NORDROAD

New Nordic Roadmap for
Welfare Technology

December 2013

University College of Northern Denmark • Denmark
University of Tromsø • Norway
University of Turku • Finland
University of Umeå • Sweden
**DEMOGRAPHIC TRENDS & DRIVERS**

- Ageing in place

**THEMES & CAPABILITIES**

- Managing everyday life
- Equality of access and services
- Collaboration between patients and professionals
- Interdisciplinary

**ROADMAP**

**FRAMEWORK**

**Nordic Welfare Model**

The framework must be sensitive to the basic values behind the Nordic welfare model and culture. 4 key perspectives are emphasized in the framework to support the development or evaluation of welfare technologies, products or services.

**HEALTH**

"Health" is the overall perspective - meta-level driver - for the introduction and development of welfare technologies and services.

**DEMOGRAPHIC**

- Dynamics and needs because of changing demographic vectors such as age, mobility, disabilities etc.

**SOCIAL**

- Maintaining and strengthen the social structures in society in access to public services and private life

**ECONOMICAL**

- Changes in the funding schemes and ability to finance service-levels and access to public services

**TECHNOLOGICAL**

- New enablers and possibilities due to technological development and innovation

**SCENARIOS**

- Scenario #1: Speech recognition - How can speech recognition and speech training technology enable 17 year old Sella to better manage her life? Can she continue and take charge of her own education?
- Scenario #2: Technologies of understanding - Will Anja (age 51) be better prepared and more comfortable with her upcoming hip-surgery because of much improved access to information-sources about her situation?
- Scenario #3: A web based ulcer record for collaboration - How can Robert (35) manage his job while being hospitalized at home and still keep in contact with numerous specialists, home care and his GP?
- Scenario #4: Using remote control for watching television - Sound like a trivial task. Not for Karin age 58 diagnosed with Alzheimer. Can a simpler remote control increase life quality for her and her daughter Julie?
- Scenario #5: Motion interactive games in home rehabilitation - Jessica (age 12) is a teen girl with teen habits. Can gamification of the rehabilitation from her unilateral cerebral palsy make a difference?
- Scenario #6: Internet-based activities, social media and older people. Can social media and tele-presence make Lilly less isolated in keeping her family close and enable her to interact with her peers?
- Scenario #7: Telehealthcare - Tom is diagnosed with COPD. Can Tom be supported to change lifestyle and exercise habits through in-body activity sensors while at home in his preferred environment?
- Scenario #8: Robot vacuum cleaning - John is living in a nursing centre where robots has entered. How will John and Yvonne (nurse) tackle their new "resident"?

**Nordic overall value**

- Ease of use
- Connectivity
- Human value added
- Cost efficiency

**Relations between scenarios and capabilities**

- Capability to produce an interactive and meaningful connection between the user and care personnel or other significant people.
- Ability to increase user’s life satisfaction and influence of relationships and other aspects of more physical well-being.

**THEMES & CAPABILITIES**

- Ageing in place
- Connecting families
- Care from a distance
- Managing everyday life
- Interdisciplinary
- Equality of access and services
- Collaboration between patients and professionals

**TRENDS & DRIVERS**

- Social
- Economical
- Technological

**FRAMEWORK**

- Connectivity
- Human value added
- Nordic overall value
- Ease of use
- Cost efficiency

**Nordic Welfare Model**

- "Health" is the overall perspective - meta-level driver - for the introduction and development of welfare technologies and services.

**Nordic overall value**

- Increased population of older people living by themselves and in need of care | A higher number of financially capable and wealthier senior citizens | Changing family relationships | An ageing workforce | A decreasing number of public servants

**Fear of isolation & loneliness | Maintaining social networks | Secure access to public services | The citizen in a role as active participant in regard to care and treatment | Focus on enabling people to enjoy life and maintain quality of life**

**Pressure on most areas of public sector in the Nordic countries. (Budget cuts) | Centralization of hospitals and forming of larger entities | Alternative funding schemes from private pension funds and private enterprises**

**Broadband communication enabling video and multimedia communication | Embedded communication capabilities in home artefacts | Integration of devices & services | Easy authentication | Rise of robotics & self-moving devices in care**

**High**

**Medium**

**Low**

**Very low**

**Relations between scenarios and capabilities**

- Ability to increase profitability over time and to reduce cost per user and/or service event.

**High**

**Medium**

**Low**

**Very low**

**Relations between scenarios and capabilities**

- Ability to increase profitability over time and to reduce cost per user and/or service event.
### Trend categories

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<th>Demographic Changes</th>
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### How to read:

The roadmap above shows the relations between the “Why?” sections (Model and Trends & Drivers) and the “What?”-section - the scenarios. Each Scenario is related to a number of the Capabilities or Future Themes that represents the “How?” of the roadmap, where and how shall we strengthen our competencies and capabilities to accommodate the demands described in the scenarios and challenges from the trends and drivers for change.

The upper half of the table on the left shows the categories of trends and their support among the identified drivers. A mark with a ▀ indicates that the trend finds support in the assigned driver.

The lower half indicates how each of the future themes or capabilities are related or finds support in the trend-categories following these Relation / support-level values:

#### Strong / high

This indicates that the theme or Capability is central or of very strong importance in the assigned trend and the supporting drivers

#### Medium

Indicates that the theme is of some relevance of some importance.

#### Weak / Low

Indicates a relation to the trend and drivers but of no vital importance

#### Very Weak / Very Low

Indicates a very weak support relation between the trends and drivers and the assigned Capability

### Future Themes / Capabilities

- Ageing in place
- Connecting families
- Care from a distance
- Managing everyday life
- Interdisciplinary
- Equality of access and services
- Collaboration between patients and professionals
The use and development of welfare technology for health purposes is continuously growing in the Nordic countries. This is partly due to changes in the healthcare systems, but especially due to challenges in the demographic development with more elderly people and the increase in number of citizens with chronic illnesses. This should be seen in combination with cuts in public spendings and shortage of resources.

Welfare technology offers many opportunities to meet these challenges, and currently several experiments making use of welfare technologies are being carried out.

The current situation can be described as a state of flux with various experiments and rapid technological development. Several and different types of technologies are being explored under the headline of welfare technology - from cleaning robots to intelligent prostheses, computer training applications, communication tools, home monitoring systems, and a multitude of new inventive products.

The rapid development of inventive technology and the need to support health professionals in their work challenge knowledge-based implementation of new technologies. It is difficult to get an overview of technological possibilities, especially advantages and disadvantages of the various technologies. This makes it difficult for decision-makers to decide what technology to focus on and implement.

For institutions educating health care professionals such as nurses, physiotherapists, occupational therapists, midwives, and similar professions, it can be difficult to decide which technologies would be relevant to included in the education programmes to provide future health care professionals with the proper knowledge and competences within welfare technology.

On this background, four Nordic educational institutions decided to provide an overview of the field of welfare technology. Our shared task was to identify current practices and point out directions for future use of welfare technology within the health sector. This was the overall purpose of this roadmap: To point to meaningful welfare technologies that would fit the mentality and culture of the Nordic countries.

The NordRoad Project
Bente Hartvig   Jette Bangshaab   Ole Faaborg
Welfare technology plays a key role in health and social services in the Nordic countries challenged by a growing number of elderly and people with chronic diseases who will demand more services and better health care in a situation where budgets are getting tighter.

The current focus on use of welfare technology for health purposes is especially driven by high-tech prospects and financial management perspectives challenging the development and proper use of welfare technology in the Nordic countries.

The purpose of the network is to enable the development and use of welfare technology for health purposes in the Nordic countries from the perspective of both users and professionals within areas central to the countries’ welfare and health initiatives.

NordRoad is a part of the NeRo-project, funded by The Nordic Council of Ministers, which conducted a number of projects from November 2011 to November 2013.

Four research and educational institutions, universities of Tromsø, Umeå, Turku and University College of Northern Denmark (UCN), joined forces to:

- Establish a Nordic network which will contribute to qualify the development and implementation of welfare technology solutions and to develop an appropriate model to facilitate understanding of relevant welfare technologies in a Nordic perspective.
- To create a Nordic roadmap for welfare technology based on relevant scenarios from practice. This roadmap should be disseminated in a variety of ways including drafting of this publication, but perhaps more importantly by appointing ambassadors from the participating institutions to spread the knowledge of a unique Nordic welfare technology.

A large number of participants from each institution have engaged in workshops, seminars and scenarios; this publication only provides a summary and an overview.

**Activity tracks**

- Workshops / Seminars
- Scenarios
- Welfare model
- Roadmap development

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Aalborg, Kick-off seminar - Establishing organisation
31 December 2011 - 29 December 2012: Nordic welfare technology model - Development of Nordic welfare technology model
01 January 2012 - 31 December 2012: Scenarios - Finding and describing 2 scenarios from each participating country
23 April 2012 - 24 April 2012: Turku, Workshop - Scenario presentations. Forming method for further work
04 November 2012 - 05 November 2012: Tromsø, seminar - Presentation of model
01 January 2013 - 01 July 2013: Convergence of scenarios and roadmap model
01 October 2013 - 01 November 2013: Closing project activities
06 November 2013 - 09 November 2013: Aalborg, Closing seminar
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THE ROADMAP STRUCTURE -
THE WHY, THE WHAT AND THE HOW

The Why?

How does welfare technology add value to health care in Denmark, Finland, Sweden and Norway? The vision - or end goal - for this baseline roadmap is to guide or direct activities within welfare technology in a direction which is in accordance with a Nordic approach to health and welfare services.

Methods used

The method used to establish an overview is road-mapping. We were inspired by others who had used road-mapping to understand current use of and future directions for use of welfare technology. This is called vision-based road-mapping (BRAID, 2011).

Vision-based road-mapping focuses on:

1. Identification of current situation: baseline with understanding of current practices
2. Identification of where we want to go: vision with focus on understanding drivers and consequences.

As outlined in the BRAID this can be followed by gap analysis and plans for action on how to obtain desired goals. In the NordRoad project the purpose is solely to develop a roadmap as outlined in bullets 1 and 2 above.

To support the identification of baseline and vision, we used scenarios as a way to organise and present knowledge from current situations and create visions for the future. Consequently, scenarios can be used to collect and connect information about use of technology which will support both analysis and dissemination of results. Moreover, scenarios can tell stories about current practices and future visions and support vision-based road-mapping.

NordRoad-roadmap structure or blueprint

Every roadmap seeks to answer four questions:

Why? - Why is a change necessary and what are the drivers behind the transformation?

What? - What do we need to address and build to accommodate this change or transformation?

How? - How could we formulate, realize and implement concrete steps and actions?

When? - When is action required and which actions are the most appropriate and timely?

To answer the “Why?”

A set of trends and drivers are pushing for changes and new structures within health care and society in general. In this roadmap we have selected four categories of key-drivers which according to workshops and discussions were the most powerful and transformational in a welfare technology context.

To answer the “What?”

Two elements try to answer or unfold this question.

Eight scenarios were used to point out key opportunities and challenges in different welfare technology settings. Secondly, this roadmap points in the direction of seven capabilities - or future themes - which the roadmapping process pointed out as vital for a future development and implementation of welfare technologies. A capability is an essential need or competence vital to obtain successful development or innovation. By combining these two elements - scenarios and capabilities - this roadmap tries to make a profile of which uses and competencies are most urgent to pursue.

To answer the “How?”

It is not within the scope of this roadmap to suggest or pinpoint specific uses or applications of welfare technologies or solutions. The aim is to provide the receiver or user of this roadmap with tools and support to facilitate own investigation of welfare technology in their own domain and context. However, to support this and to get closer to a “how?” answer a framework for understanding welfare technology is provided.

To answer the “When?”

This roadmap is vision-based and is not targeting any specific timelines for execution. The timeframe in this roadmap is primarily focused on the scenarios stretching out towards 2020.

Linking it all together

Each of the roadmap layers or blueprint elements are linked together by a matrix illustrating their interaction, the strength of the relationships and possible consequences.
One of the aims of the NordRoad project was to develop a framework for understanding welfare technology in a Nordic perspective. The framework was to support the analysis of the scenarios produced in the project and facilitate drafting of the roadmap. However, our discussions on the framework raised several questions and the development of a new framework appeared to be more difficult than we thought. We experienced the complexity of welfare technology. Before we could further develop the framework we had to establish a common basis of knowledge and understanding of the phenomenon.

The following is the result of our efforts to establish a framework that could work as a “basis of knowledge and understanding of welfare technology” in a Nordic perspective.

Three questions on welfare technology

Question #1: What is the difference between welfare technology, telemedicine, telecare and e-health? Is welfare technology a new phenomenon or a particular version of e-health?

We found no principal differences in the political definitions. We found no principal differences in the political definitions. Welfare technology may be used to develop ‘telemedicine’ services offering remote access to specialist services; information systems enabling faster communication, independent of location, and large, flexible databases; ‘telecare’ where monitoring devices allow remote supervision of vulnerable people in their own ‘smart’ homes and/or welfare technologies that support individuals in coping with own lives and health based on their own terms. In short, the term welfare technology is relatively new, but it joins the ranks of other terms with slightly different orientations such as telemedicine, telecare and e-health. They all describe technological solutions that individuals can use in order to increase self-management, social participation and quality of life. A “next of kind” perspective and a service dimension are included in the descriptions.

Question #2: What framework for understanding should be used for. Should it be used to guide implementation of new welfare technologies or to measure the effects of those already implemented?

Experiences from telemedicine, telecare and e-health suggest that both implementation and measurement have proven difficult. The technologies have considerable political appeal, but keeping promises has not been easy and the history of healthcare information systems has shown far more failures than successes. Various explanations are put forward, but it is widely accepted that particular outcomes depend on the interaction between technologies and users. Introducing ICT initiatives in healthcare may “disrupt” established ways of organising work, work of professionals and patterns of work which may create resistance towards using the technologies. However, lessons are learned from experience. In policy documents on welfare technology, it is emphasised that organisational issues need to be taken into considerations in implementation processes: “Implementation of welfare technology assumes a corresponding focus on service innovation”. In the literature there has been a growing interest for assessment of ICT in health care. Models have been developed for understanding the workability and integration of complex interventions in health care such as The Normalization Process Theory and for more narrow evaluations of the clinical or economic effectiveness of the new services.

Question #3: Who are the users of welfare technology?

Welfare technology may ensure that individuals in need of health care services can stay in their own home longer. The technologies may be used to improve quality of existing services, contribute to a better working environment or to create new ways of cooperation between health care sector, communities, families, volunteers, non-profit companies, academia and industry. This makes the term “user” problematic. A user of welfare technology may be the client, clinician, a family member or a health care provider. The term “user” should not only be associated with the end users - those who use the software to perform work tasks and other everyday practices; This is also recognised within current research on advanced information systems. Information systems have improve and attention is directed towards continuous maintenance processes of...
the systems including end users' role in shaping patterns of use.

The Nordic welfare models and the multiple functions of welfare technology

The Nordic countries are characterised by their small populations and high degree of cultural homogeneity in terms of language and religion. The countries are recognised by their social and economic models that include a comprehensive social security systems, institutionalised social rights, solidarity, and a competitive economy. The goals are to promote individual autonomy, social mobility and equality, flexible and adaptable markets through a high level of taxation and labour force participation, gender equality, extensive benefit levels, and dialogue between labour market parties. The governments play a dominant role in the formation of these social and economic models, and in the development of an extensive public sector to implement the social and economic policies.

Framework for understanding Nordic welfare technology

The Nordic welfare model is characterised by universalism, a high degree of labour force participation, gender equality, egalitarianism, and extensive benefit levels and redistribution of wealth, and liberal use of expansionary fiscal policy. The welfare model aims to enhance individual autonomy, promoting social mobility, and ensuring the universal provision of human rights, as well as to stabilise the economy. These characteristics mirror general cultural specifics of the Nordic countries. Nordic people are generally individualistic combined with predominantly female value sets, thus generating a caring and welfare-oriented society. Power distance is relatively low in tune with the very flat organisation structures in companies and organisations, and uncertainty avoidance is similarly at a low/medium level, meaning that populations like variation and do not try to control the future and are less anxious.

To ensure that the basic values of the Nordic welfare state and culture are represented in the new services made possible by welfare technology, the framework should be sensitive to these values. The framework should disclose how elements of Nordic culture and welfare models interact with the welfare technologies in use or available. In our initial discussions we found four dimensions that connect with these values and which might be key concepts in our framework:

1. Human value added
   - By added human value we mean the product's ability to increase user’s satisfaction. It could for example be how the product influences personal pride of the user and what effect the product has on individuality and independence. Added human value can also be the influence of relationships and other aspects of increased physical wellbeing.

2. Ease of Use
   - Ease of use is the product’s level of usability to different end users. It could for example be how easy it is to handle for residents at a care centre as well as for care staff and relatives. Ease of use can also encompass other decision-makers as for example local system tailors and how easy it is to replace the equipment when needed.

3. Connectivity
   - Connectivity refers to the products capability to produce an interactive and meaningful connection between the user and care staff or other stakeholders. It could be improvement of resident/staff communication, resident/family communication, resident/friends communication, resident/authority communication, or even resident/media communication.

4. Cost efficiency
   - Cost efficiency refers to the product's ability to increase profitability over time and to reduce cost per user and service. The product could for example affect labour saving procedures, institutional investment, energy consumption, maintenance costs or it could have consequences for human contact and hours assigned for care.

Nordic overall value

Human value added
Ease of use
Cost efficiency
Connectivity
TRENDS AND DRIVERS - WHY CHANGE IS NECESSARY

A number of trends and drivers call for change in the way you design and plan welfare and health care services. The NordRoad roadmap builds on some key trends and drivers that will shape the future welfare technologies. Literature review, content analysis and workshops were used to create five trends and drivers: Health issues, Demographic changes, Social differences, Economic challenges and Key technological enablers involved in or building upon the development of welfare technology.

Health issues
The demographic development with an increasing number of elderly and a growing number of people with chronic diseases challenge health care and have a major impact on our perceived quality of life. The health perspective is the point of reference for the NordRoad project and this roadmap; Other trends and drivers are seen and interpreted through this perspective.

Demographic changes
Shift in the overall demographic profile is happening now and over the next decades. Both in terms of life expectancy, number of elderly and changes in family patterns.

Social differences
Isolation, loneliness and lack of social contacts is feared by many especially elderly but also people with disabilities that prevent them from participating in normal everyday activities report that this concern drives them towards solutions and methods to strengthen or uphold as many relations as possible.

Economical challenges
The Nordic countries are under pressure financially - either from budget cuts, reassessment of funding or politically motivated reform-driven changes. A growing number of third party funding schemes such as pension funds and private insurance companies also play an economic role in the field of welfare and health care.

Key technological enablers
The technology push and investments in the communication infrastructure enable a number of trend and drivers. Increased linkage between both humans and devices opens up new possibilities on a widespread continuum of technological applications.

The NordRoad workshops have selected and prioritised these five drivers to be the ones of most interest and each category and key driver in each are listed on the opposite page.

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<th>Drivers</th>
<th>Key technological enablers</th>
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<td>Demographic changes</td>
<td>Cloud Computing, Open Source, Big Data, Multiple platforms, Increased communication options, New materials, Sensors, Embedded intelligence, Cyber physical systems, Ubiquitous systems</td>
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<tr>
<td>Social differences</td>
<td>Cloud Computing, Open Source, Big Data, Multiple platforms, Increased communication options, New materials, Sensors, Embedded intelligence, Cyber physical systems, Ubiquitous systems</td>
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<td>Economical challenges</td>
<td>Cloud Computing, Open Source, Big Data, Multiple platforms, Increased communication options, New materials, Sensors, Embedded intelligence, Cyber physical systems, Ubiquitous systems</td>
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How to read:
The table - or linking grid - on the left shows the trends or drivers and their support among the identified drivers. A mark with a indicates that the trend is supported by the assigned driver.

The category "Technological Innovation (Enabler)" are not further qualified with regard to specific drivers. The NordRoad process focuses on health issues and challenges in welfare technology in a Nordic perspective. Since the NordRoad roadmap is not a classic technology roadmap but a vision-led roadmap, the technological enablers are mainly expressed and developed through the eight scenarios.
How to read:
How is the foundation of the future themes or capabilities in the selected and prioritized drivers and trends? Above is a linking matrix that gives an indication of how the selected future categories of drivers/trends support in the trend-categories following these

Relation / support-level values:

Strong / high
This indicates that the theme or Capability is central or of very strong importance in the assigned trend and the supporting drivers

Medium
Indicates that the theme is of some relevance of some importance.

Weak / Low
Indicates a relation to the trend and drivers but of no vital importance

Very Weak / Very Low
Indicates a very weak support relation between the trends and drivers and the assigned Capability

Trend categories

Health
Issues
Social
Trends

Future Themes - Capabilities to build

This roadmap points out seven future themes or capabilities, which will be necessary to address or meet when working with welfare technology in a Nordic context. The seven themes or capabilities are:

- **Ageing in place.** Welfare technology and services should support citizens’ ability to stay longer in their own home in familiar surroundings and environment and enable them to continue everyday activities as long as possible.

- **Connecting families.** It should be a focus area to support an enabling maintaining and nurturing of relations and ties between family members even if geography or disabilities become a limiting factor.

- **Care from a distance.** Access to expert knowledge and frequent contact with e.g. health professionals will in the future be provided or mediated through multiple channels - both physically and virtually. Welfare technology will play a key role to support care from a distance.

- **Managing everyday life.** To be able to manage everyday tasks and be able to engage in the activities - especially outside the home - is vital to maintain networks and social relations. Welfare technologies and services that support the capability of managing everyday tasks and life are thus important.

- **Interdisciplinary activities.** Facilitating true interdisciplinary and interprofessional work where healthcare professionals or disciplines can engage should be considered a key capability in relevant welfare technology projects and solutions. Using interdisciplinary and interprofessional approaches often result in high perceived quality of a service by the end-user.

- **Equal access and services.** A key capability or theme in the development of welfare technologies and services in a Nordic context is the importance of even and equal access to the services provided. In a Nordic context, it is a fundamental value or embedded understanding of health and welfare services that access to services should be equal for all. This could influence factors like price and selection of technologies that could enable broad acceptance of solutions.

- **Collaboration between patients and professionals.** The more the patient is involved and enabled to take responsibility for his or her own situation the better. The capability or theme of making platforms for improved collaboration between patients and health-care professionals is thus highlighted.

The grid indicates how each of the future themes or capabilities is related or finds support in the trend-categories following these Relation / support-level values:

- **Ageing in place.**
- **Connecting families.**
- **Care from a distance.**
- **Managing everyday life.**
- **Interdisciplinary.**
- **Equal access and services.**
- **Collaboration between patients and professionals.**
SCENARIOS - OVERVIEW

We have used scenarios as our method to organise and present knowledge from current situations and create visions for the future. “Scenarios are stories about people and their activities” as John M. Carroll, one of the key figures within scenario-based design, has stated it. Consequently, scenarios can collect and connect information about welfare technology use which can support both analysis and dissemination. Moreover, scenarios can tell stories about current practices and future visions and support vision-based roadmapping. These two methodologies can therefore be used to support and enrich each other.

Structure of scenarios
In accordance with Carroll we organised analysis and creation of scenarios within the following themes:

Setting: What is the setting for technology use? If there are several settings, we choose a central setting for our analysis and presentation of the scenario.

Actors: Who are the actors in the scenario? If there are several actors, we focus on actors which are central to the actors and their activities and health care professionals are typically the key actors.

Goals: What are the goals of the actors? Which changes do the actors wish to achieve in the scenario presented? Carroll writes: Every scenario involves at least one agent and at least one goal. When more than one agent or goal is involved, they may be differentially prominent in the scenario. Often one goal is the defining goal of a scenario, viz. the answer to the question: “Why did this scenario/story happen?” Similarly, one agent might be the principal actor, to answer the question: “Who is this story about?”

Actions: What is the plot of the scenario? What is the sequence of actions? This includes actions that actors do or things that happen to the actors. Sometimes actions change the goals for the actors in the scenario.

Time and perspective of scenarios
This roadmap presents eight scenarios - two from each of the Nordic countries.

Each scenario describes a current setting in 2013 and a future setting (approx. in 2020). Furthermore, each scenario will present both a positive and a negative outcome: one where the welfare technology supports and brings true value to the actors and one where the actors miss their goals because of shortcomings in the technology, use or implementation.

For a full scenario description including references to literature etc., see Appendix A.

Scenario #1: Speech recognition - Finland
Scenario #2: Technologies of understanding - Finland
Scenario #3: A web-based ulcer record for collaboration between patients, specialists and primary care - Norway
Scenario #4: Using remote control for watching television - Norway
Scenario #5: Motion interactive games in home rehabilitation for children - Sweden
Scenario #6: Internet-based activities, social media and older people - Sweden
Scenario #7: Telehealthcare 2020 - Denmark
Scenario #8: Robot vacuum cleaning - Denmark
SPEECH RECOGNITION - FINLAND

**Actor**
Salla is a 19-year-old girl.

**Setting**
Salla had a stroke at the age of 17. Due to the stroke, her problems understanding speech. It is also hard for her to concentrate in an ongoing discussion and when reading long texts (e.g., books). Salla also has mobility problems because of the hemiparesis; she has to use a cane when walking.

**Goal**
Salla wants to manage on her own and live like her healthy friends.

**positive scenario today**
Salla copes well with her current mobility and communication aid devices. When she goes out, she uses her tablet computer, which has special applications for people with a speech defect. She can tap on a picture and show it to her friends or the tablet says the selected word out loud. Sometimes Salla writes words or draws a picture on her tablet to express her opinion, but she has to sit down because she needs to use her healthy hand to write. The applications are easy, but it is a bit slow and difficult way to communicate. But as time goes by Salla has become more fluent with her tablet and the communication applications.

Salla lives with her parents. Her mother had to give up her career after Salla’s stroke to stay home and help her daughter. They have not made any modifications in the home and they do have any assistive technology products such as smart locks (speech recognition), door openers or home health devices.

**After the stroke, Salla had to interrupt her studies in the upper secondary school, but this autumn she resumed her studies with a school aid. Studies are going well, and Salla plans to graduate in four years instead of the usual three years. Although Salla is surrounded by many students at school, it is hard for her to get to know them. Salla sometimes feels sad because she has lost contact with many of the friends she had before the stroke and she is afraid of losing the friends she has left. At the moment, however, she feels excited because she has met a boy called Jarno in a cafe last week. Jarno also has speech problems and he needs help in communication.
similar help devices as Salla to communicate with others. Jarno has an SMS to Salla to ask her out on a date. Negative Scenario Today Salla does not cope well with her communication aid devices. She hesitates to communicate by speech at home, although her parents give her all the time she needs. Salla’s therapist encourages her to speak, although Salla has not made much progress during the last year. Owing to the slow rehabilitation, Salla is afraid of worsening her disability in public. She also has bad memories of being treated like a stupid person when she has tried to speak in public places. Therefore, she prefers to show pictures from her special booklet, which is much quicker than her tablet in everyday situations although it has a limited number of pictures.

Not being able to speak or communicate fluently using the communication applications, she rarely sees her friends, which makes her sad. When she goes out with her friends she uses her tablet, which has special applications. She has participated in several research projects and has tested numerous applications and devices, personalised to meet her needs. Now Salla has a communication application on her tablet that understands her speech and automatically writes the words she tries to say on the screen or the tablet says the words aloud. If Salla has difficulties remembering the words, the tablet analyses the context and offers a range of alternative words to choose from. The communication application also allows Salla to talk on the phone with her parents and friends, which she really enjoys. She talks to the tablet or phone and it converts her speech to a more understandable language. Very seldom she has to write down words. The applications works so well that she can even use it to reserve time in the health care centre or order a taxi using her own speech.

Owing to the highly sophisticated speech recognition system in her mobile devices, Salla could continue her studies at the University of Applied Sciences after graduating from the upper secondary school. She uses the speech recognition system at the university to dictate her essays and exams if the text is too long to write for her. Instead of reading textbook for exams she uses the “from text to speech application” on her tablet and listens to the material as e-books.

Positive Scenario 2020

The speech recognition and communication aid applications have improved dramatically during the past eight years. Salla has participated in several research projects and has tested numerous applications and devices, personalised to meet her needs. Now Salla has a communication application on her tablet that understands her speech and automatically writes the words she tries to say on the screen or the tablet says the words aloud. If Salla has difficulties remembering the words, the tablet analyses the context and offers a range of alternative words to choose from. The communication application also allows Salla to talk on the phone with her parents and friends, which she really enjoys. She talks to the tablet or phone and it converts her speech to a more understandable language. Very seldom she has to write down words. The applications works so well that she can even use it to reserve time in the health care centre or order a taxi using her own speech.

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Negative Scenario 2020

Compared to the year 2012, nothing has changed. The communication aids have not improved Salla’s life at all during the past eight years, although that she has participated in some research projects and tested numerous communication applications on her tablet and smartphone. One of the main reasons for the lack of progress is that there is neither money nor enthusiasm in research to help people with speech disabilities following a stroke. Salla has been frustrated by her lack of progress. She has stopped doing speech therapy and hardly ever tries to communicate by speech even with her parents. Salla still lives at home with her primary care nurse visits her twice a day. Her mother has started working to cover all the expenses.

The school was too hard for Salla so she has dropped out. A big part of her time is spent surfing the Internet and watching films. She is very disappointed with her life and does not want to make any plans for the future.
Anja is a 51-year-old woman, the mother of two grown-up children and the wife of Urho, a 55-year-old Computer Numerical Control (CNC) machinist.

Setting

After the children moved out, Anja and Urho decided to take up their beloved hobby from their younger days - hiking. At first, they made short trips to the surrounding wild but after a while, they decided to make longer trips to conservation areas further away in the north above the Arctic Circle. At first, things were as planned and the couple enjoyed the time together. However, as the time passed on and they decided to take more challenging routes, Anja's hip started to ache. At first, the pain was mild, but gradually it started to hamper their progress. Eventually, they were forced to get back and limit their hiking to less challenging routes. Over time, Anja and Urho took other trips to different parts of the wild but her pain was getting more constant, and it started seriously to limit their active life. Anja decided to seek profession- al help and went to see a physician. Unfortunately, the examinations revealed that her left hip needed to be replaced.

Scenario

Anja was not positive to the news on the upcoming surgery. In the 1990s her mother had undergone hip replacement surgery and was already in a need of a new prosthesis. The primary reasons for the mother’s need were clinical and rehabilitation aspects as well as the quality of the prosthesis material. However, this situation had led Anja to believe that a hip replacement surgery would eventually ruin her life and make her a cripple (anecdotal knowledge).

Anja’s reassurances on the developments in the femoral component and the cup (procedural and conceptual knowledge) did not give her any comfort. Anja did not fully understand her current condition and changes it would lead to in the near future, what was about to happen and how the surgery would actually change her everyday life.

Goal

Anja wants to get her hip functioning again. She wants to resume the same kind of active life with Urho as before.

Positive Scenario Today

The news on the upcoming surgery had really upset Anja. In order to get a better grasp of things, she decided to search more information online. Her search left her baffled and uncertain and she could not create a mean- ingful picture on the basis of online sources she used. Instead of the using the internet, Anja decided to turn to her a number of friends and ask for their views. One of her friends was married to an orthopaedic surgeon who was willing to explain the current situation to Anja (and the related documentation which was riddled medical jargon). This help diminished her fears and eventually she was willing to undergo the surgery. During her recovery, Anja consulted with her friend’s spouse from time to time.
and sometimes very often. Because of their good personal relationship it never became a burden.

Negative Scenario Today
As a rather competent user of information technology, Anja decided to seek more information from the Internet and from her circle of friends. She used search engines and found a discussion board where the topic was discussed. The individual messages in the board contained personal experiences and opinions from individuals who had gone through a joint replacement surgery. Anja already had strong negative feelings towards the operation, silently suffering due to her gradually worsening condition. Her condition also affected her relationship with Urho negatively since the level of intimacy they had shared was no longer an option. Months later, Anja also noticed that the medical details she had shared on the social media were now the property of the service provider, leaving her unable to remove them.

Positive Scenario 2020
As a competent user of information technology, Anja decided to look for more information on the matter. The first thing she decided to do was to look into her personal health information file, which includes her official and updated health documentation from the service provider. In addition, she had alternative versions of the documentation that was ‘interpreted’ without use of any professional jargon. There were, however, parts of the documentation she did not fully understand. To get more help, she decided to ask for more information via the online patient information service, which was implemented as a real-time video conferencing system to be used for the femoral component and the cup. Her consultation with the professional also helped her understand the operation things would be normal after a few months of recovery. As an unexpected bonus, she realised that after the operation things would be normal and updated health documentation from the service provider unit.

After her successful operation, Anja’s medical records were automatically translated for her and her local health service providers. In addition, all physiotherapy and patient instructions were stored in her file. As a pioneer in the field, the used service provider also provided the physiotherapy with instructions through an augmented reality application that helped Anja to actually see from different angles what she should do to support her recovery.

Negative Scenario 2020
Anja never consented to the proposed operation and now it is too late. She is incapable of moving because her hip joint is destructed. She is almost always bed ridden. Even sitting in the wheelchair is too painful although she gets painkillers in very big doses. She is depressed and has lost her zest for life. Her husband Urho is her only link to the outside world.
A WEB BASED ULCER RECORD FOR COLLABORATION BETWEEN PATIENTS, SPECIALISTS AND PRIMARY CARE - NORWAY

**Scenario #3 - A Web Based Ulcer Record for Collaboration Between Patients, Specialists and Primary Care - Norway**

**Actors**
Patients and health care professionals. Robert is a 35-year-old man who has suffered from ulcers twice. The first time Robert had blisters that aggregated. Underlying diagnoses were hypothesized. The first episode lasted for four years, and different care plans were followed. Unfortunately, a new ulcer developed on the same spot three years after the first one had healed due to an accident at work. He consulted his GP regularly, went to the university hospital for follow-up and wanted to care for his ulcer himself at home. A more common scenario would be primary care nurses attending to older peoples’ ulcers in their own homes. The web-based record would be the same in any case. The ulcer team at the university hospital enrols patients to be part of the web-based record system following a specialist consultation. The specialist team also teaches primary care nurses, or patients who care for their ulcers themselves. Pleie.net has a common portal and login page with general information about the service. Participants can also select their own login page directly. All databases are run by the same server and there is a common user database and a patient database with demographic information about the users and the patients which can be linked to all the other databases and applications.

**Setting**
The university hospital offers a web-based ulcer record service (www.pleie.net). The system can be accessed from both a computer connected to the Internet and from mobile phones. It is available for nurses and doctors in the local community, specialist nurses and doctors as well as patients and their relatives. The system consists of databases to store data, an application to communicate images and text between participants and a tool to analyse ulcers. The service includes the ability for a specialist team to give advice to primary care nurses, or patients who care for their ulcers themselves. Pleie.net has a common portal and login page with general information about the service. Participants can also select their own login page directly. All databases are run by the same server and there is a common user database and a patient database with demographic information about the users and the patients which can be linked to all the other databases and applications.

A two-factor authentication on the computer is required; implying username/password and a one-time password sent by a text message from the server to the phone number registered in the user profile. When the service is accessed from the mobile phone, both user name/ password and a one-time link are used. This is in order to maintain security for non-disclosure of sensitive information.

**Goal**
Background for the establishment of the web-based record: Ulcer patients have experienced that different health care professionals convey different opinions about treatment. They may also be meet different nurses who follow different care plans. This makes it difficult to assess the effects of specific interventions.

E-mail based communication with attached images makes immediate interventions possible if the status of the ulcer changes. Rapid intervention should reduce the need for hospital admission. Ulcer patients have experienced that different health care professionals convey different opinions about treatment. They may also be meet different nurses who follow different care plans. This makes it difficult to assess the effects of specific interventions. Options to discuss the development by looking at the stored images and text makes it possible for primary care staff to make common

### Table: Required tools

<table>
<thead>
<tr>
<th>Required tools</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social issues</td>
<td>Communication tools between patients and professionals.</td>
</tr>
<tr>
<td>Health</td>
<td>New tools make daily communication between patient and healthcare staff possible.</td>
</tr>
<tr>
<td>Welfare</td>
<td>Simplify the work for nurses and doctors.</td>
</tr>
<tr>
<td>Security</td>
<td>E-mail based communication with attached images makes immediate intervention possible if the status of the ulcer changes.</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Rapid intervention should reduce the need for hospital admission and faster improvement of the condition can be expected. Options to discuss the development by looking at the stored images and text makes it possible for primary care staff to make common decisions.</td>
</tr>
</tbody>
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*Table sent by a text message from the server to the phone number registered in the user profile. When the service is accessed from the mobile phone, both user name/ password and a one-time link are used. This is in order to maintain security for non-disclosure of sensitive information.*
care plans and improve knowledge about the individual patient. This system should simplify the collection of data both at the university hospital, the GP’s and in the patient’s home. It is expected that patients should experience high quality care and follow-up by health care professionals as well as a sense of more flexibility and autonomy. In addition, it is important to have access to stored images to see improvements over time.

Scenario Today

“If anything new is discovered I can take a photo and send it immediately, usually I get a response the same day.”

After hospitalisation at the Department of Dermatology, patients or their primary care nurses are offered guidance for further ulcer treatment from the expert ulcer team through the web-based record. The patients or the primary care nurses take digital photos of the ulcers, and the option to store the ulcer images helps to compare images and observe how the ulcers change over time. The system is considered very useful, especially the possibility to use the mobile phone to connect health care services involved and the mobile phone camera to document changes in ulcers. The web-based ulcer record is currently not integrated in the electronic patient record.

Although users are positive, it is a challenge to obtain a widespread use of the web-based ulcer record. Primary care nurses seem reluctant to use it and report that they do not have time to change routines or that they are unfamiliar with the technology involved. Users have expressed another constraint: The professional language used by the experts. When sending images it is difficult to express the context and circumstances in writing and to ask questions. This can be perceived as a barrier for using the record. Images are not always enough, so a combination of physical controls and follow-up via data would be ideal. Another challenge reported is that no fully acceptable technological solutions are available to comply with legal as well as security requirements for accessing sensitive data by mobile phones. Thus, secure solutions for mobile communication are lacking.

The increasing problem of ulcers for instance caused by diabetes, the increasing costs of out-patient consultations caused by ulcers and the new political goal to move services closer to the municipalities and patients’ homes, call for a stronger focus and coordination of health care services and increased use of this kind of tool.

Positive Scenario 2020

In 2020 the ulcer record is integrated with a net-based patient record. Within this record, a number of services are developed both for internal use at the hospitals and for communication between different providers of health care. The current challenge between standardization of data and specificity and flexibility of data for communication within individual services is solved. New tools allow secure and practical daily communication between primary care nurses, GPs, patients and specialists. In the primary care district offices and in hospital departments, stored text and images are available on large screens as well as mobile units. It allows for detecting developments over time and discussions of effects of different interventions. This is combination improves knowledge, skills and interventions across different health care providers and users.

For professionals and patients, mobile units are equipped with high quality cameras and images are easily stored and transferred. In the homes, large screens are installed connecting the Internet, telephone, radio, TV, smart home technology, the ulcer record, and self-help programmes within a general health care package, as well as web-based features. These programs are also available on mobile units. The big screens are operated as preferred by patients or professionals by touch screen, physical movements, voice or remote control.

Negative Scenario 2020

There are problems with establishing a uniform database structure for patient data. This leads to difficult procedures for e.g. on authentication and levels of access: Who has access to what kind of data? The challenge of establishing unique addresses for different units and actors in health care services who are expected to communicate, is causing delays and confusion when data intended for one service arrives at a different one.
SCENARIO #4 - USING REMOTE CONTROL FOR WATCHING TELEVISION - NORWAY

Trends & Drivers
- The need for assistance with daily activities and the importance of technology in supporting this.
- Karin's increased isolation due to her dementia.

Social Issues
- Karin's isolation and the impact on her mental health.

Health
- Alzheimer's disease and its progression.

Strong/Medium/Low
- Low
- Midden

Use Case
- Karin, aged 58, was recently diagnosed with Alzheimer's disease after visiting the Memory Clinic regularly for the past three years.
- Karin's disease is now progressing rapidly.

Actor
- Karin, aged 58, has been living with her family and can manage her daily errands. However, her functional level has changed over time as her dementia progresses.

Setting
- Karin is alone at home every day and she sometimes feels lonely and occasionally anxious.

Environment
- Karin's environmental attention and ability to organise and plan activities has deteriorated.

Positive Scenario Today
- The occupational therapy project worker suggests that Karin may try a simple remote control for the TV.
- She is willing to try the remote control (SRC) and use it in the correct order. One RC operates the TV, while the second operates the digital tuner.
- Karin chooses the ordinary RCs instead of using the SRC.

Actor
- Karin may try a simple remote control for the TV. She is willing to try the SRC and use it in the correct order.

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Environment
- Karin's environmental attention and ability to organise and plan activities has deteriorated.
Julie tries to get support from the Internet shop, describing the problem by e-mail. After three weeks and three more e-mails she gets a response, a telephone number to the SRC product developer, who calls. They are helpful and give instructions on the phone how to install and see if Julie has good technical insight; managing this quite well. Unfortunately, the SRC does not connect with the TV and tuner. She calls the product developer again. Unfortunately, this SRC does not communicate with satellite TV. Julie gets angry and throws away the SRC, regretting the time she has wasted and it leads to more regretting the time she has wasted and it leads to more.

Julie and Karin did not know what to buy, nor could they afford it. Julie called the producers for further information. Julie got the brochure "Welfare technology to support dementia". These were organised in a package with four assistive technologies: a storge area, a digital calendar, an item locator and a simplified remote. These were recommended as best practice to support younger people with dementia. In every activity, assistive technologies were listed with home page and telephone number. Julie looked into the home pages where to seek proper help, cried and demanded professional help now! The therapist called 10 days later to assess the situation. Unfortunately, Karin and Julie had to wait for six months for a home visit. This was pointless since Karin’s disease progressed and that they needed support to reduce stress and necessary to ask an occupational therapist for a home visit; they sent her a link to a website.

Evidence of the most needed technologies were based on randomised controlled studies. The costs for this package was USD 1000. If they had financial problems, they could apply for a 50% reduction. The package could be sent within a few days. They agreed that it was necessary to ask an occupational therapist for a home visit; the therapist called 10 days later to assess the situation. Unfortunately, Karin and Julie had to wait for six months for a home visit. This was pointless since Karin’s disease would progress during that period of time - they needed professional help now! The firms could provide access to professional help from the occupational therapists working in the firm but the cost for high and Karin did not cover implementation of assistive technologies. The firm advised Julie to contact the Assistive Technolo- gies Center to get more information; they sent her a link to a website.

Julie opened the very instructive National Assistive Technology Center website and found information about available technologies for people suffering from dementia. These were organised in a package with four assistive technologies: a storage area, a digital calendar, an item locator and a simplified remote. These were recommended as best practice to support younger people with dementia. In every activity, assistive technologies were listed with home page and telephone number. Julie looked into the home pages wondering what she needed and the costs involved. But Julie and Karin did not know what to buy, nor could they afford it. Julie called the producers for further information. They told her that they could send her research reports to support her finding out about their needs. But Julie, who already were tired supporting her mother and finding out where to seek proper help, cried and demanded professional supervision. The firms could provide access to professional help from the occupational therapists working in the firm but the cost for high and Karin did not cover implementation of assistive technologies. The firm advised Julie to contact the Assistive Technologies Center to get more information; they sent her a link to a website.

Julie has read on the Internet about several simple remote controls. She bought one but it was made for analogue TV signals.

Implementing use of a simple remote control is a challenge. Karin’s motivation and openness towards having a new product in her home, is crucial for accepting the de- vice and seeing its usefulness for her everyday technologies. For Karl, watching TV is a part of her preferred activities, and the TV means company and entertainment for her, and also keeps the anxiety under control. However, dementia progresses, and follow-up is vital for checking whether the device is used or not, if the batteries needs to be changed, or maybe the person has to be instruct- ed again on how to use the device. For Julie, the SRC is helpful and she feels more independent. Julie can watch TV and is able to select one of four preferred channels on her own. This means that Julie does not need to feel guilty about not being at home or sleeping in the morning.

For Karin, watching TV is a part of her preferred activities and seeing it as a part of her everyday technologies. The occupational therapist and Julie support Karin to easily chosen and adaptation is individualised. Karin is very pleased that she is able to manage these to her meaning- ful activities since she spends many hours on her own in the home. The occupational therapist will follow up on Karin and Julie on a regular basis knowing that Karin’s disease pro- gresses and that they need support to reduce stress and make sure that Karin continues to participate in meaning- ful occupations. Finally, Karin and Julie can get in contact with the ICT engineer who is a part of the support health team to get support if the technology does not work.

Negative Scenario Today

The occupational therapist advises Karin to explore the use of voice recognition - TV broadcasting. Karin tells that she also finds it hard to find pictures on the phone. Julie has good technical insight and makes sure that Karin continues to participate in meaning- ful occupations. Finally, Karin and Julie can get in contact with the ICT engineer who is a part of the support health team to get support if the technology does not work.

Julie has read on the Internet about several simple rem- ote controls. It is difficult to understand which RC will be the best for her mother. However, she orders one from an online shop. The product is originally developed for peo- ple with sight, coordination and learning difficulties. The instructions do not show how to combine two RCs, because it is made for analogue TV signals.

Implementing use of a simple remote control is a chal- lenge. Karin’s motivation and openness towards having a new product in her home, is crucial for accepting the de- vice and seeing its usefulness for her everyday technologies. For Karl, watching TV is a part of her preferred activities, and the TV means company and entertainment for her, and also keeps the anxiety under control. However, dementia progresses, and follow-up is vital for checking whether the device is used or not, if the batteries needs to be changed, or maybe the person has to be instruct- ed again on how to use the device. For Julie, the SRC is helpful and she feels more independent. Julie can watch TV and is able to select one of four preferred channels on her own. This means that Julie does not need to feel guilty about not being at home or sleeping in the morning.

Negative Scenario 2020

In 2020 broadcasting has become internet-based and the menu is flexible and easy to use. The functions are easily chosen and adaptation is individualised. Karin and Julie have a large screen at home connected to the Internet, telephone, radio, TV and smart house technol- ogy - all web-based features. At the coffee table there are two small portals offering same functionality as the TV and tuner. Julie has good technical insight, managing this quite well. Unfortunately, the SRC does not connect with the TV and tuner. She calls the product developer again. Unfortunately, this SRC does not communicate with satellite TV. Julie gets angry and throws away the SRC, regretting the time she has wasted and it leads to more regretting the time she has wasted and it leads to more.

Julie and Karin did not know what to buy, nor could they afford it. Julie called the producers for further information. Julie got the brochure "Welfare technology to support dementia". These were organised in a package with four assistive technologies: a storage area, a digital calendar, an item locator and a simplified remote. These were recommended as best practice to support younger people with dementia. In every activity, assistive technologies were listed with home page and telephone number. Julie looked into the home pages wondering what she needed and the costs involved. But Julie and Karin did not know what to buy, nor could they afford it. Julie called the producers for further information. They told her that they could send her research reports to support her finding out about their needs. But Julie, who already were tired supporting her mother and finding out where to seek proper help, cried and demanded professional supervision. The firms could provide access to professional help from the occupational therapists working in the firm but the cost for high and Karin did not cover implementation of assistive technologies. The firm advised Julie to contact the Assistive Technologies Center to get more information; they sent her a link to a website.

Julie opened the very instructive National Assistive Technology Center website and found information about available technologies for people suffering from dementia. These were organised in a package with four assistive technologies: a storage area, a digital calendar, an item locator and a simplified remote. These were recommended as best practice to support younger people with dementia. In every activity, assistive technologies were listed with home page and telephone number. Julie looked into the home pages wondering what she needed and the costs involved. But Julie and Karin did not know what to buy, nor could they afford it. Julie called the producers for further information. They told her that they could send her research reports to support her finding out about their needs. But Julie, who already were tired supporting her mother and finding out where to seek proper help, cried and demanded professional supervision. The firms could provide access to professional help from the occupational therapists working in the firm but the cost for high and Karin did not cover implementation of assistive technologies. The firm advised Julie to contact the Assistive Technologies Center to get more information; they sent her a link to a website.

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Negative Scenario 2020

At the last consultation on the memory clinic, Karin and Julie got the brochure "Welfare technology to support memory loss". In the brochure there were pictures of several assistive technologies. The text claimed that younger people with onset of dementia could benefit from specific technologies. Several producers selling the assistive technologies were listed with home page and telephone number. Julie looked into the home pages wondering what she needed and the costs involved. But Julie and Karin did not know what to buy, nor could they afford it. Julie called the producers for further information. They told her that they could send her research reports to support her finding out about their needs. But Julie, who already were tired supporting her mother and finding out where to seek proper help, cried and demanded professional supervision. The firms could provide access to professional help from the occupational therapists working in the firm but the cost for high and Karin did not cover implementation of assistive technologies. The firm advised Julie to contact the Assistive Technologies Center to get more information; they sent her a link to a website.

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MOTION INTERACTIVE GAMES IN HOME REHABILITATION FOR CHILDREN - SWEDEN

Actor
Jessica Anderson, 12 years, diagnosed with moderate unilateral cerebral palsy.

Setting
Home of the Anderson family.

Scenario Today
(Both negative and positive)
Jessica comes home from school at three thirty in the hallway and hangs up her jacket. It is quiet in the house the other family members are not home yet. She walks to her room and sits down in front of her desk and turns on Facebook and chatting with some friends she met last summer at a camp for children with disabilities. For a while she Skypes with John, a guy from the camp, and they try to play an online game together. John, who also has cerebral palsy, sits in a wheelchair and is considerably more disabled than Jessica. He cannot quite keep up with Jessica’s speed and playing together is a bit frustrating.

- Jessica, dinner is ready, Mom shouts from the kitchen.
- OK, Jessica sighs, and reluctantly goes into the living room. She switches on the TV and the Xbox and opens the drawer with the games. She has several motion interactive games to choose from, but starts to be pretty tired. She chooses a sports game and inserts it into the console.

Although it took a while to get going, it is pretty fun once she gets started. After a few minutes she has to take off her sweater as she starts to get quite sweaty.

Positive Scenario 2020
Jessica comes home from school at three thirty in the hallway and hangs up her jacket. None of the other family members are home yet.

### SCENARIO #5 - MOTION INTERACTIVE GAMES IN HOME REHABILITATION FOR CHILDREN - SWEDEN

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<thead>
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<th>Weak</th>
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<td>Environmental</td>
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**Trends & Drivers**

**Health**
The Internet enables her to keep contact with friends and empowers her to take care of themselves; Game based rehabilitation is more motivating for young patients.

**Social**
Less real-life face-to-face contacts due to the use of social media apps.

**Economic**
The assistance and help is available for a larger amount of patients.

**Environmental**
Rehabilitation can be done at home.

**How interactive games can fit into rehabilitation**

- Jessica is in control and able to take an active role. The application supports social connections with and amongst of significant others and families.
- It is easy to use and does not require any special skills.
- Jessica’s physiotherapist can log into the portal and guide the physical training and execute programs.

**Future Themes / Capabilities**

- Ensures patient-controlled and safe - technology platform and a very familiar interaction design pattern.
- Jessica chooses her own game and selects her own option for rehabilitation training and the application supports social interaction and social connections with signiﬁcant others and families.
- Jessica chooses her own rehabilitation program and the application supports social interaction and social connections with signiﬁcant others and families.

**Comments**

- When a patient encounters problems with her technical solutions, it is quite expensive to get help.
- Motion sensors and interactive games based on established - and cheap - technology-platform and a very familiar interaction design pattern.
- Jessica is in control and able to take an active role. The application supports social connections with and amongst of significant others and families.
- Jessica is in control and able to take an active role. The application supports social connections with and amongst of significant others and families.

**Mock-up**

- The mock-up shows how the application fits into rehabilitation for children with disabilities.
- Perfect, Jessica thinks, now I can play without my little brother bothering me.

She walks into the living room and stops in front of the multimedia wall. Through short voice commands she starts the television and gaming console and logs on to the youth rehab portal. At the left side of the screen she can see those among her friends who have already logged in. In John, a guy she met at a camp for children with disabilities, is online; they often play together in the afternoons. By pressing on John’s photo with her hand she calls him up.

- Hey, Jessica, are you up for a revenge? John laughs when he answers.

-John, I intend to win this time, Jessica replies. They turn on their cameras and now John appears on the TV screen in front of Jessica; she can also see a photo of herself on the screen.

- OK.

- Hey it’s going? Hannah asks while she appears on the TV screen. You look sweaty! Did you have a tough game?

- Yes, we are absolutely exhausted.

-Nice. I can see that you two have been pretty busy with the training lately and you have burned many calories and also improved your handicap scores. Hanna has checked out their training profiles while they were playing.

- How about a little Tai Chi to finish up? She suggests.

- OK.

When they select Tai Chi another person pops up on the screen; this time it is Peter, an avatar, who will take them through the session. To the tunes of soft music Peter instructs them in a series of movements and they also get individual feedback on their performance through the motion tracking system of the gaming console.

- Bend your knees more, Jessica!

- Straighten your back, John.

-Hey how’s it going? Hannah asks while she appears on the TV screen. -You look sweaty! Did you have a tough game?

- My gosh, this guy doesn’t miss anything! - It is certainly not possible to cheat, Hanna giggles.

She continues to play a couple of games on her own, competing with a computer-generated avatar. It is a hard and even game, which takes about 15 minutes before Jessica finally wins the last set. When she returns to the youth rehab portal she can see that Hanna, her physiotherapist from the summer camp, has logged in and she calls her up.

- Hey how are you doing? Hannah asks while she appears on the TV screen. -You look sweaty! Did you have a tough game?

- Yes, but it is not as fun when I have to play alone.

After finishing the Tai Chi session a few other friends have logged onto the platform and Jessica hangs out for a while before it is time to sign out and deal with today’s homework.

Negative Scenario 2020

Jessica comes home from school at three thirty in the afternoon. She throws her school bag on the floor in the hallway and hangs up her jacket. None of the other family members are home yet.

- Alone again, Jessica moans. I guess I can try a little Tai Chi to finish.

When she has selected Tai Chi another person pops up on the screen; this time it is Peter, an avatar, who will lead the session. To the tunes of soft music Peter instructs a series of movements for Jessica who also get individual feedback on her performance through the motion tracking system of the gaming console. Unfortunately, the motion tracking system does not work properly and the feedback she gets is quite difficult to understand.

- Bend your knees more, Jessica!

-John, I can’t bend them anymore! It is a bit frustrating not being able to follow the instructions, or get the system to adapt to her abilities. Jessica turns off the game without finishing. At the portal she can see that she is still the only one logged in. It would be more fun if we were more users, she thinks while she logs out and starts to deal with today’s homework.
**SCENARIO #6 - INTERNET-BASED ACTIVITIES, SOCIAL MEDIA AND OLDER PEOPLE - SWEDEN**

**Trends & Drivers**

Internet-based activities and social media play an important role to enhance older people’s possibilities for maintaining an active role in society and a social network even if geographical distances increase and/or mobility problems occur.

**Future Themes / Capabilities**

Actor

This scenario starts in a rural village in northern part of Sweden. We meet Lilly, a 76-year-old woman living alone. Lilly has been living alone in her house for more than 15 years now, the place where she grew up; she left to work in a bigger city and came back when she retired. Lilly has no children but a large family; she has two siblings and many nephews and nieces as well as neighbours and friends who care about her. Lately, Lilly has experienced a decline in health with back pain, heart failure and fatigue, although she still manages to take care of herself and her house, she has big problems with mobility outdoors and when travelling. Lilly has no driving licence but until recently she has taken the bus to go shopping, to go to the library etc. But this is not possible any more.

**Outlook**

Lilly wakes up, makes breakfast and eats by herself. She would like to have company today so she calls her sister Rut. Rut lives in a bigger city and came back when she retired. Lilly has had her own computer for three years; she uses the computer to write letters (as she thinks her handwriting is impossible to read), to send e-mails, pay bills and read newspapers; she also uses a genealogy programme. She used the genealogy programme more often on a daily basis when she was able to go to the library where a lot of information was available.

**Goal**

Lilly would like to be more socially active and to participate and be active in society despite her mobility problems.

**Actor**

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**Scenario Today**

Lily wakes up, makes breakfast and eats by herself. She would like to have company today so she calls her sister Rut. Rut lives in a bigger city and came back when she retired. Lilly has had her own computer for three years; she uses the computer to write letters (as she thinks her handwriting is impossible to read), to send e-mails, pay bills and read newspapers; she also uses a genealogy programme. She used the genealogy programme more often on a daily basis when she was able to go to the library where a lot of information was available.

**Goal**

Lilly would like to be more socially active and to participate and be active in society despite her mobility problems.
She realises that the group has their weekly meeting right now at the library and that she is unable to join. It is a lovely weather today but Lilly feels down and would really like to have something fun to do. She starts to read some old gardening magazines but stops when she finds out she already knows all of it, she would like to have something that challenged her within the area of gardening, now when she no longer able to dig in the yard or work with the plants. She has so much experience in gardening but does not know where to use it anymore. The newspaper is delivered by post at about 1 pm and she reads about the party leader debate and the topics that probably would get most attention in the debate today. Lilly has a lot of opinions about these topics but no one to discuss with - she has to be patient and wait until someone comes visit.

Scenario 2020

Lilly wakes up, takes a shower and starts preparing breakfast. She knocks on the screen next to the table to see who is online and who wants to have e-breakfast with her. Her neighbour Anna and her sister Rut is there, they have already started to eat and Lilly joins them. On the table Lilly has the daily e-newspaper as always, and she skims through the news and the discussion with Anna and Rut is both about gossip and news. This way of starting the day updates Lilly and makes her feel good.

Lilly loves when someone comes to visit her, she usually serves cake or buns to her guests and therefore she almost empty. By using her touch screen integrated in the kitchen table she can enter her on-line store where she can take a virtual walk through the nearby grocery store and pick up the articles she needs. After paying, an estimated time for when the articles will arrive is shown; they will come later today with the bus.

She connects herself to the cloud where the family has their shared collection of family recipes, both culturally important "old" recipes and new ones they have tried during family dinners. Lilly picks out one of the traditional cakes that now has 12 comments made by members of the family - all very positive and the cake is called "the best in the world". She plans to make the cake in the afternoon as she realises that the genealogy group meeting starts in a few minutes.

She chooses to move from the kitchen table to the couch where she can rest her back while discussing with her genealogy friends using her multimedia screen on the wall in the living room. Most members of the group meet at the library but Lilly, and sometimes also others, join the group through Skype. She listens to the short introductory lecture and takes part in the following discussion about opportunities and obstacles in the new genealogy programme available for downloading.

After the genealogy group meeting Lilly has a sandwich and chats with a few people from the genealogy group online. After half an hour Lilly realises she needs to update her own blog about gardening. She ends the lunch chat and starts to work on a new update for her blog.

Boosted by all positive feedback from the blog she collects her goods that have arrived from the store and prepares the cake. Afterwards she enjoys a piece of the cake with a cup of coffee while listening to the party leader debate and tweeting about ideas and opinions.

Possibilities 2020 or Evaluation of goals

Lilly can continue to take an active part in the society and find her everyday life meaningful.
# SCENARIO #7 - TELEHEALTHCARE 2020 - DENMARK

## Trends & Drivers

### Future Themes / Capabilities

- **Social Issues**
- **Healthcare**

### Health Visions

<table>
<thead>
<tr>
<th>Health Perspective</th>
<th>Social</th>
<th>Health</th>
<th>Technology</th>
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<tr>
<td>The Health perspective is rooted and validated in perspectives below</td>
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**Telehealthcare system, data acquisition, RFID, Intelligent medication, Virtual environment, avatar.**

### Actors and Stakeholders

- **Patients with COPD**
- **Nurses at the health care centre**
- **Relatives to patients with COPD**
- **Hospital doctors**
- **Administrative staff from the municipality**

### Goals

- **Hospital doctors**
- **Administrative staff from the municipality**

### Positive Scenario 2020

Tom was diagnosed with COPD four years ago. He has been admitted through the TeleHealthCare system for the past 1½ years. The TeleHealthCare system is an interactive platform which collects all relevant data on Tom; the platform is also used for online, virtual contact with the patient. The physiotherapist has the time to stop by. Data from Tom’s interactive Wii training is transmitted directly to the physiotherapist’s computer whenever he has the energy for it. The Wii gives Tom the possibility to train and exercise whenever he has the energy for it. It is the year 2020, and healthcare has changed considerably because of new technologies.

### Setting

- **The homes of COPD patients.**
- **The new technologies for COPD patients are focused on functional improvements.**
- **The individual’s well-being in healthy surroundings.**
- **The new technologies for COPD patients are focused on adaptive technologies.**
- **The new technologies for COPD patients are focused on intelligent healthcare applications.**

### Goals

- **General practitioners.**
- **Hospital doctors.**
- **Administrative staff from the municipality.**

### Positive Scenario 2020

- **Tom’s interactive Wii training is transmitted directly to the physiotherapist.**
- **Tom can assess data, monitor his condition and change the treatment if needed.**
- **Relevant data is also transmitted automatically by a little chip embedded Tom’s leg. RFID tags structure the data and link them by keeping track of the medication, the patient, the equipment, and the staff. This can contribute to increase the patient’s safety.**

### Actors and Stakeholders

- **Patients with COPD**
- **Relatives to patients with COPD**
- **Nurses at the health care centre**

### Goals

- **General practitioners.**
- **Hospital doctors.**
- **Administrative staff from the municipality.**

### Positive Scenario 2020

- **Tom’s interactive Wii training is transmitted directly to the physiotherapist.**
- **The physiotherapist has the time to stop by.**
- **Data from Tom’s interactive Wii training is transmitted directly to the physiotherapist.**
- **Tom can assess data, monitor his condition and change the treatment if needed.**

### Actors and Stakeholders

- **Patients with COPD**
- **Relatives to patients with COPD**
- **Nurses at the health care centre**

### Goals

- **General practitioners.**
- **Hospital doctors.**
- **Administrative staff from the municipality.**

### Positive Scenario 2020

- **Tom’s interactive Wii training is transmitted directly to the physiotherapist.**
- **The physiotherapist has the time to stop by.**
- **Data from Tom’s interactive Wii training is transmitted directly to the physiotherapist.**
- **Tom can assess data, monitor his condition and change the treatment if needed.**
During the period where Tom has been a part of the TeleHealthCare system he has only been really sick once; he got a cold, which progressed to pneumonia. The RFID received data from pressure sensors in the walls and floors about his changed movements. The RFID could register these changes with all the other data and informed his doctor. The doctor thought the situation was acute and that a quick response was necessary. Tom needed some blood tests, which the robot assistant in the TeleHealthCare system managed. The robot assistant performed blood tests using camera sensors to reveal even the smallest veins and in addition it can also analyze the blood sample. When all data are registered in the RFID the doctor can access all the current information about Tom. The doctor contacted Tom and his wife online (virtually) and initiated a medical treatment. Due to the rapid response Tom’s condition did not accelerate.

Before Tom was assigned the TeleHealthCare platform he was always admitted to the hospital whenever his condition worsened. In those situations his respiration rapidly deteriorated because of all the fuzz such as being picked up by the ambulance, being transported to the hospital, being transferred from the stretcher to the bed, experiencing temperature fluctuations and responding to all the health professionals’ questions etc.

In general, with the TeleHealthCare system Tom is much more satisfied and he feels better. Before he had major problems remembering when to take his medication. In those situations his respiration was depressed. Now Tom gets intelligent medication to avoid that; this means he only has to take a pill once a month and it delivers specific doses when needed. This is made possible by a drug delivery technology, which uses molecular transporters and Nano particles, which deliver medicine directly to a specific part of his body. Tom’s experience with the intelligent medication is that he is feeling better. Before he had major side effects (such as terror of hands) due to his acute medication, but that is now history because the intelligent medication system targets doses on a daily basis and thereby decreases his need of acute medication. The RFID automatically reads the medication dose and acts.

Negative Scenario 2020

Tom has been admitted through the TeleHealthCare system for two months and he is not quite happy about it. First of all it does not make him feel safe and he does not like the feeling of being monitored all the time. All the sensors in the house and the little chip in his leg registers everything down to his smallest movement. That makes him feel lonely and isolated with his illness compared to earlier where the doctor, nurse and physiotherapist came round to visit him on a weekly basis. In the old days Tom had the feeling that they really understood what he was and how he lived, and that they even cared who Tom was and how he lived, and that they even cared who Tom was and how he lived, and that they even cared who Tom was and how he lived, and that they even cared who Tom was and how he lived, and that they even cared who Tom was and how he lived, and that they even cared who Tom was and how he lived, and that they even cared who Tom was and how he lived, and that they even cared who Tom was and how he lived, and that they even cared who Tom was and how he lived, and that they even cared who T
ROBOT VACUUM CLEANING - DENMARK

Actors
Residents in the nursing home and the staff who take care of the residents. The primary focus is on the staff responsible for both cleaning and personal care services for the residents.

Setting
The setting is nursing homes in four municipalities in Denmark. Robot vacuum cleaning was intended primarily for use in the common areas in the nursing homes; secondly in the private apartments associated with the nursing homes. Vacuum cleaning in the common areas was carried out mostly when the residents were not present there. Vacuum cleaning in the private apartments was carried out in two ways: in connection with other tasks the staff had to perform for the residents or when the robot vacuum cleaner was started automatically or by the residents when they left the apartment for a while. The most appropriate use of the robot vacuum cleaner was when it was started and vacuuming was performed without further involvement of monitoring by the staff.

Goals
The goal of the residents is first of all that their apartments are vacuumed and that the level of cleaning is acceptable. The goal of the staff is improvement of the working environment and to spend fewer resources on vacuuming and more on doing other tasks together with the residents.

Actions
In the evening after the residents have been eating dinner in the common areas, they are followed back to their private apartments and the common areas are left without activities during the night. Staff who work the evening shift start the robot vacuum cleaner and the common areas are vacuumed during the evening. The time staff used to spend on vacuuming is used for talking with the residents and helping them with different personal care tasks, which the residents feel add value to their daily life. This is the positive part of the scenarios below.

But the staff have to empty the dust box in the robot vacuum cleaner after each vacuuming because the box is rather small and will leave traces of dirt on the floor if it is too full (Rasmussen et al. 2009). This is done every time before the vacuuming is started and the staff must wear a dust mask and gloves to prevent allergies (Servicestyrelsen 2011). This is the negative part of the scenarios below.

Positive Scenario Today
It is evening at the nursing home. Staff are helping the residents to their private apartments to settle for the night and help them with personal care. Yvonne, a nurse, helps John, a resident, to his apartment.

The apartment is clean because the nursing home has invested in robot vacuum cleaners. John can feel the difference and especially that the staff have more time to talk. Before when they were vacuuming in his apartment it was impossible to have a conversation because of the noise. Now it is nice and clean, no noise and there is time for talking. Yvonne and John talk about...
the activities of the day, the weather and the plans for tomorrow. Yvonne has seen the weather forecast, which promises sun tomorrow and they will see if they can plan to spend some time in the garden.

After helping John Yvonne goes on help two other residents. The cleaning staff have put the food away and the robot vacuum cleaners are started to clean the common areas while the residents sleep.

Negative Scenario Today

Yvonne, a nurse, helps John, a resident to his apartment. The apartment should be clean because the nursing home has invested in robot vacuum cleaners for each apartment and for the common areas. But when Yvonne and John come into the apartment they smell smoke. John gets nervous he is afraid of fire as he is not able to walk without help. Yvonne calms him down and places him in a chair outside the apartment.

Yvonne looks inside the apartment and finds the robot vacuum cleaner stuck on the deep-pile carpet. The person who started the robot vacuum cleaner forgot to empty the dust box and clean the filter and brushes, and when the robot hit the deep-pile carpet it got stuck and the motor was overheated.

Yvonne tells John what happened and he is now convinced that it is safe to go to bed. Yvonne opens the window to ventilate the room while she removes the robot vacuum cleaner and promises John that she will vacuum his carpet tomorrow. John is rather upset and cannot sleep. He calls Yvonne and asks her to bring him a sleeping pill. He tells her that he will never have a robot vacuum cleaner in his apartment.
Developing and testing the Nordic Framework

Insights from the literature review will guide the further development and testing of a framework for understanding welfare technology in a Nordic perspective.

Designing and conducting studies of welfare technologies in use

There is need for empirical studies to provide new knowledge on the effect of technologies being integrated into work practices and everyday lives of clients. The literature review is an important element of the common knowledge base on welfare technology. However, to develop our knowledge base further empirical studies on welfare technologies in use should be designed and performed. The theoretical and methodological approach should be interdisciplinary and the users’ perspective should be included at all stages of the study.

Living labs are suitable for performing empirical studies of welfare technologies in use. Living labs are comprehensive and complex tasks, which are ill-defined and knowledge management is a key issue. What are the learning activities in relation to the technologies and how is the knowledge to be shared? Through living labs there is a potential for learning from each other and establishing a stronger Nordic cooperation. Our suggestions for future collaboration and research are in accordance with the recommendations of the Centre in setting up networks. Our suggestions for future collaboration in research and education will contribute to technology and the will to provide funding for testing technologies. The Centre believes in the potential for learning from each other and establishing a stronger Nordic cooperation.

FUTURE WORK

Future studies on welfare technology practices will give us a broader and critical perspective on technology, learn how to operate products, apply their capacities in the creation of new health services, and make them function smoothly in everyday practice involving patients and clients. Health care professionals must also have knowledge about how innovation processes should be initiated and managed, how public investments are regulated, how issues related to scalability, standardisation and interoperability of technologies.

The organisations involved in the NordRoad project intend to collaborate on the development of curriculum and teaching modules in welfare technology for students, at bachelor, master and PhD level in the Nordic countries. Assessment and mapping of already existing activities involving welfare technology at our universities will be made and shared through benchmarking. This review study and the development of the framework and the design for empirical studies on welfare technology practices will give an overview of the field as well as successes and failures of welfare technologies in the Nordic countries. This overview and knowledge will form the basis of the curriculum and teaching modules.

FUTURE DIRECTION - FUTURE WORK

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Welfare technology - “Handle with care”

The term welfare technology joins the ranks of several other concepts promoted by governments in the Nordic countries to solve challenges related to efficiency and quality in the delivery of public services. This framework in a contribution to existing knowledge on the understanding of Nordic welfare technology. In order to get an overview of the existing research literature we suggest a literature review to be conducted of existing models of ICT evaluations. We also suggest that empirical studies of welfare technologies in use are carried out; together these will establish a common knowledge base concerning welfare technology.
This project offers advice concerning the practical application of the activities derived from the project as well as a published Roadmap. The aim of the Roadmap is not to give answers, merely to provide users with tools to facilitate investigation of welfare technology in their own domain.

This is done by some general considerations, and by giving two examples of how the receiver might apply the Roadmap. We find there are two main perspectives for use of the Roadmap:

- As a learning tool where students can get a perspective on welfare technology issues, and the impact of technology on their work.
- As a tool to support decision-makers in both public and private settings.

The Roadmap can be used in private companies to support decisions on developing services and products. In the public domain it can be a tool to support the choice of technology and/or technological solutions. It is important to emphasise that the Roadmap is meant to support decisions and facilitate work processes.

Roadmap elements

- Trends and drivers: The trends and drivers are derived partly from the scenarios presented, partly from other roadmaps from both practices and researchers. We believe, however, that the eight scenarios pinpoint the main capabilities. The user should be aware of this, and discuss the relevance if using the Roadmap.
- Linkage between drivers and capabilities: The linkage between trend/driver and thematic capabilities is a matter of perspective and prioritisation. Hence, the users are encouraged to make this assessment themselves, especially if they find further capabilities. In that case the user ought to facilitate a process where this matter is discussed.
- Examples of usage

The following section provides some suggestions on how the Roadmap might be used as a facilitating tool.

Students

When a student or a group of students work with problems from practice as a part of their curriculum or during clinical placement, they can describe a scenario, similar to the scenarios in this Roadmap, derived from their experience. By applying the case to the roadmap structure, they will be obliged to discuss the impact of technology in their professional life.

Companies

A private company is recommended to perform a full-scale technological roadmap. The NordRoad Roadmap can be seen as a tool to qualify the findings that the company gets from their own roadmap work. This could be helpful whether the two roadmaps are coherent or not, as it initiates further discussion of the strength and reliability of the company roadmap.

Research

In the area of science and research, there is a growing trend (postulate) within interdisciplinary research. One of the challenges is to define the purpose and goal of the research. The Roadmap can facilitate a discussion where researchers can qualify the discussion in relation to the general trends and capabilities identified.
LIST OF APPENDICES

- Appendix A: Full description of 8 scenarios including references
- Appendix B: Full description of the Framework for understanding Nordic welfare technology, including references

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