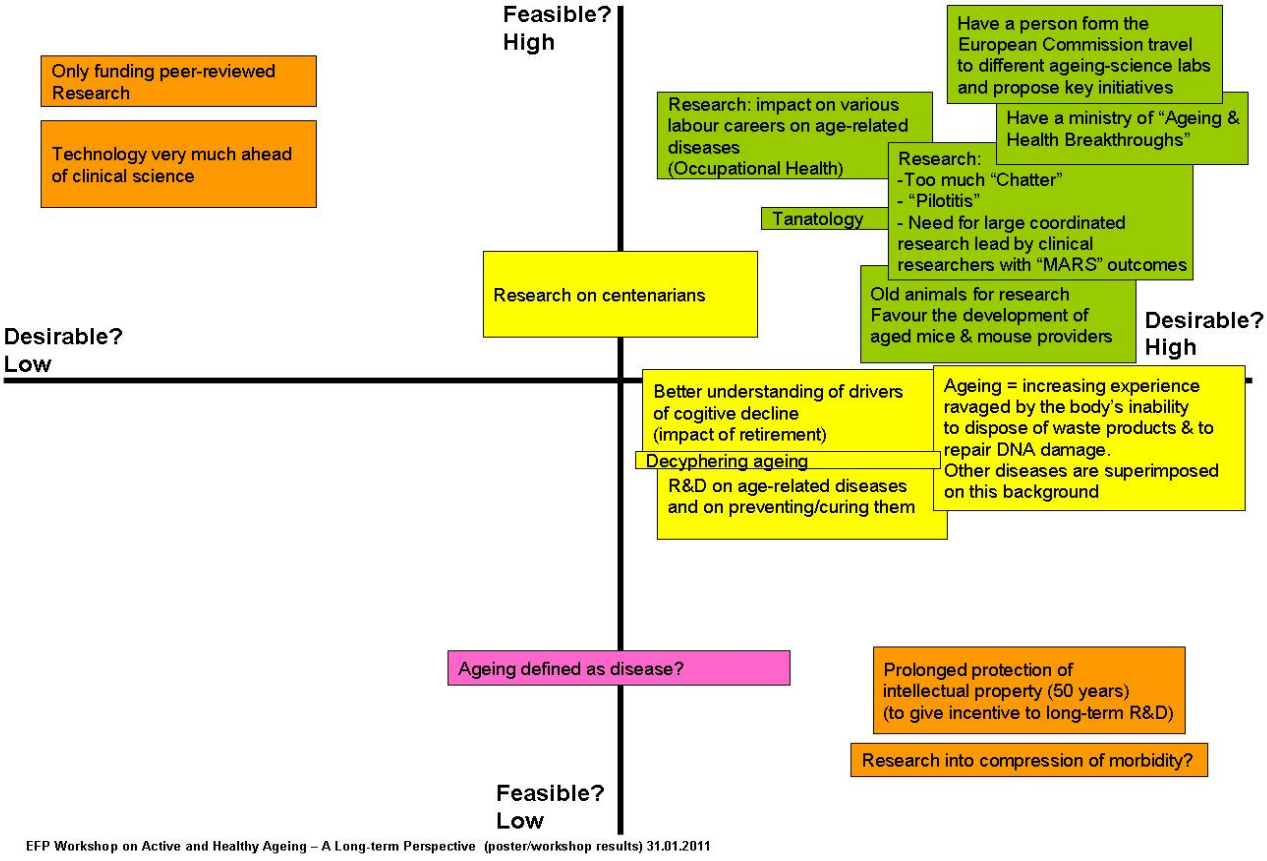
Cluster 2: Research on Ageing as such



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Cluster 2: Research on Ageing as such

Actions (Policy Proposals)	Enabling	Hindering	Challenges
Prolonged protection of intellectual property to 50 years (in line with artists)	Patent-Life extension (50 yrs.) 1) Governmental debate 2) Legislation 3) Industry 4) Scientific necessity	Social perception of patents Reliance on surrogate outcomes	
Foster research on ageing	Ageing research (understanding) - applied dialogue	Ageing research understanding: • too much associated with "ageing as a disease" • Age and disease are inextricable in practice	Challenge: Prolonging life with morbidity will be a by-product of prolonging healthy life
	Ageing research (applied) - understanding dialogue Ageing research: novel, but accepted in scientific community	Less acceptance, more skepticism (applied ageing research)	
Innovation in research practice and procedures	New approaches to research funding (consensual dialogue & peer review Better evaluation of research on ageing & coordination	Restrictions imposed by peer review process, too many small, repetitive projects - peer review research only… - too much distance - between technology and - clinical trials	

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Cluster 2: Research on Ageing as such

Actions (Policy Proposals)	Policy Requirements	Time Line	Level	Reflection
Have a ministry of "Ageing & Health Breakthroughs"	Government approval	2012	EU	++++
Prolonged protection of intellectual property to 50 years (in line with artists)	EU and international law	2020	International	+
Specific funding for clinical trials on ageing in animals and humans	e.g. FET Flagship initiation on ageing-related topics	2011	EU & National	+
Long-term cohort studies in animals and humans	Large-scale clinical trials	2011	EU & National	+
Consensual (in addition to competitive) peer-reviewed grant funding for centrally directed research	Hire people who convert ideas into projects Less bureaucracy	2012	EU & National	++
Public understanding of research into ageing	Media & education	2013	EU & National	+
Innovative strategies for engaging the population in applied research	e.g. FET Flagships	2013	EU & National	++

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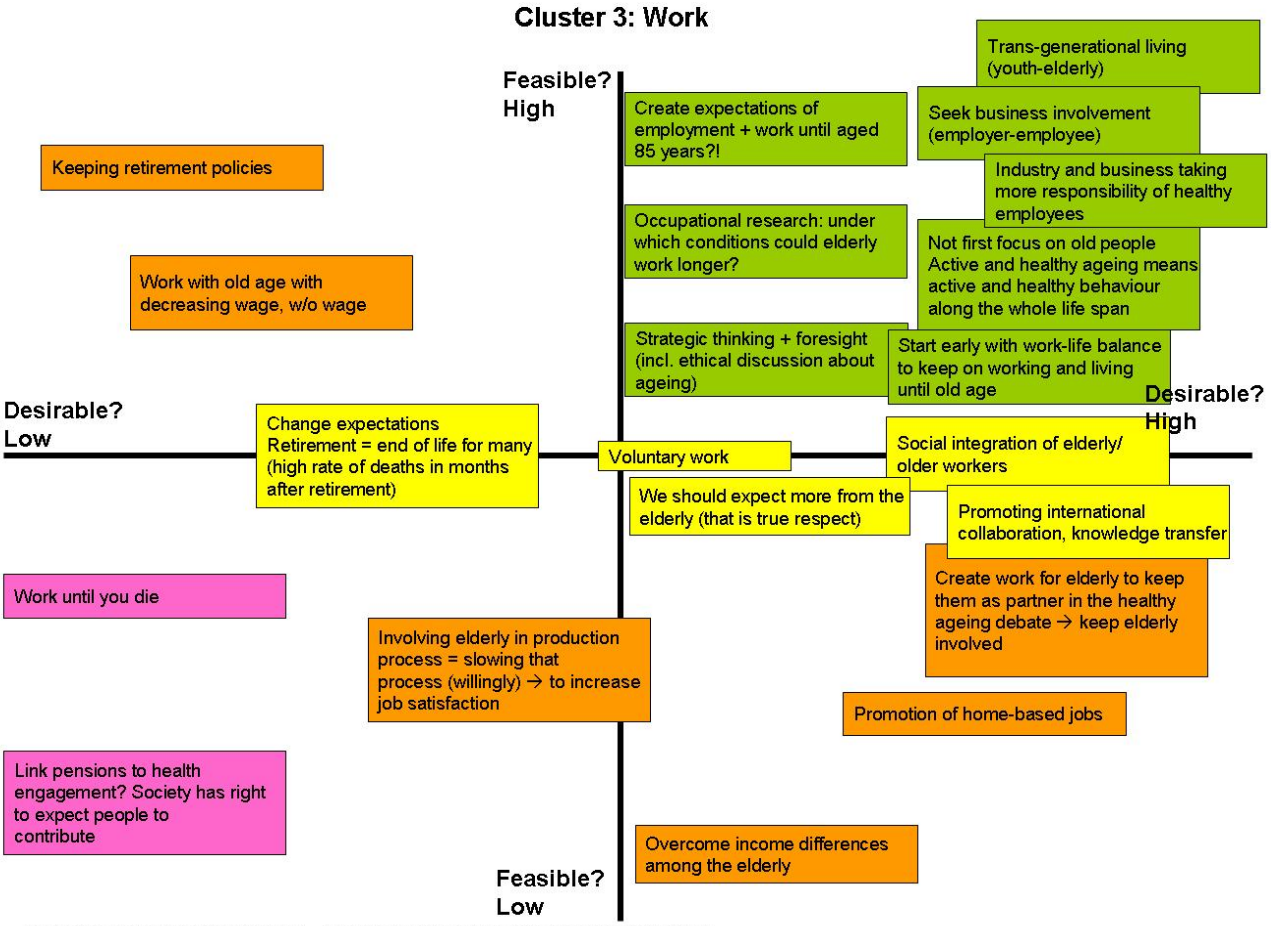

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Cluster 3: Work

Actions (Policy Proposals)	Enabling	Hindering	Challenges
Seek business investment (employer-employee relation) health conditions of employees	Tax reductions incentives		Discussions with trade unions
Start early with work-life balance policies	Examples of good practice Social welfare system	Traditional career system Shortage of labour and work demans	Rigidity of deliverables/based systems ↑ Cost of life
"Voluntary work" after retirement	Integrating retired people at "all" levels Recognition of elderly people's experience and knowledge	Negative impact on employment of youth	Public acceptance
Promote strategic thinking & foresight (work for older people) + creation of jobs	Teleworking	Growing unemployment in some European countries	Who should participate in the discussions
Promoting home-based jobs		Need for social interactions (fear' of isolation)	Accounting issues / monitoring

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Cluster 3: Work

Actions (Policy Proposals)	Policy Requirements	Time Line	Level	Reflection
Seek business involvement	Tax reductions incentives (regulation) also on income revenue for employees	2015 - 2020	National	Relieve Health + Pension Insurance System
	Competition among socially responsible firms Eligibility criterion for EU funding	2015 - 2020	EU	
	Promotion of professional health + safety + environment inspection	2015 - 2020	EU	EMAS
Start early with work-life balance	Working-time regulations (daily, annual)		EU	European Foundation for Working and Living Conditions + Industrial Relations (Dublin)
	Social reward beyond the professional activity (→ Elderly)			
	Funding for social work infrastructure			

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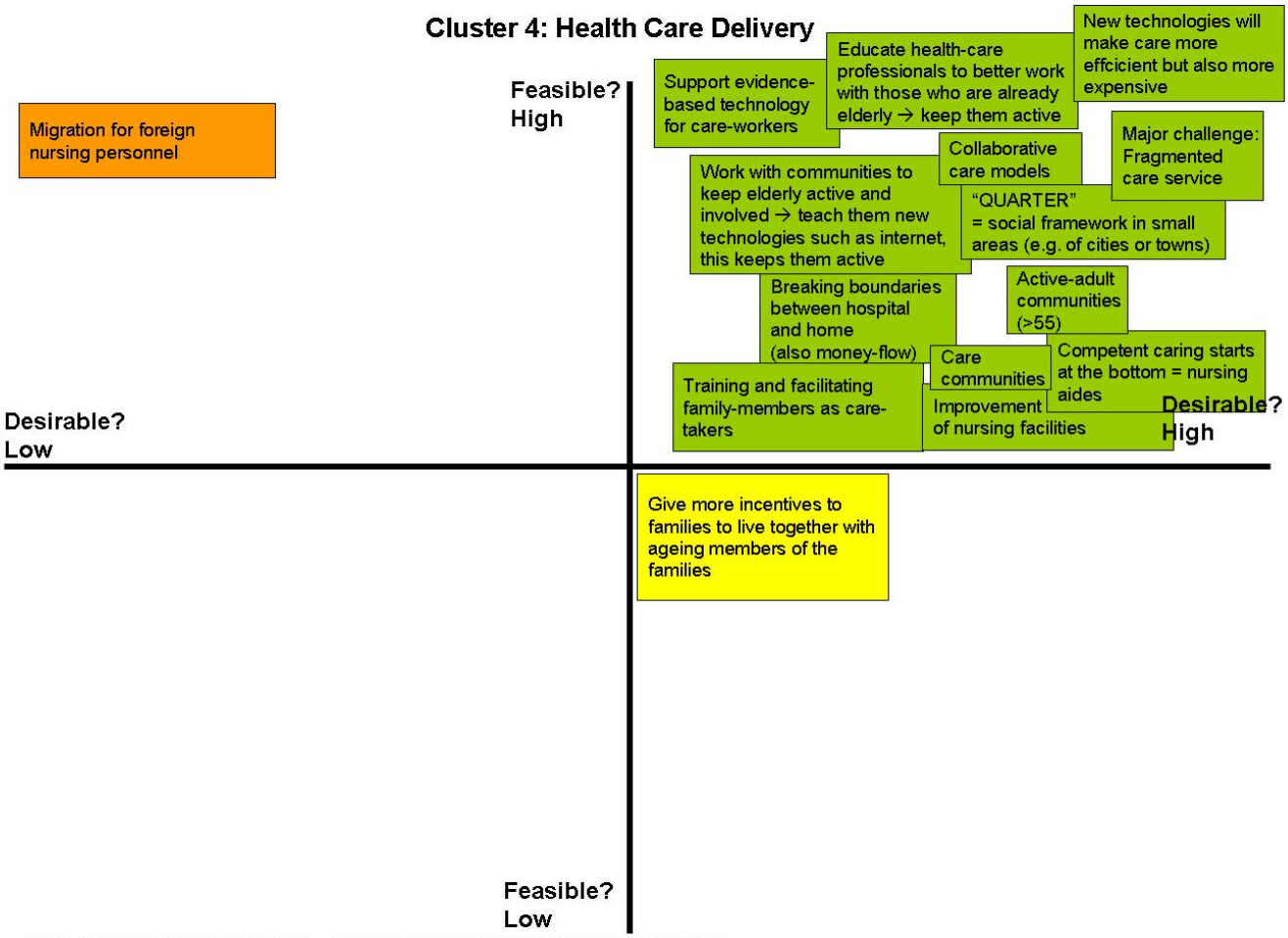

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Cluster 4: Health Care Delivery

Actions (Policy Proposals)	Enabling	Hindering	Challenges
Integrative care, incl. homes	• Social care-broker • People feel that things need to change	Finance of health care service	New (financial and quality) incentives to organise integrative healthcare
		Interoperability of systems	Harmonisation on EU-level
	• Upgrading of nurse professions • Rising healthcare costs	Lack of user-oriented product design	Common acceptance of evidence on healthcare practices
	• Lot of technologies developed to support this, e.g. telecare, remote patient management		Patient-oriented financing instead of vertical pillars
+		Status-quo/lack of incentives to change	
		Lack of business-models	→People are afraid of change, little room for experiment
Integrative social care	• ICT • Internet → broadband • Virtual social networks	More people + money needed to organise social care broker	
		Lack of evidence in cost-effectiveness	→Evidence should be generated in real life situations
	• Retirees as volunteers or as workers → caretakers		→need professional support
		Underfinanced communities to develop services	
	• Private professional services for elders		
		Responsible minister of ageing?	

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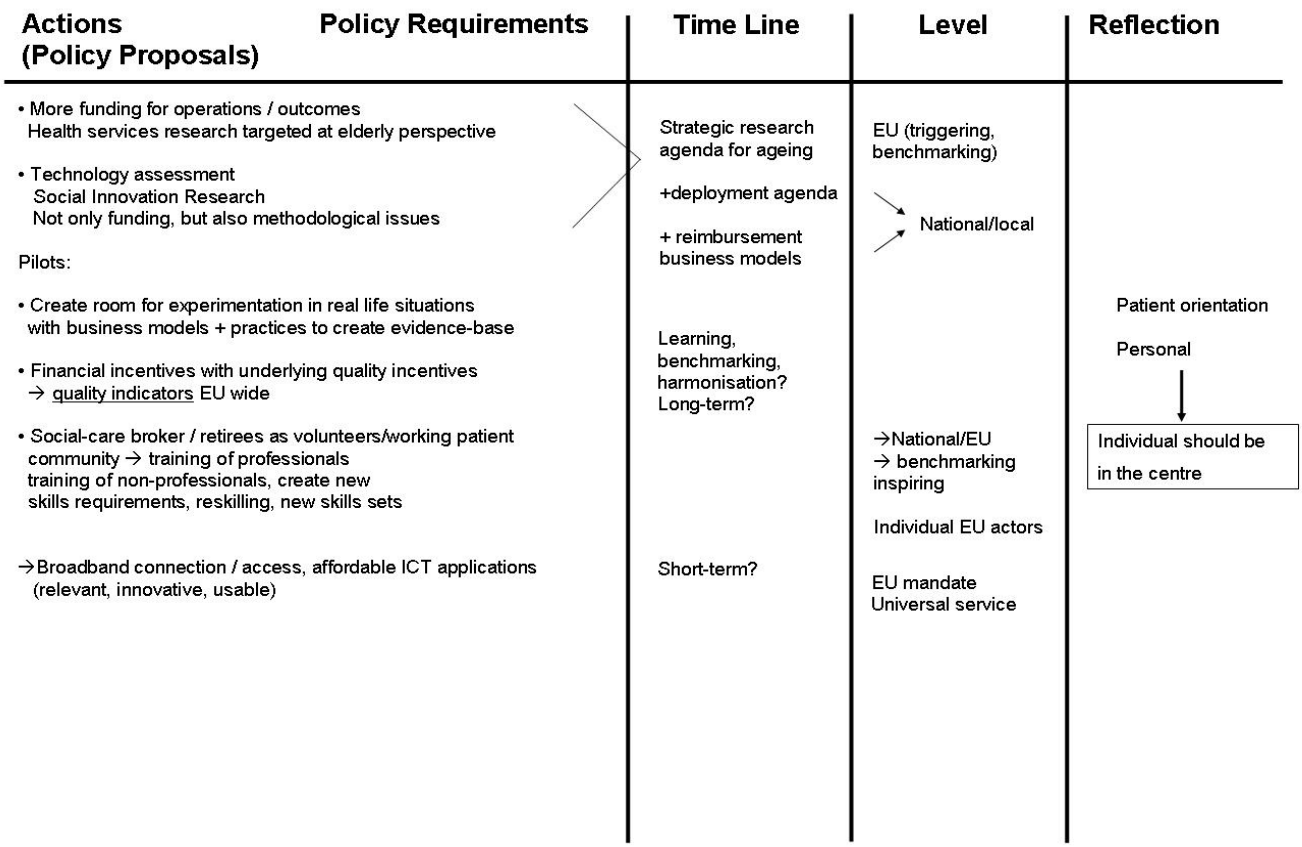
Cluster 4: Health Care Delivery



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