Technical Foresight Report
Social Wellbeing for Active Healthy Ageing
Executive Summary

Social wellbeing is identified as increasingly important for active healthy ageing, where a good example is that loneliness among elderly people leads to an increased risk for frailty and associated physical conditions. The European population is at the same time undergoing a drastic change in demographic composition. The overarching challenge is thus to meet this societal change and the problems associated with an increased life-span within the bounds of the available resources.

The identified trends include the internationalization of health services, the proliferation of digital communication tools including social computing (even for the elderly), the importance of social connectedness for independent living, the expected focus from employers on prevention potentially driven by analysis of Big Data and social data, the introduction of self-care supported by online societies and through direct contact with experts, the Web as a platform for tailored communication services, and the quantified self as a driving factor for new social services.

The challenges outlined are grounded in the need for social connectedness, as loneliness is seldom accepted as a medical reason for issues like frailty. A challenge is also to overcome the barrier of introducing new services, where eHealth economics is an underdeveloped field (gain versus cost in more dimensions than just monetary). This is reflected in the challenge to design systems that are easy to use yet have a great impact on the quality of life, for which pervasive computing offers great benefits. Naturally also privacy is a main concern, both in regards of communication systems but also in regards of data storage and analysis. Finally a large challenge is how to integrate privately obtained data with national health systems and global services that may be cloud-based.

Regarding recommendations, the fragmented European market would benefit from a larger best practice study and the initiation of collaboration between member states on regulations and on issues like the use of privately obtained data together data stored in national journal systems. A recommendation is also to continuously study the effects of loneliness in relation to frailty and potential interventions. It is also recommended to investigate how Big Data and social data can be analysed to detect early onset of diseases such as mild dementia. Another area of particular interest is dynamic communication services implemented as web services tailored to specific needs. The report finally shows that there are mainly German projects within the social wellbeing domain, while few US projects were found, which means that the potential for establishing European projects with high potential impact in this domain is good. It can also be seen that few projects focus on workplace or mobility aspects; instead there are many projects within the area of ambient assistive environments. A last recommendation is thus to focus on mobility and workplace aspects for social wellbeing at a European level.
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Scope

This foresight technical report is part of the EIT ICT Labs Innovation Radar within the thematic action line of Health and Wellbeing (HWB). This report on social wellbeing for active healthy ageing was drafted in parallel with the foresight technical reports on mental and physical wellbeing as well as a white paper. A report on business models for active healthy ageing was also produced within the activity. In addition, Philips produced two technical reports on the Internet of Things and Data Analytics - Semantic Reasoning.

The foresight technical report aims to identify key trends, challenges, and recommendations in regard of Health and Wellbeing, in particular Active Healthy Ageing. The foresight will help expose future themes with high innovation and business potential. The purpose is to create a common outlook on the future of ICT and to establish a strong community across EIT ICT Labs nodes and partner organisations.
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Social wellbeing is being identified as increasingly important for active healthy ageing, where a good example is that loneliness among elderly people leads to an increased risk for frailty and associated physical conditions. The European population is at the same time undergoing drastic changes in demographic composition, as seen below, where for example persons that are born today in Sweden will generally reach a mean age of 100 years. The overarching challenge is thus to meet this societal change and the problems associated with an increased lifespan within the bounds of the available resources.

A recent report describes the demographic development in Sweden, where the mean increase of the lifespan of the population is nearly two months per year [23]. This means that the demographic composition is rapidly changing, due to a combination of decreased nativity and increased lifespan. There are no signs that this demographic trend is diminishing. The conclusion of the report is that Swedes can look forward to longer lives while being increasingly well with fewer functional disabilities. Figure 1 depicts the demographic change in Sweden from 1910, 1960 and 2010 together with the predicted change until 2060 for men (Män) and women (Kvinnor). This also reflects well on the European demography in general.

The technical development is very rapid, even being described as exponential by researchers such as Kurzweil [24], which can help shape a new inherently technology-based society. This is however well documented in other reports, but the main things to understand is that the potential of technological interventions are great when considering the limited resources in our society. An example is that the Norwegian Center for Tele-medicine and the University of Tromsø in Norway today educates 1 of 4 of their students within the health sector. Within a few years the need to educate students in the health sector will be 1 of 3 within a few years and 1 of 2 in a few decades. Norway may be leading this development in Europe, where for example many nurses from Sweden is moving to Norway because of the demand and the increase in salary following this demand. A key is thus to find technological interventions that reduce the need for healthcare resources in a way that are acceptable for the society.

The challenge to meet the increased lifespan of the European citizens and the associated needs for a societal perspective are naturally linked to mental, physical
and social wellbeing. This report focuses on social well-being. In the general course of this report, we follow the definition of Keyes [22], who proposed the following five dimensions for constructing social well-being measures: social integration, social contribution, social actualization, social coherence, and social acceptance. The conclusions of the report are therefore discussed from the perspective of Keyes measures.

The following scenario shows a technological intervention based on sensor-enriched environments and shared dynamic virtual spaces. The report then depict a view on the status quo in Europe, US and Germany regarding research projects related to well-being, followed by identified general trend categories and challenges within the health domain. The report then detail a number of social wellbeing areas, followed by identified trends, challenges and recommendations.

1.1 Scenario: Remote Care of Persons with Mild Dementia

Signy has always been active, but after her 55th birthday she started to become forgetful and her capability to remember her activities during the day started to degrade. Because her father had dementia she and her husband went to a doctor that found her to have a mild form of dementia. She became depressed and thought her life to be over.

The doctor told her that she could not be cured, but that there were help to get. She was equipped with a wristband and a neckband capable of sensing her physical activities during the day. She was also given a mobile device enabling her to be active in social networks and to communicate with audio and video with her grandchildren, while capturing her social activities online.

Signy then could do the consecutive meetings with the doctor together with her husband and her therapist by using a shared spaced tailored for their particular needs. The shared space shows video of everyone together with the ability to visualise her social activities since the last meeting. Based on this the doctor and therapist can agree on medication and therapies to remedy the effects of her dementia as much as possible while keeping her active in order to avoid frailty and social isolation.

The scenario shows how social sensing and group communication tools can help persons to age healthily with being active. Technologies depicted in the scenario are now becoming available. This foresight technical report discusses technologies that can be used to implement such a scenario and many others related to social aspects of an active healthy lifestyle.

1.2 Status Quo: Germany, EU, USA

The study of existing projects was based on searches in the research databases of the EU (CORDIS), Germany (BMBF) and the US (NSF) for projects related to the topics of social and physical well-being. This is not claimed to be an exhaustive search, but gives a first impression on the current state of (public research) in the
The study shows that there are mainly German projects within the social wellbeing domain, while few US projects were found, which means that the potential for establishing European projects with high potential impact in this domain is good.

Figure 2: An overview of current research projects.

It can also be seen that few projects focus on workplace or mobility aspects; instead there are many projects within the area of ambient assistive environments. A recommendation is thus to focus on mobility and workplace aspects for social wellbeing at a European level.

1.3 General Trend Categories

The projects identified above can be clustered in general trend categories according to the topics of their main activity as seen above. As the current projects mirror the trends as seen by the researchers and funding agencies, the explicit or implicit topics define the short-to-medium trends for innovation in the area under consideration.

1 The numbers refer to a list of projects that is included as an appendix to this report.
From the project descriptions we extracted the trends and challenges these projects address. We then identified nine general trend categories, which in our understanding cover most of the trends currently under research or in innovation activities towards new markets. These are as follows:

1. **Promoting safety and independent living support**
   Independent living is key to reducing the need for care and technologies that for instance support the feeling of safety at home can alleviate the burden on the national health systems. The majority of the identified projects are however in the domain of ambient assisted living in elderly persons homes, which leaves a lot of innovation potential within the area of mobile systems in particular for persons still actively working at least part time.

2. **Preventing hospitalization**
   This general trend category is widely applicable within the health domain, where for instance prevention of obesity has large effects on hospitalization. Prevention is however a very large area but it can also be said that certain aspects, such as utilization of worn sensors and also targeting healthy persons, hold particular future potential. It is foreseen that this area will be increasingly popular for employers to target, in order to increase the available workforce while the demographic development continues to reshape society.

3. **Physical distance**
   A commonality among the identified projects was also the subject of overcoming physical distance, or even the need to be physically collocated. This is related to category 5 and 7, but is more focused on collaborative means and remote use of diagnostic tools and therapies. Virtual health care may be a general trend of specific importance, as the new generation expects rapid help thus overloading the hospital emergency wards, so that care can be provided at any time by offering care at an international level (care centres with nurses not only operating within national borders).

4. **Overcome isolation**
   The link between social isolation and frailty is clear, which means that many projects focus on reducing isolation in general an in particular for elderly persons. Reducing frailty through increased social inclusion through new technologies (social computing, virtual meetings, community enforcement, distance sensing and actuation, etc.) is increasingly popular within the health related projects identified. The potential in the field of social inclusion is thus great, as it can have large effects on reducing resources needed to cater for loneliness and isolation.

5. **Use of online services**
   The web has enabled a great new set of available online services, where recent advances such as WebRTC makes it less complex to develop and maintain such services. A new service can now be launch after a fairly short development period, which indicates the increased pace of the health care markets.
Nevertheless, the national health systems are as a contradiction very slow on adopting to new tools and services, which opens large potentials outside of the traditional national health systems such as for international stakeholders and private organizations. The potential of apps are related to online services as well and is a common ingredient of many current health projects.

6. **Improvement of self-care**
   Self-care aspects are often related to prevention and the need to travel somewhere for medical treatment. It also goes hand in hand with an increased enlightenment of care takers, with the risk of mistreating ailments. The improvement is thus generally focused on a closed loop with the caretaker and a medical expert or general practitioner, where remote sensing and use of live data from worn sensors or sensors in the caretaker’s environment are a popular topic. The potential of this field is also large, as it reduces the need for care at care facilities.

7. **Telehealth solutions**
   Solutions involving telecommunications as a technology for delivering health is quite common in the identified projects, in particular for remote consultations with experts or for instance for remote surgery involving advanced robotics. It is clear that remote sensing in combination with real-time data analytics has very good potential to reduce the personnel resources needed for many care scenarios. Telehealth can also be effectively linked with preventive care and self-care as well as naturally be a key to overcome physical distance.

8. **Reducing healthcare costs**
   A motivation of most identified projects is to reduce the costs related to healthcare in various forms, which in turn builds on reducing the required resources needed. This is not limited to care staff as a resource, but it also includes the reduced burden on spouses, relatives and friends or even the caretaker. This general trend category has probably the highest attention within the national health systems, but a prominent lack is the one of health economics looking at the more complex situation for the current national health systems and what the real effects of potential interventions would be. An area to focus on is thus more complex analysis of healthcare interventions.

9. **Quantified self**
   The quantified self is a movement to incorporate technology into data acquisition on aspects of a person's daily life in terms of inputs (e.g. food consumed, quality of surrounding air), states (e.g. mood, arousal, blood oxygen levels), and performance (mental and physical). Such self-monitoring and self-sensing, which combines wearable sensors and wearable computing, is also known as lifelogging. Several products such as the Nike FuelBand and Apple Watch will lead the technical development from a device perspective while the data needs to be linked into care services. The main challenge here is to incorporate the data in a sensible way into the national health systems, to be used for national or regional care services, and how global services may utilize the data.
As examples, the German projects SmartSenior and LeVer, address various aspects of the general trend categories shown, namely 1, 3, 4, 5, and 7.

1.4 Challenges Categorized in a Tree-map

![Challenge Tree Diagram]

**Figure 3: Challenges found in the study of projects (Germany, EU, USA).**

The challenge tree shows some of the issues that were mentioned in several of the projects mapped, and also in the projects with contributions from DFKI (The German Research Centre for Artificial Intelligence). Some of these issues are further discussed in the following chapters.

A major issue in all the projects were the business models: *Who is going to provide the services and which monetization scheme can be used.* For example, in SmartSenior the result of an in-depth user survey resulted in a general acceptance of social networking services, delivered in the homes of users based on TVs which is the standard media consumption devices in this age group. However, the SmartSenior project expected that services would be free, provided by social agencies, or together with basic cable services.
2 Social Well-being

The following chapter describes some of the more prominent projects conducted by the EIT ICT Labs partners and other leading projects in the field. The purpose is to give an overview of the current state of art and to introduce some trends and challenges.

2.1 Social Well-being Reducing Loneliness and Social Isolation

In old age the risk factors for social isolation and feeling of loneliness accumulate [17]. Even though loneliness is a phenomenon perceived almost equally by younger and older age groups, the number of people feeling lonely is higher in very old age [18]. The risk of loneliness among old people is higher than in other age groups, because the mortality rates of spouses and friends and reduced mobility and chronic illnesses. Being single or widowed are among the most prominent risk factors for both social isolation and loneliness in old age. A person can be a life-long isolate or become isolated in old age [19].

Social relationships differ in their emotional valence and meaningfulness. When developing methods for reducing social isolation, the emotional significance of relationships should be emphasized. Online social networking solutions are mostly designed for younger people; even though the need for social interaction is still high among older adults.

Recent projects suggest technologies for reducing social isolation:

- Several Ambient Assisted Living Joint programme projects:
  - The Social Media for All Elderly people - SoMedAll project was designed to make the ICT usable at home for ageing people to deliver happiness, security and safety, social activities and connections over language borders, mental and physical activities, education, new hobbies. It can serve tailored content in social media services like: communication possibilities, social groups, games, and entertainment to help keeping up the mood and quality of life [20].
  - Virtual Coach Reaches Out To Me - The V2me Project Virtual Coach Reaches Out To Me, V2me, planned to combine real life and virtual social network elements to prevent and overcome loneliness in Europe’s ageing populations. Its overall goal is to enhance the joy of life of the network members. To fulfil this goal V2me supports active ageing by increased integration in the society through the provision of social connectedness and social network services and activities [21].

- Several robotic solutions for reducing loneliness are being investigated, such as the European MOBISERV project. According to the project, “the robot, a mobile wheeled semi-humanoid figure equipped with cameras, sensors, audio and a touch screen interface, can remind users to take their medicine,


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suggest they have their favourite drink or prompt them to go for a walk or visit friends if they have not been out for a while. As part of a larger smart-home environment that can include smart clothing to monitor vital signs, the system can monitor user's health and safety, and alert emergency services if something is amiss”.

Figure 4: The MOBISERV semi-humanoid robot.

Examples of available tools:

- JIVE: jive is a proof of concept for a new communication device⁴. Jive was created as part of Ben Arent's product design degree. Jive is a range of 3 products that were designed to get elderly technophobes connected to their friends and family.

Figure 5: JIVE.

⁴ [http://jive.benarent.co.uk/](http://jive.benarent.co.uk/)
- Pieni piiri lets older people connect with their friends and relatives by using an easy to use video connection\(^5\).

\[\text{Figure 6: Pieni Piiri}\]

- Bettie is a device that simply and easily let the older people to keep in touch with other people\(^6\). Bettie is a simple device and can be used as a digital photo frame, computer and mobile phone.

\[\text{Figure 7: Bettie.}\]

\(^5\) http://www.pienipiiri.fi/
\(^6\) http://www.bett.ie/
2.2 Measuring Social Activity

Social strength, or tie strength, can generally be said to be a metaphor that quantifies the social relationship between persons. It was initially studied by social scientists [25, 26, 27]. In 1984, Marsden et al addressed the problem of measuring social strength by using multiple dimensions such as closeness and duration [25]. In 2009, Gilbert et al defined seven dimensions for predicting social strength: intensity, duration, intimacy, reciprocal services, structural, emotional support and social distances [28]. These seven dimensions have been applied for predicting relationship tiers as being either strong or weak, mainly by using manual efforts.

Today we also can leverage from the fact that we increasingly communicate with other persons using electronic tools such as mobile phones, email and social networks [2]. Our electronic communication can be used to automatically gather information about the social strength between persons. The definition of social strength by Rana emphasizes a few of the dimensions identified by Marsden while also realizing the value of context:

"Social Strength is a metric that represents the tie strength between persons and is calculated based on the frequency, duration, context and media type of the electronic communication between the persons."

![Figure 8: Calculating Social Strength by Extracting and Analysing Communication Patterns.](image)

The social strength can then be used to compose an aggregated social graph, which is a weighted egocentric graph where the social strength is the weights for the nodes. The graph can then be used to prioritize and filter information, manage groups and initiate tailored communication services (see figure 8). The filter could be based on any meta-information, such as position obtained from a Bluetooth device [29].
The data extracted from online communication can be complimented with data harnessed from physical artefacts, as illustrated in figure 9:

- Vicon Revue, that collects images at a certain interval and when triggered by sensors, such that you can measure when you meet other persons.
- Q-Sensor, a wristband that sense skin resonance to measure arousal, such that you can sense when meeting other persons.
- Shimmer sensors, that are more general sensors such as accelerometers capable of sensing your poses and if shaking hands, etc., which can also be used to sense if you meet other persons.

This means that we now can analyse social activity, not only to rank, prioritize, filter and recommend contacts and information, but now also to detect a person's social activity at a quite detailed level. We believe that this is a major opportunity, as it may be possible to detect mental and physical decline as well as with social-wellbeing. This in turn means that we can measure social activity together with emotional arousal and thus likely loneliness, which can be used for technical interventions that can capture empirical evidence of the development of frailty and subsequent degradation in bodily functions such as resistance to infections. It can also be used to study the onset of mental disorders such as dementia and even if dementia so far is classified as incurable, the quality of life can be significantly improved by a suitable set of interventions such as memory support systems [30, 31].
Recent development by Narrative\(^7\) shows that sensing technologies such as what the Vicon Revue offered, is becoming more available through reductions in both size and prize while becoming easier to operate.

### 2.3 Tailored Communication Services

The overarching trend categories presented earlier, such as physical distance and reducing healthcare costs, can all be at least partly overcome by the use of communication services. There is however a multitude of services that in rare cases only are tailored for the specific needs of the persons involved.

New technologies like HTML5 and WebRTC makes it possible to now create very tools for communication (in terms of time needed for setup and dedicated special equipment needed). The Ericsson Shared Spaces is an example of such a communication service, which is completely implemented in HTML and JavaScript by using APIs such as WebRTC. It means that components, or widgets, can be composed at runtime into an environment for tailored communication.

![Figure 11: Ericsson’s Shared Spaces.](image)

Figure 11 depicts a tailored communication service that can be composed dynamically based on the context of the users. In this example, widgets for file sharing, shared maps, learning (Wolfram Alpha) and shared tasks are integrated for a particular need. Note also that the composition can be automated and that participants can be invited automatically based on the social strength between users and the context (intent) of the shared space. This is further exemplified as a scenario in chapter 1.1.

\(^7\) [http://getnarrative.com/](http://getnarrative.com/)
This means that online collaboration and communication will be much easier to tailor, where widgets can be selected based on the capability of users (bad sight, etc.). The lightweight style will enable a flora of new services capable of running in about any device that supports web technologies. Shared spaces can thus easily integrate widgets visualizing sensor data at home or worn on the body as well as from the Internet (for analysing social activity, etc.). These highly tailored communication services may partly be a solution for many of the challenges that this report presents.

2.4 Virtual Coaching

Virtual coaches that act as a friend in a parasocial relationship but also as mentor that helps the older user to create meaningful relationships in his actual social environment are a powerful method to overcome loneliness and to increase the quality of life in the older population.

Already studies by Nass and Steuer [3] showed that people tend to respond to computers as if they were humans. Further studies showed that computers that flattered their users were found more likeable and more effective [4]. The basic feature of virtual coaching system is usually an automated, animated computer agent, which helps users to set goals and offers personalized feedback [5] or provides a social model with anthropomorphic characteristics to interact with [7]. Studies have shown that virtual coach is beneficial in maintaining activity level [5] and doing physical exercises is more enjoyable with a virtual coach than without it [8]. Virtual coach helps to enhance motivation and perceived control in home exercises [9]. It has also been stated that motivational systems with anthropomorphic agents has to be carefully designed, especially if they are used to deliver persuasive messages. Similar coaching methods can also be used to activate users socially.

One of the key elements in a system that supports its users to maintain or increase their activity level is calendar functionality. It enables reminders that are sent to older users in case of they have difficulties with their memory or they need encouragement to participate in activities. In addition, information can be easily updated, and people get information about cancellations and rescheduled events. For the service providers, such as private care organisations calendar is a marketing channel through which they can advertise their service offering. Calendars have also been developed for logging information about the activity level of the older adult and for getting information of the depression level [12]. Even though older users have used to use paper calendars and information newsletters that they receive via mail, a study on sharing family calendar showed that older family members adopted an electrical calendar easily and was willing to use it even after the study. As it is important for grown children to know the status and schedules of their ageing parents, the study showed that it is also important for ageing parents to know the schedules of their children and grandchildren. More symmetric sharing is desirable [11]. It would be important to study more how understandable electronic calendars are and how willing older people are to adopt them.
2.5 LeVer: Memory Training
In LeVer (see Figure 12), the aim is to provide an online learning platform for stimulating cognitive processes, specifically for the target group of older users (> 60 years). We decided explicitly to also target elderly users with light impairments (regarding visual, auditory, cognitive abilities, and motor skills) as well as users with little or no computer experience.

![LeVer start screen](image)

Figure 12: LeVer start screen

Initial analysis identified tablet computers as primary target device, especially suitable when including elderly users with little computer experience; for this purpose a user study was conducted as well as existing literature reviewed. For instance, Murata and Iwase [14] generally found that touch interaction increased accessibility for older users: they performed worse using mouse-based interaction whereas using touch, they performed equally good as younger users. Werner et al. [16] conducted a qualitative field study, concluding that tablets could increase the ease of adaption and use by elderly users with little or no previous computer experience.

At the start of LeVer, no guidelines for developing software application for this specific combination of target device and target user group existed. As a result, we developed a set of guidelines, based on literature review, existing guidelines for related application areas, and user tests that were conducted in context of our project. In a first evaluation, 46% of the study participants (50 seniors between 61 and 93 years, 27w/23m) rated the handling as very user-friendly, 42% as quite user-friendly. Only 6% of the participants experienced the handling as partially and 4% as not much user-friendly.

This result provides support to the thesis that the interaction devices of the 2010-years, tablets, smartphones and other personal computing devices, are very suitable for all user groups if the interaction design is carefully aligned with the needs of the users.
3 Foresight Results

The foresighting has mainly been conducted through a series of reports, where this report presents findings from a social perspective. A foresighting workshop was also conducted in parallel to the reports. Below is an example image from the workshop, where maturity, potential business impact and launching year is plotted for each identified trend scenario. Some of these are mentioned in this report, such as tailored communication and remote care.

![Image of foresighting chart](image)

**Figure 13: Foreseen products and services from a social perspective**

This chapter presents a few of the identified trends, challenges and recommendations in more detail. These are seen as of extra importance for the social wellbeing action line within EIT ICT Labs.
3.1 Trends

1. The demographic change in Europe is a major factor that is created by a reduction in nativity and an increase in the mean lifespan (such as 2 months per year increase in Sweden). The trend is that the resources available are quickly becoming a bottleneck for most national care systems. This is troublesome as the adoption-rate for new technologies is low in most national health systems. The persons born today will likely achieve a mean lifespan of 100 years.

2. The cost for care is a major issue within the EU and every country or region has their own rules and regulations regarding who actually take the cost for specific care activities. The market is more or less controlled by national health systems, but their limited resources often leads to cases that so to speak falls between the chair (such as the treatment of chronic Lyme disease or Borreliosis in Sweden). This has lead to a trend where individual and private organisations today select extra health care insurances that circumvent the national health systems (this is for instance increasingly common in Sweden). Individuals are increasingly taking the cost themselves and healthcare tourism is growing more common. By 2020, 30% of all health-care will be provided on an international arena.

3. The modern care has lead to us living longer, as many diseases now are treatable, but that also means that we live with (multiple) diseases for a longer time. Naturally this affects the social well-being, in particular for elderly, and, as we also more often than not move from the cities we grew up in, these elderly become increasingly socially isolated. A clear trend is the increase in the use of social networking and electronic communication services such as Facebook and Skype, even for very old people. By 2018, 50% of all elderly will be capable of using electronic communication tools. The potential of social gaming is also noticed and there will be more possibilities also for the older population.

4. Independent living may be a key to reducing the need for care and technologies that for instance support the feeling of safety at home can alleviate the burden on the national health systems. The trend is that independent living is mainly targeted by the domain of ambient assisted living in elderly persons homes, which leaves a lot of innovation potential within the area of mobile systems, in particular for persons still actively working at least part time. Social connectedness is imperative to independent living, so this trend will push new services to emerge.

5. It is foreseen that the area of prevention in general and prevention of hospitalization in particular will be increasingly popular for employers to target, in order to increase the available workforce while the demographic development continues to reshape society. The social aspects of prevention cannot be neglected, such as involving persons early in support groups or communities. Prevention can also be driven by analysis of Big Data and social data, where an example is to study dementia tendencies by analysis of how we communicate (social graph analysis).
6. Self-care is a trend often related to prevention and the need to travel somewhere for medical treatment. It also goes hand in hand with an increased enlightenment of care-takers, with the risk of mistreating ailments. A closed loop with the caretaker and a medical expert or general practitioner, where remote sensing and use of live data from worn sensors or sensors in the caretaker’s environment are a popular topic. The potential of this field is large, as it reduces the need for care at care facilities, especially if blended with dedicated online societies for support of certain ailments and for increased social connectedness.

7. Online communication will continue to evolve very rapidly, pushed by new technologies like HTML5 and WebRTC and pulled by new needs to overcome social isolation and reduce the cost of health care. The ability to easily integrate widgets to visualize sensor data is a key factor for the success in the telehealth domain, as these communication services needs to be very simple. By 2015, a majority of the electronic communication services will be tailored for a particular use.

8. The quantified self is a movement to incorporate technology into data acquisition on aspects of a person’s daily life in terms of inputs, which combines wearable sensors and wearable computing. Several products such as the Nike FuelBand and Apple Watch will lead the technical development from a device perspective while the data needs to be linked into care services. Social services, like the Apple Watch ability to transmit the heartbeat between persons, are a new trend that has good potential.

3.2 Challenges

1. Social issues like loneliness are not often, or at all, classified as an issue within the national health systems. Loneliness has been proven to lead to frailty, a state where the body for instance has a reduced capability to withstand infections. A challenge is therefore to get social well-being accepted as an issue within the national health systems.

2. Technical interventions are in many countries very limited, such as smart homes or wearable solutions, because the economic strain of the national health systems. The challenge of making the cost of technical interventions more accepted needs to be overcome, maybe by launching key strategic initiatives that show the feasibility and impact of such interventions.

3. The use of social networking and electronic communication services is increasing within the area of social well-being. Also the acceptance of using different technologies is increasing with time. The systems are however generally complex, where persons with mild dementia or other diseases simply cannot cope with the technologies. A challenge is thus to design systems aimed at this target group, which are easy to use but have great impact for the quality of life.

4. The rapid development of communication services, such as social networks and lightweight composition of communication systems based on context, will
require careful consideration not only regarding technical solutions but also regarding usage and the privacy/integrity of users.

5. A large challenge is how to incorporate privately obtained data, through devices such as the Nike FuelBand or the Apple Watch (quantified self), in a sensible way into the national health systems. This data can be used for national or regional care services as well as for global services that may utilize the data for novel data analytics.

6. Privacy is also a challenge when managing sensible data such as how we communicate (social graph analysis) or data related to the quantified self (worn sensors and wearable computing). Data saved in the cloud therefore need explicit activities to balance the need for individuals' privacy and the need for researchers to analyse large quantities of data from many individuals.

3.3 Recommendations

1. Innovation is very hard on such a fragmented market. A recommendation is therefore to investigate the situation in the EU and to use EIT ICT Labs as a catalyst for changing the innovation landscape within the national health systems by conducting a larger best practice study and trend analysis.

2. Technical interventions that can work as best practices needs to be highlighted by EIT ICT Labs, especially for the area of social well-being that is increasingly important to alleviate loneliness, frailty and dementia, but that has a weak foothold in the EU research arena and the European national health systems.

3. To detect the onset of mild dementia by studying social activity may now be possible and is one area of innovation that has an increasingly importance for the ageing population in Europe. Supporting innovations in this field is therefore recommended.

4. Frailty among elderly is a common diagnosis that eventually leads to death by the body’s incapability to handle infections etc. A major reason for frailty is inactivity and social disconnectedness. Interventions that measure and increase social activity is therefore important to study.

5. A potential ground breaking technology on the way to maturation is web technologies for tailored communication services. A recommendation is to support innovative solutions within this field, as they have the potential not only to reduce the cost of communication services but also the care in focus of that communication service (such as by integration of widgets for visualization of sensor data).

6. Products in this area are subject to national regulations for medical devices, which is a large obstacle especially for start-ups to overcome. Special actions are required to make innovators aware of regulatory limits in the different countries of the EU and to act for more uniform regulations across the EU.
4 Conclusion

In conclusion let us return to Keyes’ five dimensions for constructing social well-being measures [22].

**Social Integration**

The development of our society, where social isolation increases due to an increased mobility, needs to study how to integrate citizens socially in a sustainable way. For an active healthy ageing, family is very important, even if they are located somewhere else. The thought of creating communities within communities is also very potent, where people can form groups and help each other.

**Social Acceptance**

To be socially accepted is on of the pillars behind feeling safe and is also of importance for social integration. However, ageing sometimes means a reduction in capabilities, which sometimes are frowned upon. Technology can alleviate some, but far from all, of these problems by introducing memory aids and similar devices. It can however be said that these devices themselves have challenges to become socially acceptable, which is something we as a society needs to overcome.

**Social Contribution**

Ageing does not mean that you no longer can contribute, rather the opposite! It only means that the method of contributing will need to change and that services for this needs to be developed. Mentoring roles for new entrepreneurs or tutoring of students are good examples of this. Contributing to society also means a higher grade of integration and acceptance.

**Social Coherence**

The meaning of life, or social coherence, builds on a society that is discernible, sensible and predictable. Unpredictable and often traumatic events can effectively dismantle the feeling of social coherence. Social support structures are therefore important, so that individuals have something to fall back on when such events occur. These social support structures, such as a ‘digital village’ where people have joined together for such purposes, also strengthen social integration, acceptance and contribution.

**Social Actualization**

Keyes stated that: “Healthier people are hopeful about the condition and future of society, and they can recognize society's potential. Socially healthier people can envision that they, and people like them, are potential beneficiaries of social growth”. We have more tools than ever to show the growth and refinement of society to our citizens, where an increasing amount of information about our society now is available as open data and where new communication tools can disseminate information effortlessly.
Finally, social wellbeing is the area least supported by national health systems and for which services it is unclear who will provide and pay for. This report therefore initially present status quo (Germany, EU and USA), trend categories and challenges categorized in a tree-map. It then discusses how to measure social activity and how to tailor communication services that have the potential to meet the identified challenges. A scenario illustrating remote care of persons with mild dementia is also presented. Lastly a set of trends, challenges and recommendations are highlighted that may be of particular importance for EIT ICT Labs based on current carrier projects and catalyst activities.
References


[10] Neßelrath, R., , Haupert, J. ; Frey, J. ; Brandherm, B. Supporting Persons with Special Needs in their Daily Life in a Smart Home, This paper appears in: Intelligent Environments (IE), 2011 7th International Conference on, Date of Conference: 25-28 July 2011, Page(s): 370 - 373 ,


[12] Aguirre, A.; Rodriguez, M.D.; Andrade, A.G. “A Pervasive System for Enabling Older Adults to Cope with Depression by Motivating them to Socialize”


Appendix

This appendix lists the identified projects in Germany, EU and the US as depicted in figure 1.

   http://paloma.isr.uc.pt/projects/socialrobot/
2. I2WEB – user models based upon existing accessibility standards (30.04.2013)
   http://i2web.eu/index.html
3. Join-In – Senior Citizens Overcoming Barriers by Joining Fun Activities; cost-efficient technology platform, social networks and games (31.07.2013)
   http://www.aal-europe.eu/projects/nostalgia-bits/
5. KomPass – communication platform with adaptive user interfaces for elderly (31.08.2014)
   http://iss.umwelt-campus.de/iss/index.php?id=kompass
   http://www.silvergame.eu/project
7. SI-Screen – Social Interaction Screen; Tablet (30.04.2013)
   http://www.si-screen.eu/projekt/vision.html
   www.soziotech.org/si-screen-elderly-interaction-service-assistent/
8. Gut leben im (hohen) Alter – development of concepts and practical solutions so that elderly can stay longer in their home environment (28.02.2013)
9. SooBa – on- and offline-consulting for seniors and their advisors (31.08.2015)
   http://www.hawk-hhg.de/sozialearbeitundgesundheit/187032.php
   http://www.hawk-hhg.de/ausgeblendet/media/SooBa_Rundbrief_01_121212.pdf
10. FoSIBLE – Fostering Social Interactions; console-based community platform, train mental and physical fitness (30.09.2013)
    http://fosible.eu/
11. SmartAssist – system of wireless sensors installed in the home, which detects social parameters, gradual changes and emergencies (31.12.2012)
    http://www-old.itm.uni-luebeck.de/projects/smartassist/index.html?lang=de

12. SHB: Medium: Collaborative Research: Crafting a Human-Centric Environment to Support Human Health Needs (31.08.2015)


14. SHB: Small: Socially Assistive Human-Machine Interaction for Improved Compliance and Health Outcomes (31.08.2014)

15. SHB: Type I (EXP): Context-aware Ubiquitous Human Health Monitoring (31.08.2015)

16. SHB: Small: Cell Phone-Based Activity Tracking for Telehealth (31.08.2014)

17. SHB: Type (EXP): Instrument socks for Prediction and Prevention of Acute Decompensated Heart Failure (31.08.2014)

18. SHB: Small: Use of Gaming Peripherals in Acute Rehabilitation of Balance Following Stroke (31.08.2014)


20. AISENSE – Human-Computer Interaction and Computer Vision for Improving Healthy Living of Elderly through Exer-gaming (31.07.2015)


22. STEADY – ICT based holistic concept for fall prevention and management among the elderly community (31.08.2016)

23. WIISEL – Wireless Insole (31.10.2014)
http://www.wiisel.eu/

24. Motivotion – Preservation of the physical and mental fitness of elderly by microsystems technology supported Motivation for physical activities (31.08.2012)
http://www.motivotion.org/site/
http://www.vitaphone.de/en/company/research-development/motivotion-60/


29. SBIR Phase I, II: An Internet-based Emotional Connectedness and Monitoring Device and Service for the Elderly (31.07.2013)

30. FLORENCE – Multi Purpose Mobile Robot for AAL (31.01.2013)
http://www.florence-project.eu/

31. SRS – Multi-Role Shadow robotic System for Independent Living (31.01.2013)
http://srs-project.eu/

32. SOCIALIZE – Service Orientated Assisted Living Infrastrukture (30.04.2015)
http://www.springtechno.eu/socialize.html
http://www.aal-europe.eu/projects/socialize/
33. AALuis – AAL-interface (30.06.2014)
www.aaluis.eu
http://www.kooperation-international.de/detail/info/verbundprojekt-ambient-assisted-living-user-interfaces-aaluis-teilvorhaben-innovative-multimo.html
34. TSA – social-technical assistance system for comfort, security, health and communication in the inner-city-area (31.07.2013)
http://www.aal-tsa.de/projekt.html
35. Erfahren ins Netz 2.0 – training of older employees (45+) in the public service (31.05.2012)
http://seminare.krzn.de/C12576F6005014B5/0/655DA517B6B9A07BC125770E00359FC4?opendocument
http://www.dlr.de/pt/desktopdefault.aspx/tabid-3182/4908_read-26102/
http://www.moodletreff.de/pluginfile.php/12561/mod_resource/content/0/_Vortrag_moodletreff2011_Kompatibilitaetsmodus_.pdf
36. PASS – personalized assistive system and services for the mobility of elderly (31.07.2014)
http://www.fraport.de/content/fraport/de/misc/binaer/innovationen/pass/jcr:content.file/pass_de.pdf
http://www.bmbf.de/pubRD/Mobi-Steckbriefe-komplett.pdf