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**RE-THINKING ELDERLY CARE: REALIZING THE POTENTIALS OF NEW WELFARE
TECHNOLOGIES AND USER-DRIVEN INNOVATION**

This document reports on the Danish case study for the OECD Project: " Information and Communication Technologies (ICTs) for a Silver Economy". Aspects of this report were presented and discussed at the OECD Workshop on "Anticipating the Special Needs of the 21st Century Silver Economy: Smart Technologies and Silver Innovation" held in Tokyo, on 12-13 September 2012.

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RE-THINKING ELDERLY CARE: REALIZING THE POTENTIALS OF NEW WELFARE TECHNOLOGIES AND USER-DRIVEN INNOVATION

Under the pressure of budgetary and fiscal constraints, Denmark has been seeking innovative ways to improve the efficiency and effectiveness of its health and social care sector. The country has exploited information and communication technologies (ICTs) to champion new welfare technologies that promise innovative services and solutions for the elderly.

The three case studies analysed in this paper contribute to our understanding on how governments can leverage user-driven innovation¹ to develop new products and services to improve the delivery of home care to the elderly. This requires new approaches to map consumers' experiences and non-recognized needs. It also requires innovative public procurement practices and a public sector catalyzing public-private partnerships.

¹ In Denmark, the term user-driven innovation was applied for the first time in the 2003 FORA publication "A Benchmark study of innovation and innovation policy – what can Denmark learn?".

THE CASE STUDIES

Introduction

1. The rapid growth of the aging population in Denmark is expected to place unprecedented demands on the Danish public care system. Currently over 16% of Denmark's residents are age 65 or older. Life expectancy at birth in Denmark is 79 years, slightly lower than the OECD average of 80 years. Life expectancy for women is 81 years, compared with 77 for men. By the year 2050, one in every 4 Danish citizens will be over 65. The sharpest rise will be in the above 80 age group, which are in most critical need of care (The United Nations Population Division's World Population Prospects, 2011). This group alone, often described as the 'oldest-old' in society, is expected to grow by 20% over the next 20 years.

2. Recognizing this increasing demand for additional care services, Denmark has, more than any other OECD country, given explicit policy priority to promoting innovation to keep older people's living in their own homes. Over the last decade a more intensive and active engagement with this rapidly growing older age group has led to government-sponsored welfare technology research and new services in health and social care aimed at improving the quality of home care, reduce hospitalizations, and delay institutionalization by helping the elderly "to help themselves".

3. The three case studies included in this report are examples of efforts to develop new care systems that allow for more flexibility and quality in the living conditions and the social environment of older persons. They all focus on implementing a range of new and more efficient ways of delivering health and social care services to old people, and increase their involvement and empowerment. Technology and organisational innovation are both shaping the change process.

4. The welfare technologies discussed in this report are listed below. They are clustered in four groups according to their purpose and function (Table 1):

- **Assistive and compensatory technologies** - devices or systems that allow individuals to perform a task that they would otherwise be unable to do, or increases the ease and safety with which the task can be performed. The use of assistive technologies within the home is increasing and can help people remain independent for longer.
- **Technologies for self-management** (particularly in health)- enabling older people to take control of their personal health and health care management.
- **Remote care and disease monitoring technologies**- for the monitoring of disease development, or of home adjusted treatment and care, and the transmission of health data to care institutions. Many healthcare services are taking advantage of high-speed broadband to develop location-independent models of care – such as taking chronic disease management into the patients' home through tele-monitoring, instead of relying solely on outpatient appointments in hospitals and clinics.

- **Social technologies** - to structure circles of support, recreating in virtual space the sorts of informal networks that in the past surrounded older people. Some of the most promising developments in this area include video-conferencing and social networks.

Table 1 Examples of welfare technologies classified according to purpose and function

Technology/purpose	Examples/function
Assistive and compensatory technologies	Safety systems (alarms for heat, light, locking doors); Motion and fall detector Tracking system, for objects and persons Cognitive training and assistance
Help to everyday practical tasks for self-management	Reminders of medications, automatic pill dispensers Exercise
Remote care and disease monitoring	Monitoring of disease development, home adjusted treatment and care, transmission, assessment and monitoring (of vital signs and alarms) at care institution
	Check-ups, medication and follow up Psychotherapy, psychology services by ICT (VR, telePresence)
Social Technologies for communication support recreating in virtual space social networks	Technologies for real time audio-visual contact Physical Activity Monitoring for Aging People (PAMP) Social groups (audiovisual-technologies, telepresence) Patient information (web-based, interactive) Social networks

5. Taken together, these welfare technologies promise to overcome physical, sensory, and cognitive impairments of the older populations to allow continued ageing in place.

6. For example, telemedicine for home services has been reported to be particularly effective in chronic disease management. Distance monitoring of heart failure has been shown to reduce mortality and hospital readmissions, while the remote monitoring of HbA1-c has resulted in better diabetes care management.

7. Sensor technologies can also prevent harm, *e.g.* automatic fall detectors can make people less anxious and less afraid of falling. Tracking and alert technologies can make people with dementia and their families feel safer. Video-communication can have empowering and autonomy-promoting effects. People with sensory impairment can increase their welfare through sensory-compensating technologies, *e.g.* deaf people can benefit from video communication. Technology for communication support may also increase social contact and reduce depression.

8. Additionally, smart home technologies provide an opportunity for dignified treatment at home as they enable older people with various kinds of physical or mental impairments to age in place and are welcomed by the old people themselves.

9. As exemplified and discussed in the three case studies below, these technological solutions can be designed and combined to meet multiple and varied needs.

The DREAMING Project (elDeRly-friEndly Alarm handling and MonitorING)

10. DREAMING is a pilot project funded under the European Union's ICT Policy Support Programme, Competitiveness & Innovation Programme (ICT PSP-CIP). Six countries are involved in the project: Denmark, Estonia, Germany, Italy, Spain and Sweden.

11. The Danish pilot was launched in Langeland on May 1, 2008, at a time when the welfare technology sector was just about picking up in importance in Denmark. Langeland is a remote area with 14.000 citizens, of which about 22% in 2011 were over 65 years old.

12. Scheduled to terminate in April 2011, the pilots were recently extended for one additional year, until 30 March 2012. The final evaluation of the six pilot sites was released in June 2012. The project has been operating with a total budget of 5.540.000 Euros of which half from the EU (2.770.000 Euros), and the other half from local sources, specifically, the Langeland Municipality and the Southern Denmark Region.

13. The core objectives of the DREAMING project are:

- Enable older , frail people to continue to live in their home, without compromising their safety
- Provide older people with a simple and effective way of staying in touch with family and friends
- Increase the efficiency, appropriateness and the timeliness of interventions, including emergency services.
- Reduce health and social care expenditure.

14. This is being achieved through the implementation of three types of welfare technologies:

- **Chronic Disease Telemonitoring** - older people handle their own measurements (*e.g.* blood pressure or oxygen saturation), which are then sent to a portal accessible to the care providers.
- **Digital mobile Alarm and Localisation Systems** - directly connected to the surveillance care Centre to ensure that older people are safe at all times.
- **Videoconferencing** - specifically designed for older people to stay in contact with friends, relatives, and health professionals.

15. Demonstrating the benefits of these new care services and the associated welfare technologies through randomized evaluation is one of the principal aims of DREAMING. The key questions asked are:

- Is the system robust and secure enough to allow the older people with chronic health problems to remain at home longer, maintain or improve their health status; avoid unnecessary hospital admissions; feel safer?
- Does the system help informal carers? Is it user-friendly and reliable? Is it cost effective?

- Is there a business case? What are the barriers?

The technology

16. The DREAMING pilots are based on market-ready solutions. The telemonitoring technology was developed by Health Insight Solutions GmbH, based in Munich. It combines in one solution different kinds of vital sign monitoring devices, such as blood pressure meter, weight scale, glucometer (for people suffering from diabetes), asthma monitor, 1-lead ECG monitor (for people with serious heart conditions)-pulse/oxymeter monitors (for people suffering from respiratory or heart disease), etc.

17. The equipment is non-intrusive, and easy to use (Figure 1). It includes a fixed unit, which is connected through wireless protocols to a series of medical devices and environmental sensors. The selection of the devices and sensors as well as the number and frequency of measurements depend on the pathologies of the elderly and are tailored to the individual case.

18. Measurements are automatically sent to a central unit that acknowledges receipt of the data by a vocal message or monitor display which also includes the values of the readings. The data are further relayed to the contact centre for further processing through a web-based decision support system, CentreSight. CentreSight is designed to follow pre-defined protocols which are common to all monitored persons, or may be specific to a subgroup with particular health conditions. These protocols include triage or differential responses according to the severity of condition and need for follow-up. If the network connection is unavailable, the data are stored locally and automatically delivered as soon as the connection has been re-established.

19. The mobile alarm and localizations systems are based on a mobile unit composed of a cellular phone, the Mambo, which has been designed specifically for use by older people. The Mambo includes the following features:

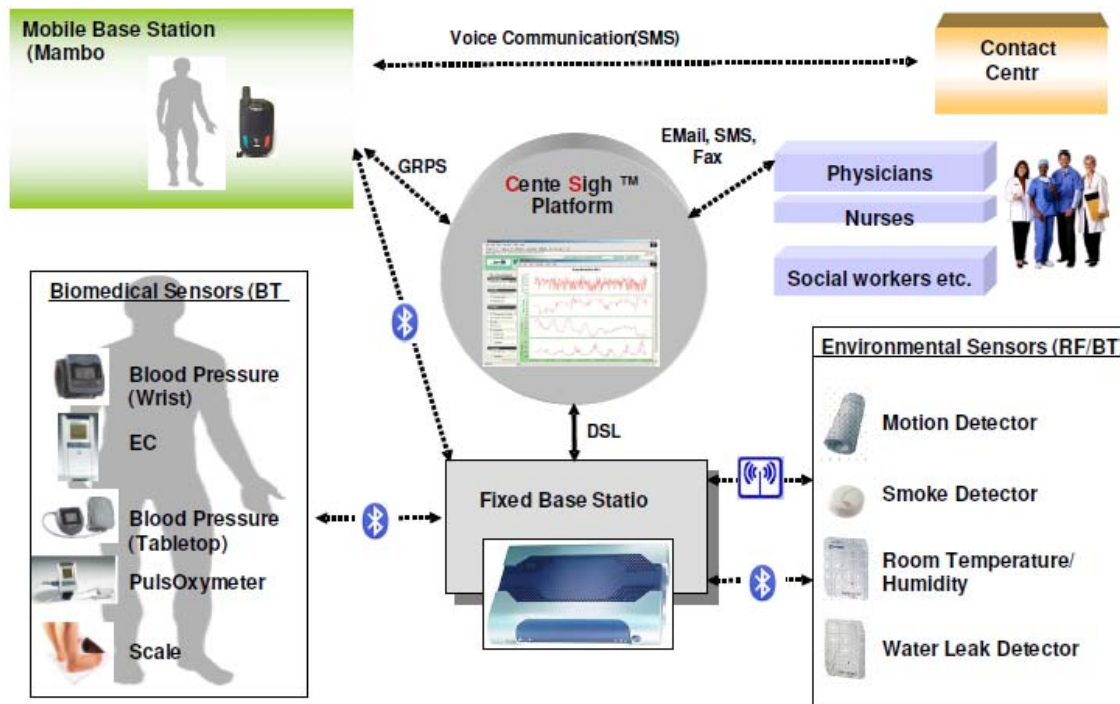
- Ability to connect to all the medical devices that the fixed unit can connect to with the only exception of the ECG
- Integrated panic button to send alarms to the surveillance care centre
- Integrated fall detector based on a three-axe accelerometer
- Medicine reminder- which is a programmable message to remind the older people of their medications
- Vital signs check with user confirmation and alarm
- Position system based on GPS which allows to locate the older person when outdoors

20. In addition, according to the health condition of the elderly, an Environmental Monitoring Subsystem is also available which detects movements and can analyse them against an average or normal user profile. Sudden changes to the normal pattern are detected and reported to the surveillance care Centre. The surveillance care centre is then able to establish voice communication with the flat or house to check on the individual before an emergency procedure is launched.

21. The video-conferencing system is based on a simple set of rules similar to the operation of televisions and is adapted to the average skills of a 65+ old person. The system can be switched on with an ordinary remote control, and once activated it gives a menu of choices including the list of close contacts.

The system is a closed loop, secure system, under the control of the older person, designed in respect of his/her privacy.

Figure 1 Components and Architecture of the DREAMING solutions



Online Omsorg and Care @Home

22. The Online Welfare and Care@ Home pilots share many of the technical features of the DREAMING project. A distinctive feature of these case studies is the proactive role of the two companies, Rambøll Informatik and KMD (which have merged in 2011), the pre-commercial procurement process and the key role played by the municipalities in both the development and the piloting of the respective welfare solutions. The two case studies are briefly described below.

Online Omsorg- Online Welfare

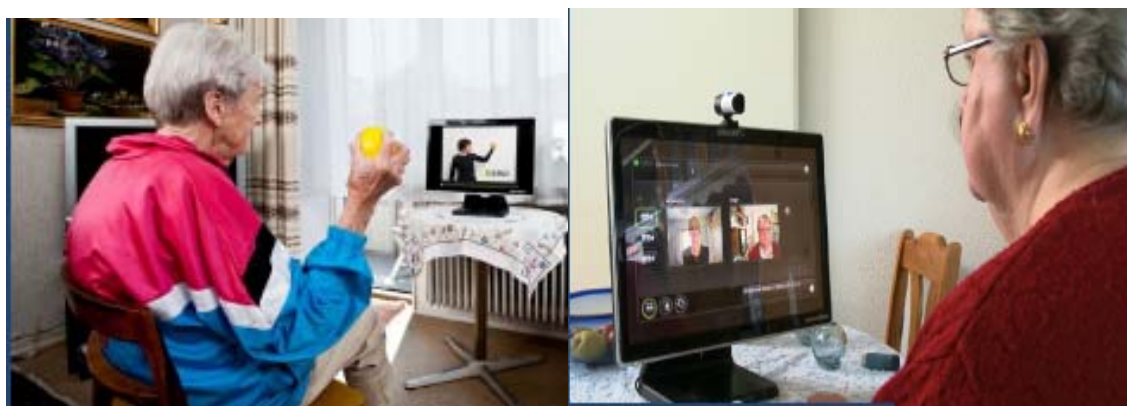
23. Online Welfare is an interconnected web-based portal that offers a range of services, including video communications (one-on-one, one-to-many, many-to-many) that can be used to deliver remote care. It consists of a terminal with a specially designed touch screen linked to various monitoring equipment, cameras and more. The screen is based on standard components and allows communication through a secure network. The portal is user-friendly - all of the technological solutions are designed for elderly users with little or no prior experience of ICTs. The video solutions were adapted to the specific needs of the elderly (Figure 2). They can also be used for social communication and networking.

24. Among the services offered are:

- remote home care and disease monitoring,
- rehabilitation,

- reminders,
- emergency care and supervision.

Figure 2 Online Omsorg's Video-Solution



25. The project was launched in 2011. It is funded by the Public Welfare Technology Fund - previously known as the ABT Fund together with four municipalities: Aabenraa, Greve, Kerteminde and Aalborg.

Pre-commercial Procurement

26. Differently from the DREAMING project, the company KMD approached the Aalborg Municipality in 2010 with a pre-commercial concept based on off-the-shelf technology. Although not explicitly defined as such in the interviews, the Municipality and KMD established a pre-commercial procurement agreement to further develop the concept and implement the pilot.

27. Under such an agreement, public authorities and industry share risks and benefits of the R&D needed to develop new innovative solutions that outperform those available on the market. The objective is to create a public-private partnership to overcome the obstacles in procuring new welfare technologies and services and allow companies to access the public procurement market in Denmark as well as in Europe.

28. This approach has proven useful in overcoming the main obstacles in procuring welfare solutions to enhance the efficiency of social care. These obstacles are:

- Defining and describing what is being procured, mainly due to the complexity of the welfare sector and the many different aspects and technologies that are involved.
- Sustaining the involvement of small companies and their commitment to the process. Small- and medium-sized businesses often have a distorted perception of the public tendering process that restrains them from bidding
- Balancing the value and risks of innovation, which poses many difficulties, since both value and risk are difficult to define and measure

29. Southern Denmark with its Welfare Technology Regional Cluster is a leader in the pilot implementation of welfare projects, and the testing of pre-commercial procurement thereby driving innovation in this sector. A project in the Region which has generated tangible results in the past two years is the Welfare Partnerships (2011-2013), managed by the Regional Business Development Centre.

30. In the case of Online Welfare, the Aalborg Municipality played a key role by approaching with a proposal the Public Welfare Technology Fund (Box 1). The Fund covered 75% of the costs of the implementation of the pilot project. The Aalborg Municipality and the three other municipalities supplied the rest (25%). The project was put to tender according to European rules.

31. The pilot involved 60 elderly individuals and about 100 care providers in four municipalities: Aabenraa, Greve, Kerteminde and Aalborg.

32. The local municipalities had to put in place a range of local agreements to deliver the infrastructure necessary for the video-conferencing, and the necessary training and technical support services for the pilots. The whole process took more than one year and the start date of the pilot was consequently delayed to 2011.

Box 1: The Public Welfare Technology fund

The Public Welfare Technology Fund was established in 2008 to co-finance investments in projects that seek to employ labour saving technologies in the public sector and to adopt innovative ways of working and structuring public organisations. These investments aim at harnessing the potential of ICTs to support political agendas such as efficiency, effectiveness, modernisation and quality development in the public sector, to ensure a high quality of public services for citizens and businesses and tackle the main issues associated with the ageing population as described previously in this introduction. They build on the efforts made by the Danish government for several decades to develop the national ICT infrastructure and to achieve a broadened understanding on, and exploit the full potential of ICT use in the public and private sectors. The Fund supports two types of projects:

Demonstration projects where new labour-saving technology and new work and organisational forms are tested. Implementation Projects where a well-proven and mature technology is implemented nationally.

Care@home

33. CARE@home is the product of a public-private partnership between Rambøll Informatik and the Hjørring and Esbjerg municipalities. CARE@home offers software solutions for home and nursing care, to enhance the citizens' self-confidence and self-sufficiency. The welfare technologies consist of a touch screen with an integrated video-camera placed in the citizens' homes.

34. The digital services under the label “Rambøll Care” consist of:

- Medication Lists
- Schedule for measurements
- Graphical overview of measurements
- Calendar
- Video-call / -conference
- Digital Photo Frame

35. Care@home provides solutions for 'live-counselling' with a specialist staff, help with rehabilitation and an overview of medication and daily schedules. The elderly can, at any time, enter the results from e.g. measurement of blood pressure, weight or insulin levels and has access to earlier measurements, both within and outside the home. The specialist staff may also conduct safety checks on the screen if they have indications that there is something wrong with the patient.

36. In 2008 Rambøll Care was one of the market leaders in health and home care in Denmark. The company had bought in 1992 Samfundsdata, a data warehouse in use in about 42 municipalities, including Brøndby, one of largest in the country. In 2011, at the time of the merger with KMD, Rambøll Care was still a market leader with approximately 50% of the market share. The other big players in the Danish IT health and home care market are CSC and Avaleo.

37. CSC developed in 2006 a care assessment solution which gives carers access to drug administration and care-planning information via PDA. Providers can also write clinical notes and communicate with other healthcare organisations, such as hospitals, GPs and pharmacies, while they are on the move. There are 3,500 PDAs in use today in Copenhagen and carers use them to get information about services, record details of the services and treatment delivered, and update clinical information and documentation. CSC mobile solution uses a VITAE Care Data Warehouse specially designed for the City of Copenhagen. The implementation project was the biggest IT roll-out project in Denmark in this field, and won the 2006 National Digitization Award.

38. The Aalborg and Hjørring municipalities had also originally considered the implementation of a PDA-based system; the idea was soon discarded given the type of high quality, reliable connectivity needed to monitor the health status of the elderly.

Implementation Challenges

39. A major technical challenge for all three projects reviewed in this report has been the setting-up of a high resolution video-conferencing system, which needs to operate for long periods with reliable broadband connections in both the home of the older people and the municipal care centers.

40. In the case of Dreaming, according to interviews and a recent interim report², the time needed for procuring the technologies, and actual installation of the equipment was vastly underestimated. Given the remoteness of the Langeland area, broadband connectivity was poor. Installation of ADSL lines constituted a major problem, as will be discussed in later sections. The technological solutions needed significant adjustment and improvements and a dedicated technical support team had to be set in place.

41. This resulted in a substantial gap (from May 2008 to October 2009) between the time pilot participants were recruited and randomised and the time the trials started. During this period, a good number of the older participants lost interest in the trials, or had to move to nursing homes because of deteriorating health, or even passed away.

42. Legal issues also slowed down the deployment of the videoconferencing equipment. This had to do with a specific functionality in the service (the possibility for the nurses to force a videoconferencing session in case of suspected serious problems) which did not comply with the Danish Data Protection Directive, the Danish Act on TV surveillance, and the directives from the local Ethical Committee. This

² Elderly-friendly alarm handling and monitoring (2010) Deliverable D3.6, Draft Deployment Plan Version 1.0-<http://www.dreaming-project.org/documents/D3.6%20v1.0%20DREAMING%20Draft%20Deployment%20Plan%20100607.pdf>

functionality had to be removed from the Danish pilot. Consequently, alternative emergency procedures had to be put in place.

Reimbursement is a key obstacles to further deployment

43. One of the major obstacles to the further deployment of the welfare technologies and services described in this section has to do with the cost of the purchase and maintenance of the equipment and the reimbursement of the new services. The question of whether the municipalities will agree to take on the full cost of the use of these systems is yet to be resolved. This problem has become particularly important since the recent decision in Denmark to suspend reimbursement of the irobot-based home cleaning device which signals the decision of government to gradually reduce funding for non essential home services and encourage co-payments (Figure 3). These are devices that more or less randomly move around on small wheels picking up dirt and dust using fairly standard rotating and stationary vacuum brushes.

44. Reimbursement is, clearly, a major milestone that must still be conquered for many welfare technologies. This issue is, however, not unique to Denmark. Researchers in the US have, for example, cited the dearth of insurance industry spending on elder care robotics as a crucial inhibitor of growth (Bekey and Kumar, 2004)¹. Past analysis of the US assistive technology device market demonstrated that insurance reimbursement schedules correlate strongly with replacement rates of assistive technology devices (Phillips, 1993).²

45. Given the dominant role of government in care provision across OECD countries public support for these technologies is critical for their early development and commercialization. Many governments and organisations, however, already struggle to contain health costs while ensuring quality care. In this context, new technologies entail a risk of further destabilising current health and social systems and related financing arrangements.

46. As demand rises, countries will probably want to assess the value of these technologies in terms of their cost effectiveness and contribution to quality of life. Without any realistic estimate of the potential long-term value that an investment made in new products and services for the older populations can provide, it will be difficult for the public sector to justify major, continuing investments

Figure 3 The I-robot home cleaning device



47. The issues of the separation of responsibility between the health and social care and the sharing of the patient and home care records are also of importance. The dreaming project, for example, depends on workflows which cut across health and home care. The Danish Health Data Network is a national network

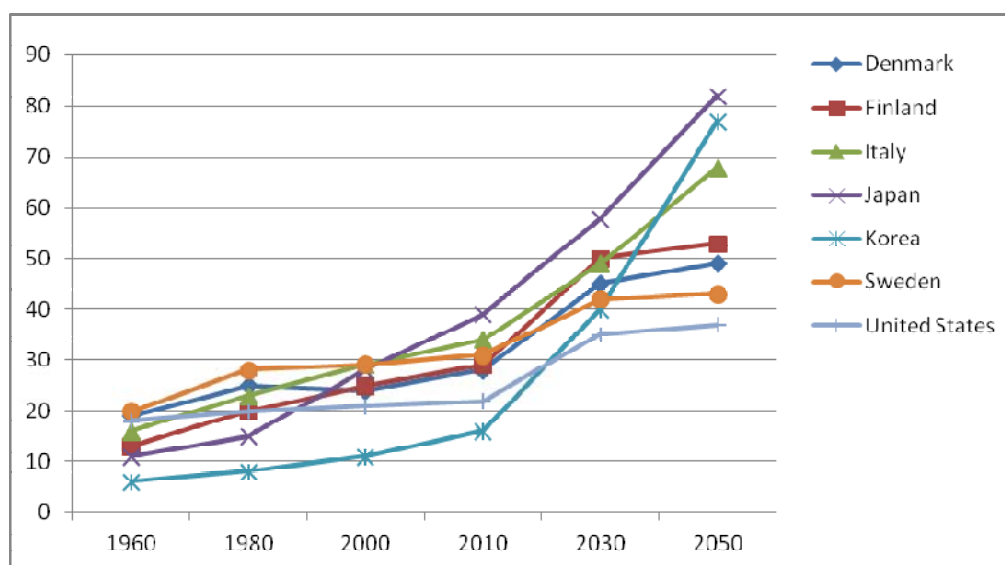
that goes back to the 1980s when interest in electronic communication among healthcare providers grew. It is a long-term project that enables effective data transfer between several actors of the health service. Integration of social care data with this system is therefore very important for the type of chronic disease management applications and other remote care services implemented by Dreaming.

THE DEMOGRAPHIC CHALLENGE AND ELDERCARE IN DENMARK

48. The size of the “dependent” population relative to the “working age” population who theoretically provide social and economic support will increase dramatically in Denmark by 2030 (OECD, 2010). Figure 4 shows the observed and projected demographic trends in Denmark compared with the six case study countries of the OECD project.

49. In 2009 there were approximately four 18-64 year olds for every 65+ years old. In 2019 this figure will be reduced to approximately three 18-64 year olds for every 65+ years old. And in 2044 the figure will be further reduced to only two 18-64 year olds for every 65+ years old. The demographic trend alone is expected to lead to growth of 20% or more in public health and long term spending on older people between 2000 and 2030.

Figure 4. Observed and Projected Senior (+65) Dependency Ratio (1960-2050)- (OECD Factbook 2010)



Eldercare in Denmark

50. *Denmark has more than any other OECD country given explicit policy priority to community care over residential care, promoting older people’s living in their own home.*

51. Today eldercare in Denmark is organized according to the principle that care is provided as “*help to recipients to help themselves*”. Older people whose physical or cognitive skills are limited permanently or temporarily have a right to receive health and social care in their own home. This right is enshrined in legislation.

52. Older people in need for care are eligible to receive nursing at home, home care and practical help. Home nursing refers to medical treatments (e.g. injections, wound care) provided by professional nurses at home, usually as prescribed by a physician. Home care services also include health promotion and rehabilitation services. Home help refers to personal care services (i.e. activities of daily living- ADL assistance) and domestic tasks (e.g. shopping, meal preparation, cleaning) provided by a range of allied care professionals, including personal care workers and housekeepers.

53. All citizens in Denmark are entitled to receive social services, irrespective of age, gender, income, assets, or living arrangement. The assistance is provided on the basis of the recipient's particular needs and conditions and in consultation with the individual and his/her family. Eligibility for social care is decided by a special municipal service. There are no minimal requirements to receive benefits from the local community. People aged 75 and over receive two preventive visits a year from a municipal case manager, who evaluates their needs and helps them plan for independent living.

Management and organisation

54. Denmark has a strong tradition of decentralized responsibility for health and care. Formally the responsibilities are divided between 5 regions and 98 municipalities.

55. The regions provide virtually all hospital and medical care services for the elderly. They own and administer all of the hospitals in their area. They pay the salaries of physicians who work in the hospitals and reimburse general practitioners for their services. Until 2008, regional services were financed from a combination of regional taxes and a block grant from the State. Today the latter is the main financing source.

56. The municipalities are legally responsible for nursing homes, home care services, home help, meals-on-wheels, day centres for the elderly and sheltered housing. These services are financed by municipal taxes, a block grant from the State, some occasional specific subsidies from the State and, to a small extent, contributions from individuals with an income over a specified amount.

57. In Denmark, the Government is responsible for the legislation concerning social services and assistance, but the local authorities are responsible for providing social services and for their performance.

58. Since 2003, older people are entitled to choose freely between private and municipal providers of services. The local authorities are legally obliged to establish a framework for enabling private providers to enter the market for personal and practical assistance. According to the Local Government Act, the municipal council must decide whether services should be tendered and, if so, which ones. The municipal council is, therefore, responsible for capacity planning and quality monitoring.

Need for care

59. 20% of the 65+ and 50% of the 80+ today require home health visits/care. Approximately 80% of the Danish elderly live independently in the community, and 40% receive state-subsidized social and health services.

60. The population over 65 years is responsible for one-third of all hospital admissions, representing over 50% of the total number of hospital days in Denmark.

61. There are around 6.6 million people suffering from common chronic diseases in the Nordic countries, with around 2.2 million being severely incapacitated by them. This means that 60-80% of Nordic spending on hospitals goes to treat people suffering from these chronic conditions. Owing to the

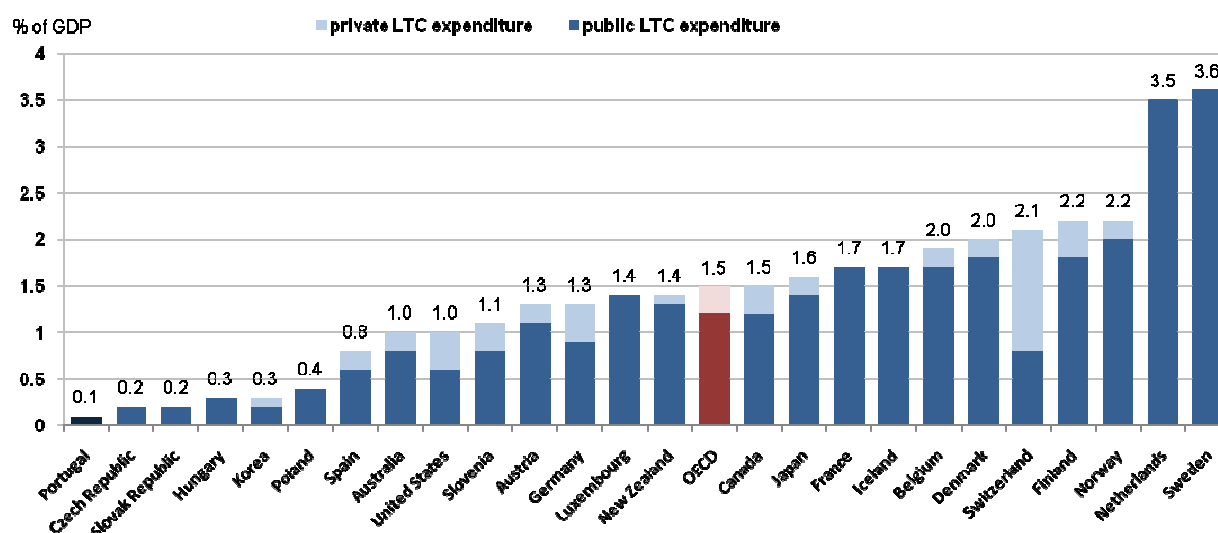
anticipated rise in life expectancy (more than 8% for both sexes between 2008 and 2050 in Denmark) and the increasing prevalence of chronic diseases, the number of the chronically ill is growing.

62. This means that health costs are expected to rise in Denmark from just over 6% of GDP to around 8% in 2020.³ It is therefore important to introduce technology that helps people to live with a chronic disease in their own home, enabling them to take responsibility for having as good a life as possible with a chronic ailment. Enabling a large proportion of people with chronic diseases to take greater responsibility for their own health by using welfare technology, for example, will be a vital factor in reducing resource consumption in the health sector.

63. The need for care depends not only on the health conditions but also the living conditions of the elderly. Singles will generally require more help than people living with a partner. Whereas the “young old” often have a partner (two thirds of the 65 to 69 years old persons have a partner), the share of people living alone rises sharply with age. Around 72% of the people aged 85 to 89 are singles.

64. In 2005 around 4,055 million Euros were spent on long-term care in Denmark. This was 1.95% of GDP. Most of the amount was spent on home care (4,044 million) and 11.2 million Euros on nursing homes. In 2008 long term care expenditure in Denmark had remained relatively stable, amounting to about 2% of GDP (Figure 5).

Figure 5. The share of public and private LTC expenditure Percentage of GDP, 2008



Source: Help Wanted, OECD 2011

65. The EU Ageing Working Group (AWG) carried out in 2009 a study on the development of long term care expenditure in the EU (EC/EPC 2009). To estimate the share of the elderly population in need of long term care services, the AWG used disability rates (inability to perform one or more Activities in Daily Living). According to this study, Denmark had 164,000 dependent elderly in 2007, this number is expected to double to 327,000 by 2050.

66. In 2001, Denmark had about 4,800 for people with dementia. In 2007, the number was around 5,700 registered institutionalised individuals, corresponding to an increase of 19% in less than six years.

³ <http://ipaper.ipapercms.dk/IDA/Politik/Velfaerdesteknologi/>

The Consolidation Act of Social Services

67. In 1998 the government, together with the municipalities, formed a committee to investigate how and in what areas of the social care sector it would be possible to generate greater efficiencies and extend the scope of free choice between public /private service provisions. Four year later, in 2002, the Consolidation Act on Social Services- a major Danish reform program- was introduced (Box 2).

68. The reform establishes free choice as a right for each citizen, not just an option depending on the municipality. In 2009, amendments to the Consolidation Act of Social Services made Denmark the only Nordic country where free choice of providers is mandatory for municipalities (Karlsson and Iversen, 2010)⁴.

Box 2: The Consolidation Act of Social Services

The Consolidation Act on Social Services specifies that a citizen can get personal and practical assistance if he or she is an adult, is resident in Denmark and cannot perform the personal and practical tasks him- or herself. The term personal assistance and care covers assistance with, for example, personal hygiene, getting into or out of bed, or getting dressed. Practical assistance in the home may be assistance with cleaning, laundering or shopping. The local authority is the body responsible for the offer of personal and practical assistance. The local authority also determines the level of home-help services and decides as to who is entitled to receive home-help services.

A municipality can choose three methods of implementing a consumer choice model. The first and most common entails a local council having a contractual relationship with each service provider that meets the locally defined standards, without an option to restrict provider's entry. In the second model, a municipality contracts with at least two but no more than five qualified service providers, through a tender (Government of Finland, 2009). The third model is a combination of the first two. It involves the first provider being found through a tender, and any other provider being allowed to enter the market, subject to price competition. The municipality is responsible for setting the local quality standards (Ministry of the Interior and Health, Ministry of Social Affairs, 2005).

The Consolidation Act gives the municipalities an additional option to increase freedom of choice by implementing a so-called "servicebevis" (service certificate). This certificate gives eligible individuals the opportunity to employ their own personal carers. The payment to the service provider is then made by the municipality.

The size of the Social Welfare Market

69. Providing users with choice over the care they prefer can stimulate providers' competition and encourage service innovation.

70. A municipality in Denmark can choose three methods of implementing a consumer choice model. The first and most common method involves setting up agreements and contractual relationships with any private service provider that meets the locally defined standards. In the second model (outsourcing model), a municipality contracts with a minimum of two but no more than five qualified service providers, through tenders. The third model is a combination of the first two. It involves a tender to identify the first provider, without setting entry restrictions to other qualified providers, subject to price competition.

⁴ Karlsson, M. and T. Iversen (2010), "Scandinavian Long-term Care Financing", Working Paper, No. 2010:2, University of Oslo Health Economics Research Programme, accessible at www.hero.uio.no/publicat/2010/2010_2.pdf.

71. Privatization in Danish elderly care has generally not taken place through the purchase of services from one or more private providers based on a competition of price and quality (the first option). Instead, most municipalities have opted for the fixed-price arrangement, inviting private suppliers to provide the care in a free-choice system, where elderly receivers of care are entitled to choose between providers that have been accredited by the municipality. In all cases the responsibility for providing and paying for care remains with the municipality, and it is also the municipality that makes the assessment about the type and amount of care to be provided in each case. The tendency has been for municipalities to separate practical care (cleaning) from personal care – and to have private companies provide the larger part of practical care, keeping most personal care provision within the municipal care units.

72. In 2005, free choice was implemented in 79% of the municipalities (The National Social Appeals Board, 2005 cited in Help Wanted, 2011)⁵. 90% of the home care recipients past the age of 65 were offered a choice between two or more service providers.

73. According to the Ministry of Finance, in 2006, 15% of care receivers got all or part of their care from private providers (Branchefakta 2006)⁶. In 2009 about 30% of all practical care (cleaning) was provided by private providers. When looking at the private provision of personal care, the figure in 2009 was 5% (Bækgaard 2011)⁷. However, we expect the share of private providers to continue to grow.

74. In 2004, 63% of the municipalities had reported more than one provider of home care services – in 2011 this number had grown to 76% (Danish Chamber of Commerce).

⁵ The National Social Appeals Board (2005), “Frit valg i ældreplejen – landsdækkende brugerundersøgelse”, , accessible at www.fritvalgsdatabasen.dk/indhold?system=fritvalg&id=fritvalg.publikation.

⁶ Branchefakta (2006), <http://www.arbejdsmiljoekrav.dk/b8-fakta.html>

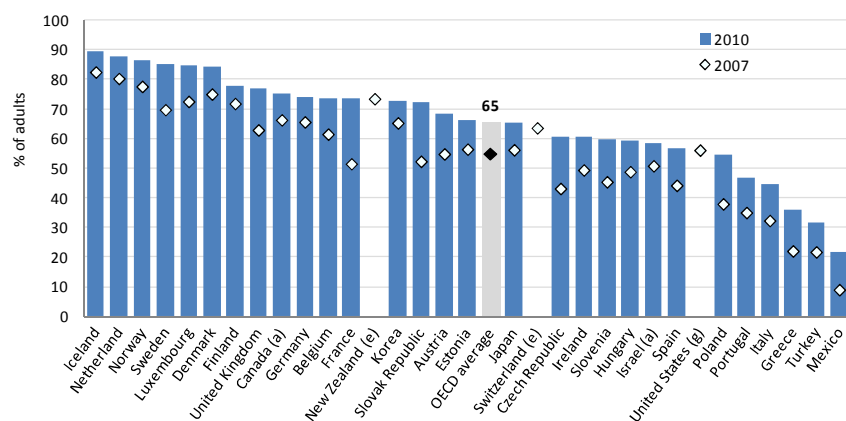
⁷ Bækgaard, M. (2011), Frit valg i ældreplejen, Århus: Danish Evaluation Institute for Local Government (Krevi).

INFORMATION AND COMMUNICATIONS TECHNOLOGY IN DENMARK

75. Denmark is in the top-tier in global league tables on Internet adoption with an average of 90% of households reporting having an internet subscription. Denmark has a fixed broadband penetration of 37.3% over a EU27 average of 23.9% and an OECD average of 22.8% and features near complete coverage of fixed broadband networks.

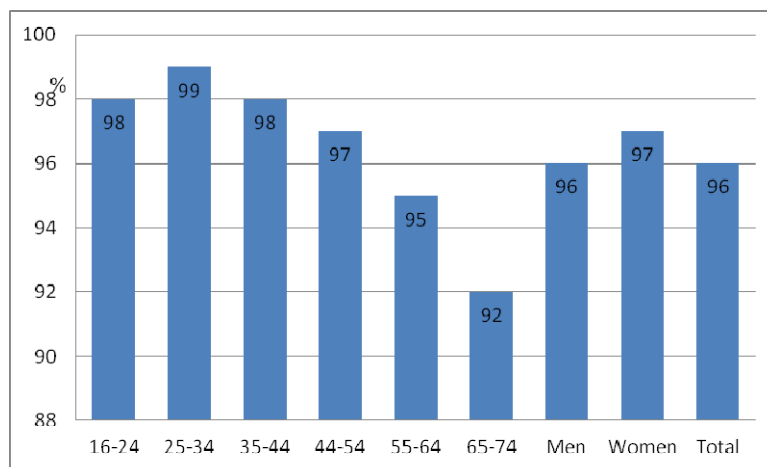
76. Denmark is also one of the front-runners in terms of regular and frequent use of the Internet, with over 80% of the population using the Internet for sending e-mails or making voice calls (Figure 6).

Figure 6. Individuals who used Internet for communicating, 2010 or latest



Source: OECD Statistical Compendium, 2011. Based on the OECD, ICT database and Eurostat, Community Survey on ICT usage in households and by individuals, April 2011.

77. Use of mobile phones is wide-spread in Denmark, also among the 65+ (Figure 7).

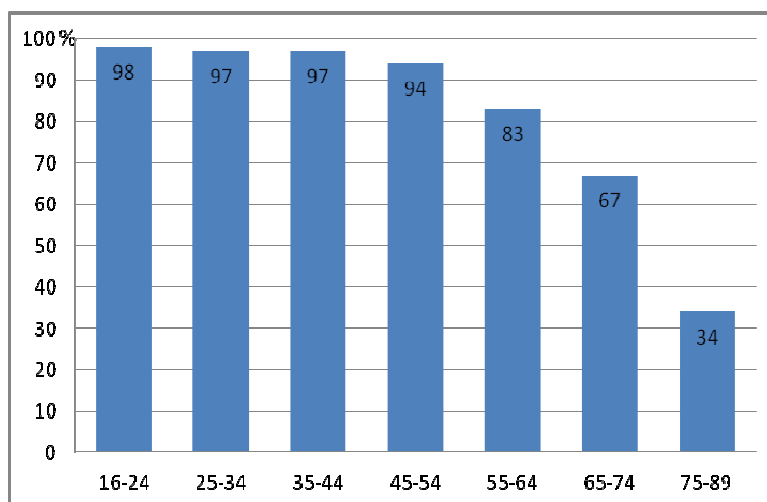
Figure 7 Use of Mobile Phones by Age Group (2011)

Source: Statistics Denmark 2010; Base: percent of population 16-89 year

78. In Denmark more than 65% of individuals engage in e-commerce. This figure is well above the OECD average (38%). In addition, the proportion of individuals never having used the Internet, at 11%, is amongst the lowest in the EU.

79. With 84% of the twenty basic public services for citizens, and 86% of the basic business services, available on-line, Denmark also records among the best performances in Europe in terms of sophistication of e-government services.

80. The data on Internet use among the older segments of the population is also very promising. Over 50 % of the oldest age category (65-74) reports the use of the Internet.

Figure 8 Individuals using the Computer by Age Group (2011)

Source: Statistics Denmark 2011; Base: percent of population 16-89 year

Telemonitoring and Broadband Speeds

81. There is a dynamic interaction between Information Technology infrastructure and welfare technology development. The availability of infrastructure promotes the development of new services and the need for services can stimulate new infrastructure. To take full advantage of the welfare technologies, and particularly tele-monitoring, it is not only necessary that all homes and businesses are able to get broadband, it is also necessary that everyone gets access to stable and high bandwidth connections. This will be further discussed in the next sections.

82. The fibre network in Denmark has been expanded considerably in recent years. By mid-2011 over 36 % of all households and businesses in Denmark had fibre network coverage. The fibre network also includes LAN connections based on fibre. In mid-2011, 38 % of Danish households and companies had access to a 100 Mbps broadband connection. The improvement is due to both an expansion of the existing fibre network and an upgrade of the cable network. Fibre coverage has gone up from 31 % in mid-2010 to 36 % in mid 2011. Other broadband platforms that use fibre such as cable and DSL can also play a key role in supporting telemonitoring, although they typically lag behind fibre in download, and more importantly, upload capacity. In addition, the access to connections with higher upstream speeds has increased. The main developments are shown in the table below

Table 3: Main Developments and Coverage (2009-2011)

	2009	2010	2011
100 Mbps downstream		25%	38%
50 Mbps downstream		68%	74%
30 Mbps downstream		74%	80%
10 Mbps downstream	77%	92%	96%
2 Mbps downstream	98%	99%	99,9%
100 Mbps upstream		24%	30%
50 Mbps upstream		29%	34%
30 Mbps upstream		30%	35%
10 Mbps upstream		45%	56%
2 Mbps upstream		90%	97%

Source: Danish Business Authority (2011)⁸

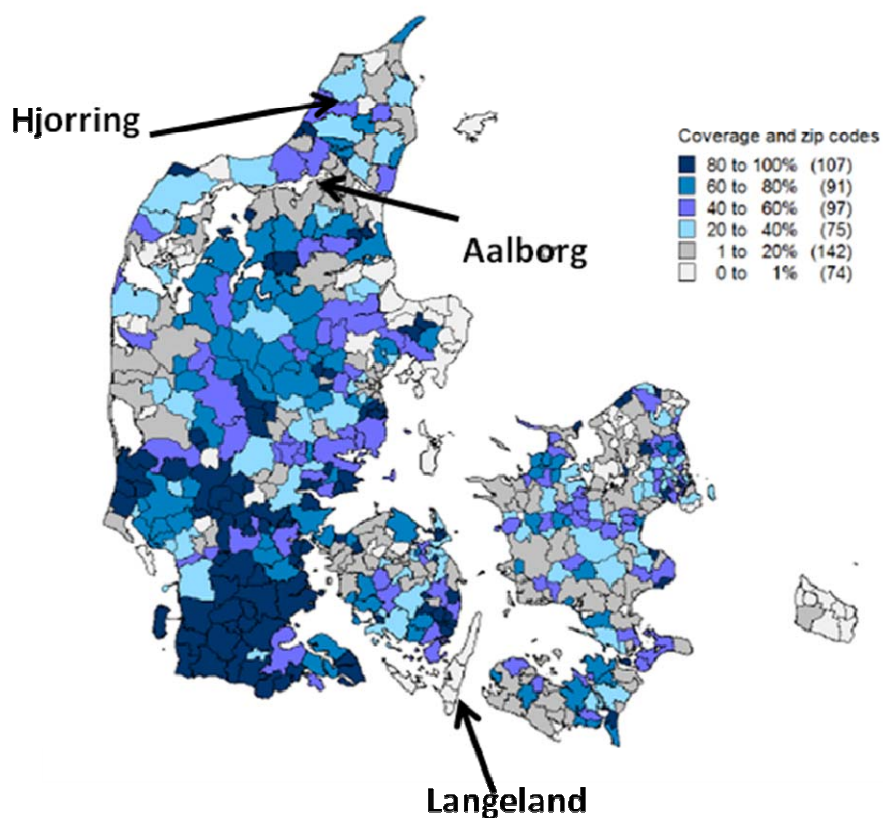
⁸ BROADBAND MAPPING 2011, <http://www.erhvervsstyrelsen.dk/file/225279/bredbaandskortlaegning-2011.pdf>

83. The availability of high-bandwidth infrastructure is critical for telemonitoring and tele-rehabilitation. With proper optimization, remote monitoring data can be efficiently transferred through the high-bandwidth infrastructure, thereby providing more complete information about the client during the therapeutic assessment.

84. The increase in high bandwidth availability also drives most video conference developers to incorporate high-definition (HD) content into their systems, allowing higher quality of multimedia files to be transmitted over the network.

85. Despite its rapid growth, the fibre network in Denmark is still in its early stages of deployment in many regions, including in the Aalborg, Langeland and Hjørring municipalities included in this report's case studies (Figure 9). The lack of high-bandwidth infrastructure in these locations was perhaps the most important barrier in the implementation of tele-rehabilitation in the case studies reviewed in this report.

Figure 9 Fibre Network-Coverage in Denmark



86. The records of the Aalborg pilot indicate that 20 % of the older people who had consented to participate in the Aalborg online welfare project, had to be excluded from the pilot because of the lack of stable and high bandwidth connections.

87. A forthcoming study from Aalborg University confirms these observations. This is not a challenge specifically targeting the suppliers, but a general issue in relation to the available infrastructure in Denmark.⁹

Bandwidth requirements in the Case Studies

88. In the Dreaming project, the bandwidth requirements and the overall success of the video-conference link depended on whether data exchange was asynchronous or synchronous. Asynchronous data-collection and transmission is less demanding and can be done on 3G mobile networks where speed and latency do not matter. Data-intensive real-time monitoring demands, on the other hand, high upload and download speeds. High definition (720p) video-conferencing was unreliable with connections below 1152 kbit/s in both directions per stream.

89. The bandwidth conditions for the Online Welfare pilot were particularly demanding since KMD aimed at delivering a range of real-time services, including more than one participant per session. The minimum requirement was for upload and download speeds of 1500 kbps (1.5Mbps). Municipal records indicate that 33 % of the participants were, however, supplied with 512 kbps (0.512Mbps) upload speeds and 2048 kbps (2.04Mbps) download speeds. For this group the videoconferencing session resulted often in blurred or frozen images and other technical challenges.

90. Videoconferencing on mobile networks was generally not considered an option because most mobile 3G have a maximum upload speed of 384 kbit/s and will generally be lower because the available bandwidth is almost always shared between users and radio interference can further decrease the quality of the video-connection.

Estimating the Requirements for Telemedicine

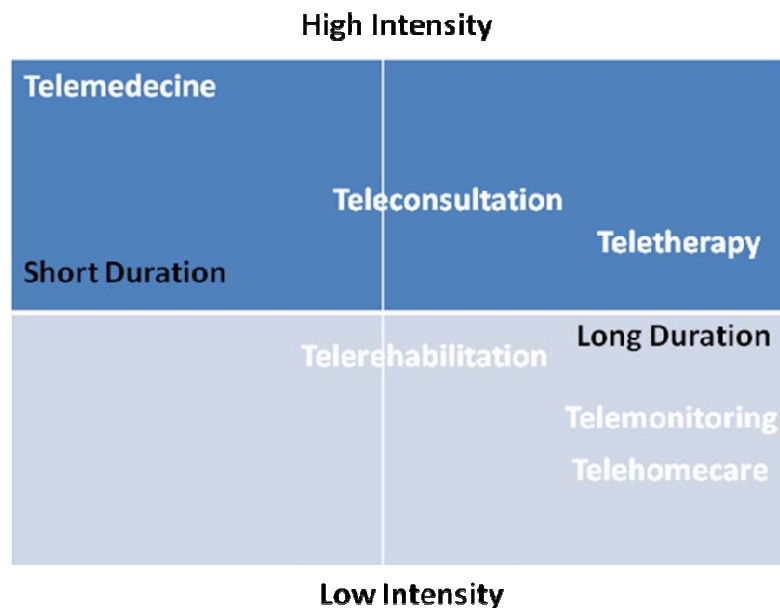
91. There is little agreement on the minimum or maximum requirements for tele-medicine. A reason for this is that the field of telemedicine can be mapped into four quadrants (Figure 10) based on the intensity and duration of the service delivery (Bambang and Saptono, 2009)¹⁰. The intensity is the amount of information exchanged (usually measured by the size of the files used, speed/resolution of the video required, etc.) between the participants in the telemedicine process. The intensity ranges from high intensity (e.g. for telesurgery) to low intensity (e.g., for in-home rehabilitation).

92. Intuitively, low-intensity services are delivered via low-speed connections, although low-intensity services are increasingly delivered via high-speed connections to achieve better quality of service. The typical tele-rehabilitation encounter, for example, involves usually a short, intensive session between a clinician and a patient. The rehabilitation process (e.g., speech-language therapy; audiology; rehabilitation counselling; physical therapy; assistive technology/wheelchair evaluation, etc.), however, requires the continuous and frequent monitoring of the patient's functionality to test the delivered therapy and/or adapt it to the patient's progress.

93. The unavailability of high-speed connections required for high-intensity services is often circumvented with the store-forward method of delivery for services that do not require live communication. Tele-radiology is an example of a high-intensity service that does not require synchronous communication and often can be conducted via the store and forward method.

⁹ See preliminary results from a study by Michael. Jensen, Center for Network Planning Aalborg University. The study is expected published 1 half of 2013.

¹⁰ Parmanto, B. and Saptono, A (2009) Tele-rehabilitation: state of the art from an informatics perspective, International Journal of Telerehabilitation. 1 (1): 73-83

Figure 10. Map of Telemedicine Service according to Intensity and Duration of the Sessions

Source: adapted from Parmanto, B. and Saptono, A (2009)

94. Chronic disease management involves monitoring over a long time period. The interaction and communication in chronic disease management usually is of low intensity. Therefore, chronic disease management using tele-monitoring such as in the Dreaming case study can be categorized in the low intensity – long duration quadrant. Tele-rehabilitation services also require continuous interaction over a long time span.

95. Traditional telemedicine such as tele-radiology and tele-pathology mostly falls into the high intensity – short duration quadrant. These types of services require very reliable high-speed connections. These services usually involve a short, one-time encounter that either does not repeat or only repeats a few times. Tele-rehabilitation, in contrast, usually requires repetitive encounters over long time spans.

96. Asynchronous IT infrastructure is used by a significant number of rehabilitation service delivery sites. Asynchronous communication stores and forwards rehabilitation data to the therapist; this allows data retention over long time periods. In the asynchronous communication models that were used in the past for at-home tele-rehabilitation projects, large data files were transmitted in small chunks over low to medium bandwidth channels, allowing the infrastructure to be deployed over common household connections.

97. A wide array of devices can be used to capture data at the client's side in the low intensity – long duration quadrant, ranging from simple emergency call button to automated monitoring robots. Therefore, the asynchronous IT infrastructure also requires a network that supports multimodal data and can be interfaced easily with the various monitoring devices. Almost all networks can support asynchronous communication and the Internet is a great candidate to deploy the asynchronous IT infrastructure.

98. Most of the services in the High Intensity- Short Duration quadrant are conducted in clinical settings and connect rural and metropolitan area clinics. Therefore, the requirement for this quadrant is an infrastructure that allows high intensity, interactive communication over a short time period. Due to the setting, the bandwidth needed can range from a medium to high-speed connection.

99. Recent studies in Australia suggest that bandwidths between 10Mbps and 100Mbps are needed for health applications, such as team-to-team video conferencing with data support (Coopenet@qld, 2009)³ and broadband speeds of up to 100Mbps for telemedicine – with applications such as high definition, 3D video consultation and education (NBN Co, 2010).¹¹

100. Synchronous IT infrastructure fits with the requirements of the High Intensity- Short Duration quadrant. High-quality videoconference systems combined with interaction tools are necessary to allow an effective communication in a tele-consultation. The level of interaction needed varies between clinical applications. Assistive device tele-prescription generally requires a high level of interactivity such as high-quality videoconferencing, which allows a real-time assessment of the client remotely.

101. High quality video and audio systems are a necessity for synchronous tele-consultations. The video/audio systems are utilized to show detailed aspects either of the client or the therapy materials. Additionally, the video/audio systems are also used as communication tools allowing feedback from the therapist to be delivered in a timely manner. Therefore, a very high-speed and reliable network is required for the IT infrastructure to support services in this quadrant.

102. The future of the tele-rehabilitation infrastructure points toward multimodal services delivered over multimodal telecommunication applications. Deploying Web 2.0 technologies on top of the Internet will allow for the development of sophisticated applications that integrate videoconferencing, electronic medical record, online collaboration, and other services into a single multimodal system. Employing this approach and open-source technologies will enable the rapid development of an integrated multimodal tele-rehabilitation service in a low cost fashion.

¹¹ NBN Co. (2010). CommsDay Summit Presentation. In Australian Telemedicine opportunities in the context of the National Broadband network.2010.

THE SOUTHERN DENMARK WELFARE TECHNOLOGY CLUSTER

103. With a surface of 12.191,2 km² and 1,2 millions inhabitants, the Southern Denmark Region is the largest of the regions in Denmark. In 2010, the Region, together with the Odense Municipality, created the Welfare Technology Region, an innovation cluster and incubator bringing together more than 200 companies, research institutions, hospitals and municipalities to promote R&D in welfare technology.

104. The Cluster invites enterprises to take part in innovation by opening up the social and health sectors to pilot projects and testing of new products, methods and solutions. It involves users in the innovation process by establishing a platform where they can present ideas for other stakeholders such as businesses and public institutions.

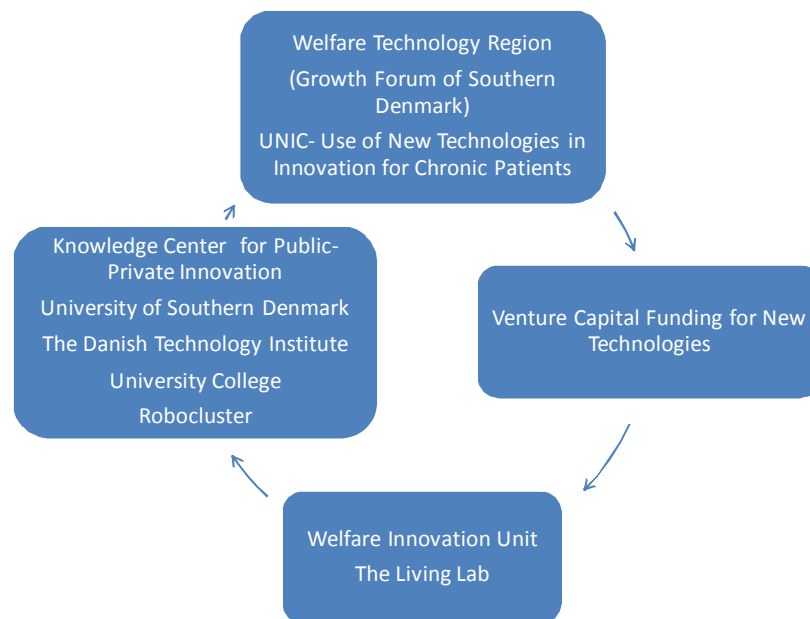
105. The aim is to create by 2013, through the activities of the Cluster, 500 new jobs, 50 new enterprises, and 100 new development projects on welfare technology.

106. The key components of the initiative are depicted in Figure 11 :

- ***The Knowledge Centre for Public-Private Innovation*** contributes to the implementation of public procurement in welfare services. The Centre is funded by all Danish regions and the European Union structural funds. Its aim is to further public-private innovation in relation to the development of both technologies and better services within the social and health areas.
- ***The Welfare innovation Unit*** aims to clarify and identify the needs for welfare technology. This Unit is linked to a “Centre for user-driven innovation” or “Living Lab”, established in 2010. The Centre aims to develop new “super” hospitals in the region and will make it possible to test new processes and products in real settings.
- ***The Use of New Technologies in Innovations for Chronic Patients*** (UNIC) is a newly formed national partnership with the administrative secretariat in the Southern Denmark Region and a budget of DKK 130 million (17 mil. Euro). The aim of the project is to promote innovative solutions for patients with chronic diseases, such as cancer, heart disease and chronic respiratory diseases.
- In 2011, in cooperation with other regions, Southern Denmark has also set up a ***venture capital fund***, with more than DKK 100 million to invest in welfare technology companies. The initiative aims to close the gap in translational research by making high-risk funds available to spin-off companies at a very early stage in the innovation chain. Southern Denmark has invested some 56 million Euros since 2007 on welfare projects.

107. In 2007, companies in the Region exported welfare technology and services for an amount of 400 million euros. The sector saw a 20% growth in exports between 2004-2008. 300 SMEs work or cooperate in the field of welfare technology and see this as their core business. The sector employs 4300 people, 1% of the Region's work force.¹²

Figure 11: Key Components of The Southern Denmark Welfare Technology Innovation Cluster



Source: Jeppe Kristensen; Regional Development, Region of Southern Denmark

108. The South Danish European Office (SDEO) acts as liaison office for local and regional public authorities with the EU, international organisations and partners. Via SDEO the Region is active in many EU Forums, and ensures cooperation in many types of European programmes. SDEO facilitates participation of enterprises in EU projects, ensuring that they share and benefit from European best practices. The Enterprise Europe Network also, for example, helps small businesses make the most of the European marketplace by supporting SMEs in developing business in new markets. Another example of support for international outreach is the initiative by the Regional Business Development Centre to help companies conduct market analysis, participate in trade shows, and establish export start-up groups for networking.

¹² jeppe.kristensen@regionsyddanmark.dk <http://welfaretechnology.dk/> <http://regionsyddanmark.dk>

THE BUSINESS CASE AND GROWTH POTENTIAL

109. Denmark's publicly financed social care creates the conditions for a stable home care market and, this, in turn, is an incentive for companies to develop welfare technologies.

110. In recent years, both the scale and the nature of the relationship between the government and the private sector have changed. The municipalities, for example, are contracting for a wider variety of services (including robotics) and municipal contracts are purchasing whole or integrated care programs, rather than simply limited services. Interest is growing in bringing for-profit companies into the welfare service area.

111. It is therefore, to be expected that more companies supplying publicly funded welfare services will be set up in the next few years. Older people with the economic means will tend to buy a number of additional care services. The offer might include more and better cleaning, more and better assistive devices, and solutions for monitoring safety and health, for example. The new private players on the welfare market will try to expand the market for the new products and services using consumer-oriented advertising.

112. From a business perspective there is, therefore, a profit potential in developing welfare technologies and in delivering new services for the elderly. This section will first review the business case developed for two of the case studies and then will provide an overview of the forecasted demands on the social care sector.

Business Case of the Online Welfare and Dreaming Projects

113. An analysis of costs and benefits is available for two of the case studies: Dreaming and Online Welfare. A positive economic return was demonstrated for both projects. The result is particularly compelling in the case of the Dreaming pilot since the project was evaluated in a randomised controlled trial. It should be noted that in no case these welfare technologies were expected to substitute for human care, nor to substitute genuine human interaction. They cannot replace visits by children, siblings, of friends and neighbors. The aim was to offer real-time monitoring as a means to promote greater safety and participatory care.

Online Welfare

114. Based on the experience from the pilot and the solutions tested, the Aalborg municipality developed a business case for the further scaling of the Online Welfare project. The business case includes an evaluation of the pilot, including estimates on benefits, costs and risks. The evaluation took note of the following possible contextual limitations:

- The technical problems would be addressed with no additional cost
- Citizens will be able to chose between remote or traditional home care
- There will be some limitations in Internet access with sufficient speeds

Table 2 : Online Welfare Estimated Annual Returns on Investment (DKK)

	Greve	Kerteminde	Aabenraa	Aalborg	Denmark
Rehabilitation	224.257 (30.069€)	126.335 (16.939€)	577.935 (77.491€)	1.595.834 (213.979€)	42.249.955 (5.664.907€)
Home care and home nursing	117.451 (15.7479€)	76.221 (10.220 €)	182.722 (24.499€)	664.054 (89.035€)	17.615.705 (2.361.902€)
Total	341.708 (45.818€)	202.556 (27.159€)	760.657 (101.992€)	2.259.888 (303.011 €)	59.865.660 (8.026.943€)

Source: Aalborg Municipality (* : November 2012 conversion rates)

115. The results of the analysis indicate that the total potential across the tested services (realistic and realizable) is app. 60 million DKK (8,045,106€). If the video-based services were mandatory and if there were sufficient access to high speed connections, the total potential (nationally) would be app. 130 million DKK (17,431,317€) annually. Upfront expenses (equipment, implementation, operations, etc) are not included although as discussed below they are largely amortized over the 3-year pilot.

DREAMING Cost- Benefit Estimates

116. Results for the DREAMING project also indicate that the savings from reduced face-to-face nurse and GP visits, reduced hospitalization and delayed institutionalization could be substantial.

117. The initial number of participants in the Dreaming project was 26 for the intervention group and 25 in the control group. The distribution of older people was not stable from start to end (due to dropouts); therefore, the healthcare services costs were calculated for an average number of 18.5 participants for both groups.

118. The upfront costs (acquisition of the technology and installation) were significant. They include:

1. Direct costs of purchasing software and hardware;
2. Indirect costs of installing, operating and supporting the IT investment.

119. Acquisition and installation costs are largely fixed expenses that require a one-time capital outlay. The total acquisition cost (for monitoring devices, home sensors, central units, and videoconferencing systems) was 81.741 €. The total costs of the installation of these technologies in older people' homes were estimated at 21.039 € in total. This figure comprises: time to install equipment (18.500 €), time to train participants (1.289 €), and time to install the broadband connection (1.250 €).

120. These costs were largely amortized over the three years of the pilot by the reduced health and social care costs of the intervention group.

121. Three results stand out:

- cost of GP consultations: the control group was 77% more expensive than the intervention group;
- cost of home visits by nurses: the control group was 41.6% more expensive than the intervention group;

- cost of home visits by social workers: the control group was 450% more expensive than the intervention group.

Table 3: Health and Social Care Events

	Pilot Group		Control Group	
	Visits (number)	Total Cost	Events (number)	Total Cost
GP consultations	182	3.276 €	323	5.814 €
Home visits by nurses	3.584	96.768 €	5.075	137.025 €
Home visits by social operators	3.054	82.458 €	16.819	454.113 €
Total Costs of Care		676.932 €		1.024.934 €

122. The control group had been significantly more expensive (in total 51.5%) due to greater health and social care costs than the intervention group.

123. Results of an opinion poll of participants in the Danish pilot suggest that both the elderly and the care providers are pleased with the new services, although there was an initial loss of productivity due to the need to adapt to the new workflows and the type of monitoring that the new technologies are making now possible. The old people report that they feel safer since they know that the care providers can control their measurements regularly and are promptly alerted if something is wrong. The care providers, in turn, are satisfied that they can save time by avoiding unnecessary travel when measurements are in order.

The Growing Demands on the Social Services Sector

124. In 2007, 43 % of Danish Municipalities provided a free-choice of elderly care provision (Den Sociale Ankestyrelse 2007). 179,000 elderly received permanent home help, among them 116,000 oldest old (80+). The share of people receiving permanent home help was 21% for people aged 75 to 79, 37% for people aged 80 to 84, and 60% for people aged 85 to 89, and to 83% for people aged 90 years and older (Schultz, 2010).¹³

125. In 2006, a total of about 100,000 people were employed in the social care sector (full-time equivalent). Around half of them were home helpers, social and health workers (45,300) and more than one quarter were social and health assistants (26,300). Only 6.4% (6359) were engaged in nursing and another 2.5% in managerial nursing (2520). Persons engaged for catering, cooking, kitchen help and cleaning amounted to 8,500 full-time equivalents.¹⁴

¹³ Schultz, E (2010) The Long term care system in Denmark.
http://www.diw.de/documents/publikationen/73/diw_01.c.359021.de/dp1038.pdf

¹⁴ http://www.diw.de/documents/publikationen/73/diw_01.c.359021.de/dp1038.pdf ; Statistics Denmark (2009), Statistical Yearbook 2009, Copenhagen.

126. Between 2001 and 2006 the number of social care workers increased by 4.5% , driven by the ageing of the population (Danish Statistical Yearbook 2009)¹⁵. A recent study by Ramboll Informatik indicates that at the current pace of demographic change, by 2015 an additional 7,000 nursing care providers will be needed and by 2020, an additional 12.000.

127. Care workers have a high labour turnover and 30 % change job every year. For the rest of the work force this figure is only 17 % (Pilegaard *et al* 2010). Work in elderly care is usually considered demanding both physically and emotionally. Based on figures from the six largest municipalities, the level of sick absenteeism is about three times as high for care workers as it is for employees in the state (Hasle & Jensen 2006)¹⁶, and care workers have a 61 % higher risk of requiring early retirement compared with the work force as a whole (Sejlbæk *et. al* 2010)¹⁷. The risk of accidents (mainly when moving and lifting patients) and musculoskeletal problems is also very high in elderly care.

Private for Profit Care Providers

128. The public sector is the major provider of long-term and home care for older people, but the government favours the development of competitive private agencies. Since 2002 people are entitled to choose a private or public provider of practical assistance and since 2003 also of providers of personal care. In 2007, around 63% of municipalities provided free choice of practical assistance and 41% of personal care providers (Rostgaard 2007).

129. Private “for profit” home care providers are expected to gain an increasing share of the market. The specialized nature of home care requires, however, well-trained professionals and imposes significant start-up costs. The pool of capable and accredited private care contractors is still quite small (Sclar 2000;18 Cohen and Eimicke 2001)¹⁹. The market appears to be dominated by a small group of large companies with many smaller companies running small scale, local operations. In 2006, some 600 private providers were offering home care services in Denmark, however, these were mainly practical assistance and cleaning services (Andersen, 2009).²⁰ The market is still described as fragmented although some significant consolidation is taking place. Multinational company presence in the social care sector is still relatively limited.

130. The desire for continuity in service provision may also hinder switching among potential service providers, further restricting the choices available to public agencies (Kettl 1993)²¹.

¹⁵ <http://www.dst.dk/en/Statistics/ofs/Publications/Yearbook/2009.aspx>; Pilegaard Jensen, T., Bendix Lauritzen, H. and Østergaard Larsen, B. (2010), *Social- og sundhedsansattes veje på arbejdsmarkedet*, København: AKF.

¹⁶ Hasle, P., Jensen, L.P. (2006) *Arbejdsmiljø og screening i sociale- og sundhedssektoren*. København: LO.

¹⁷ Sejlbæk, C. S., Clausen, T., Carneiro, I. G., Borg, W., Aust, B. (2010) *Ændringer i det psykosociale og fysiske arbejdsmiljø i ældreplejen 2005-2008*, København: Det Nationale Forskningscenter for Arbejdsmiljø, SOSU rapport nr. 20.

¹⁸ Sclar, Elliott D. 2000. *You Don't Always Get What You Pay For: The Economics of Privatization*. Ithaca, NY: Cornell University Press.

¹⁹ Cohen, S. , Eimicke, W. and Salazar, M.P.(1999) *Public Ethics and Public Entrepreneurship Managing Privatization* <http://www.columbia.edu/~sc32/documents/PublicEthics.pdf>

²⁰ Jørgen Goul Andersen and Martin B. Carstensen (2009) "The Welfare State and Welfare Reforms in Denmark", pp. 70-109 in Stanislaw Golinowska, Peter Hengstenberg, Maciej Zukowski (eds.), *Diversity and Commonality in European Social Politics: The Forging of a European Social Model*, Warszawa: Friedrich Ebert Stiftung.

²¹ Kettl , D (1993) *Sharing Power: Public Governance and Private Markets*, Washington DC; Brookings Institution

From user to "customer"

131. Around 25% of future Danish pensioners will only have their state pension to live on. The other 75% will likely have additional income from savings and pension schemes.

132. A study carried out by SFI (Danish National Centre for Social Research)²² shows that more than a third of pensioners in Denmark have assets in excess of DKK 1 million (excluding pension savings).

133. The proportion of wealthy pensioners is expected to increase in the next ten years. This means that more pensioners will be able to buy help and technological solutions over and above what the public sector can offer. This trend, which is already apparent, is set to intensify, partly because of political pressure to introduce more freedom of choice in a number of public services, and partly because future older people will be more used to buying what they need to increase their quality of life.

²² <http://www.sfi.dk/pensionistersummery-3618.aspx>

USER-DRIVEN INNOVATION

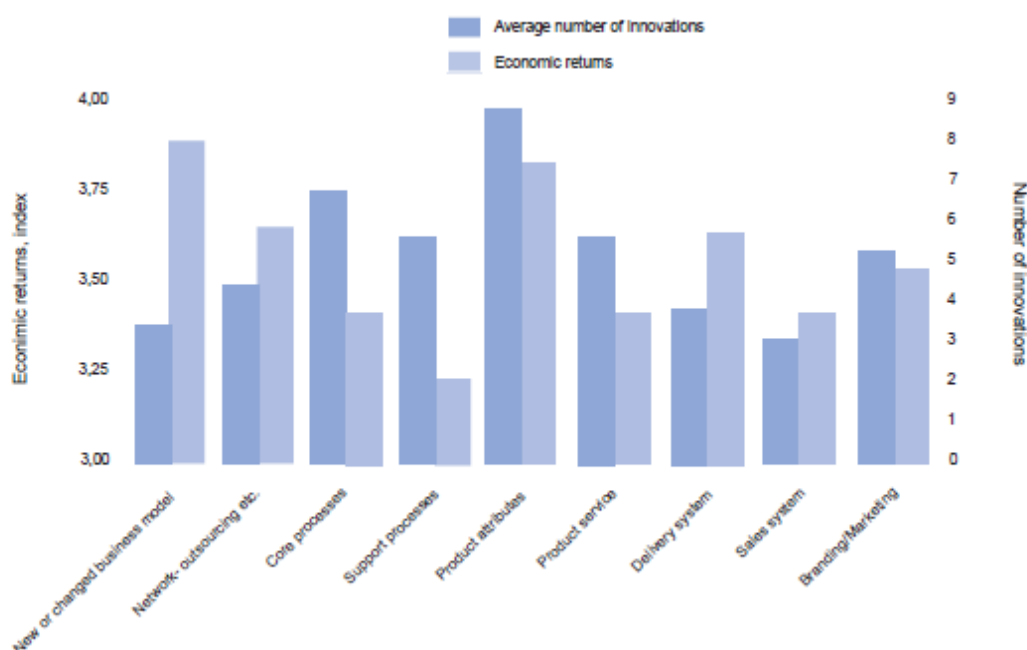
134. User-driven innovation takes place when companies work closely together with users and involve them as part of the innovation team in certain steps of the innovation processes. According to the Danish Business Authority²³ "user-driven innovation" can be described as: "the process whereby knowledge is obtained from users with a view to developing new products, services and concepts. A user-driven innovation process is based on an understanding of user needs and a systematic involvement of users." This includes both conscious and unrecognised user needs.

135. Without early and ongoing user involvement in the innovation process for products and services it is, for example, difficult to ensure usability. Usability is achieved by, among other things, prioritising the most important functions in order to reduce complexity and make operations simpler.

136. Innovation in the electronics and the medical device industries has generally followed a traditional innovation pattern. Most of the innovations in this sector occur in production processes and product attributes, where the economic returns are substantial (Figure 12)²⁴.

²³ <http://www.ebst.dk/brugerdreveninnovation.dk/about>

²⁴ Rosted J.(2005) User-Driven Innovation Results and Recommendations-FORA; Nordic Innovation Center (2010)Creating new concepts , products and services with user-driven innovation-
<http://www.ebst.dk/file/76299/udi.pdf>.

Figure 12 Average number of innovations in the electronics industry and their economic impact

Source: FORA Questionnaire on Innovation-Rosted J.(2005) User-Driven Innovation Results and Recommendations

137. The case studies included here, however, suggest a departure from this traditional approach.

138. The users have generally participated in the innovation process together with a team from the company. This has happened through on-site visits to homes and workshops where the old people and care providers met to discuss with representatives of the company and the municipalities the proposed changes in the care services.

139. In the development of welfare technology products and services, Denmark uses a relatively high degree of user-driven innovation in order to ensure that the new solutions really solve the specific problems of the older people, as well as being usable and ethical.

Policy Initiatives in Denmark

140. The Danish government has been very focused on improving the framework conditions for user driven innovation. Two of the most important initiatives in this process have been implemented by the *Danish Ministry of Economics and Business Affairs (now the Ministry of Business and Growth)* and the *Danish Ministry of Science, Technology and Innovation (now the Ministry of Science, Innovation and Higher Education)*.

141. As a part of the *Danish Ministry of Economics and Business Affairs* the *Danish Enterprise and Construction Authority (now the Danish Business Authority)* launched in 2007 the "Program for User-Driven Innovation" with the purpose of strengthening the diffusion of user driven innovation into the Danish business sector and in the public sector. The project which was terminated in 2009 had a yearly budget of 13.5 million euro.

142. The *Danish Ministry of Science, Technology and Innovation* has, through the Danish Council for Strategic Research (DSCR), also allocated 12 million euro annually between 2007 and 2010 to support a “User-Driven Innovation Research Program”.

CHALLENGES

143. As indicated in previous sections, one of the great potentials of the welfare technologies lies in its ability to cross professional, organizational, and social boundaries, explore new solutions, and create new services. At the same time, even good solutions may meet organizational constraints. Some of these may be related to professional or cultural resistance (Hardy et al. 2001)²⁵.

144. While advanced technology used in private homes appears effective from a clinical and organizational perspective (Lehoux *et al.* 2006)²⁶, it may not be meaningful for patients and families (Lehoux and Law 2004)²⁷. Health professionals may also feel that the potential to support and enhance patients' quality of life is reduced by the technological rationality dominating the service delivery (Liaschenko 1994, 2001)²⁸. Hence, technically successful implementation of the new welfare technologies may not be beneficial, unless the organizational and cultural constraints are addressed.

145. The most important change observed in the case studies is indeed the way health and social care is provided. This requires a certain willingness to adapt to change, both by citizens and the care providers. The older people must be ready to receive care in a different form while home care providers must change their everyday working procedures and deliver services in a different manner.

146. Change in work processes and a new way of organizing work is an important variable - it is a prerequisite for achieving effective delivery of services.

Procurement rules

147. Existing procurement rules were often identified as a barrier by interviewees. The procurement rules are seen to be complex and unclear. It is not always obvious what is or is not allowed within the current regulatory frameworks in relation to a procurement process for new welfare technologies and services. This was, for instance, mentioned in the Online Welfare case, where stakeholders argued that it is sometimes not clear how the municipality can proceed with a targeted development process or pilot without violating public procurement rules.

148. Moreover, public procurement rules can complicate and slow down the innovation process. It took nearly one year for the Aalborg Municipality to clarify and adjust to the judicial aspects of the EU procurement conditions. The transaction costs in preparing the EU tender were significant. The Municipality had to raise additional funding with the Public Welfare Technology Fund for this process.

²⁵ Hardy, B., I. Mur-Veeman, M. Steenbergen and G. Wistow. 1999. "Inter-Agency Services in England and the Netherlands: A Comparative Study of Integrated Care Development and Delivery." *Health Policy* 48: 87-105.

²⁶ Lehoux, P., Richard, L., Pineault, R., & Saint-Arnaud, J. (2006). Delivery of high-tech home care by hospital-based nursing units in Quebec: Clinical and technical challenges. *Nursing leadership* (Toronto, Ont.), 19, 44-55.

²⁷ Lehoux, P., & Law, S. (2004). Health care technology at home: Issues in organization and delivery in Quebec. AETMIS: Montreal. http://www.inesss.qc.ca/fileadmin/doc/aetmis/Rapports/SoinsDomicile/2004_06_en.pdf.

²⁸ Liaschenko, J. (1994). The moral geography of home care. *Advances in Nursing Science*, 17, 16-26; Liaschenko, J. (2001). Home care, novels, and the future. *Home Care Provider*, 6, 148-149.

149. Procurement rules do not appear to reduce risks for the private partner, as it is uncertain whether there will be a buyer of the product/service after the pilot phase. Moreover, being successful in one region does not necessarily entail success with other partners or municipalities.

Funding and human resources

150. A lack or insufficient financing/funding opportunities was mentioned as a barrier by project participants. Seed money often only covers costs related to the early development of the project since significant resources are spent in the preparation and submission of an application for funding.

151. In relation to funding for human resources, it was also stressed that it may be a barrier when such funding only supports the private partners' activities, as the public partner can have difficulties finding the resources necessary in the existing budgets to hire additional staff. Lack of funding for the further development of a product has also been mentioned as a barrier.

Size of the private and not-for-profit partner

152. Another project level barrier can be the size of the private sector partner. Generalist commercial and pedagogical competences are not necessarily available in small companies. In the DREAMING case, it was pointed out that the pilot managers experienced difficulties under-taking all tasks and responsibilities such as heavy administration, teaching end-users about the product, and the technical support for the new services.

Commitment of key persons

153. The commitment of key persons involved in a pilot project is important for project progress. There has to be someone who believes in the project and drives it forward (committed organisational entrepreneurs) on both sides with commitment and goodwill. The importance of key individuals is stressed as a driver in all case studies.

154. A central figure in the municipal administration and political backing are important if the project is to succeed. According to interviews, the DREAMING project would never have been realised if the municipality had not delegated the technical aspects of the project to one person who had this as his only responsibility.

CONCLUSIONS

155. Denmark is at the forefront of efforts made by OECD countries to addressing the needs of an ageing population. The country has exploited information and communication technologies (ICTs) to champion new welfare technologies that promise innovative services and solutions for the elderly. This is the result of the continuous commitment and strategic systemic approach by the Danish government in using ICTs to provide high quality services to its citizens.

156. Denmark has also been one of the first countries to recognize the value of the early involvement of users in innovation. The country has experimented with user-driven innovation since 2006 by establishing dedicated programs.

157. The development happening in Denmark is very much focused on innovation in home care services. It is applied research to produce useable products and services at the point of eldercare. The Danish government is, however, also committed to investing in welfare technology for growth and development. There is a need to better understand the growth potential of this sector.

158. The analysis and comparison of the case studies included in this report indicate that remote care enabled by information technology provides a service alternative that is cost-saving and more convenient for most users. By capitalizing on the power of tele-medicine, municipalities can offer a service that is both affordable and part of a paradigm shift in the way care is optimized for older populations.

159. Tele-monitoring and tele-rehabilitation have the potential to allow small communities to expand their home care services. In light of an aging population and a healthcare provider shortage, these technologies will play an increasingly important role in delivering care and rehabilitation services to older individuals in both rural and metropolitan areas. The trend toward portable monitoring devices and ubiquitous, sensor-based technologies also provides new opportunities to bring specialized services closer to the clients.

160. These potential benefits will, however, not be realized unless tele-medicine systems can be easily adopted by care service providers and their clients. The case studies indicate that in order for take-up to increase, there is the need for greater high-speed broadband penetration. It is also necessary to demonstrate the power and the potentials of the technologies' capability, and to address the ethical and legal barriers. Finally, co-ordination and integration of social and health care will be necessary.

161. In Denmark, however, as in other OECD countries, the whole set of political, regulatory, and funding structures are different between the health and social care sectors. Not only is care provision and delivery separate, the very governance structures are set against facilitating coordination and integration. Though they serve the same citizen, and each depends for its efficiency on the other, there is seldom a formal shared integrated structure, including across the established health information technology network, and thus there is no vehicle to initiate integration of governance, funding, or of care.

162. To conclude, a substantial body of evidence exists today which has much to reveal about the range of beneficial outcomes from welfare technologies. This evidence is primarily based on small-scale pilot studies as the ones described in this report. Little research has fully documented the economies of scale possible with collaborative and online welfare technology.

163. There are, however, many ways governments can reap the benefits of economies of scale from welfare technologies. In order to accomplish this, governments must make some critical planning decisions prior to implementation. Notably, efforts need to be organized on a national scale and knowledge widely disseminated. Otherwise, the ad hoc nature in which welfare technologies are evolving will undermine the many benefits of scale in the future.

¹ Bekey, George and Kumar, Vijay (2004). “Rehabilitation Robotics and Assistive Robots.” *WTEC Project, US Workshop, July 22, 2004*.

² Phillips, Betsy, MS and Zhao, Hongshin, PhD (1993). “Predictors of Assistive Technology Abandonment.” *Assistive Technology, Vol. 5, No. 1, 36:45*.

³ Cooeenet@qld. (2009). Submission in response to the Australian Government on Bachaul Blackspots Consultation Paper.