Section I

Opportunities and Barriers of Smart Technology in Care
1 Smart eHealth and eCare Technology
What Is That?

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The use of technology in health and social sector has increased lately due to its huge potential in solving challenges caused by the aging of the population, in helping the healthcare professionals’ work, and especially in enabling living to full capacity despite possible personal limitations and disabilities. Nowadays, the technology can be implanted or wore, or may be part of our environment. Information and communication technology (ICT), electronics, and automation have already had a huge effect on various fields of business. The same technology that is targeted for industrial use has also many applications in health and well-being. The demographics and lack of resources in health and well-being industry are increasingly forcing us to find alternative solutions for more individualized care or social services. Smart technologies provide enormous potential for solving this challenge. However, technology industry, healthcare industry, and social services sector have not yet been accustomed to collaborate deeply that is needed to make the technology serve this purpose. Smart eHealth and eCare Technology is no-mans-land due to its multi-disciplinary nature, and very few people have adequate expertise and experience from all fields concerned—technology, healthcare, and social sector. The lack of common understanding has led to wrong kinds of technology products that do not
provide expected user-friendly solutions needed in real-life situations and service delivery systems. Nevertheless, the time is now ripe to foster joint development between the two different fields of business in order to create innovative solutions to meet the real user needs with the help of the latest technology achievements. A good variety of technological innovations are already available for various purposes including numerous assistive technologies and barrier free design supporting autonomous living, novel sensor technology, mobile applications for activation and self-rehabilitation purposes, electronic patient records system for improving care and communication between various parties in the healthcare delivery systems, reliable medical technology for improving treatment and analytics, and even mobile phone-based testing applications for making laboratory analyses easier and more cost effective (Häyrinen 2008, Karlen 2014, Kiili 2010, Koivisto 2011, 2013, 2015, Merilampi 2014, Sirkka 2012, Wichert 2008).

This book enhances communication between technology, healthcare, and social sectors, and tends to promote new innovations. The purpose of this publication is to discuss various technologies and share experience and knowledge regarding the needs and requirements for developing technology products successfully. This discussion starts with terminology clarification and introduction to various types of assistive and enabling technologies.

This book defines smart eHealth and eCare technology as the use of technology in promoting health, well-being, and quality of life, and thereby assisting people with impaired or declining function (physical, psychological, cognitive, or social). The term user may refer to an individual with declined functioning, a professional, or a family caregiver. In most cases, the benefit of using technology is typically real-time data about issues related to the patients’ status of health and well-being, or the data related to therapeutics or other caregiver actions.

This chapter tends to provide a general overview of the available assistive and enabling technologies. The subject is very wide, and it is hard to define which technologies can be considered enabling ones and which not. According to Löfqvist (2005), assistive technologies could be divided into two categories: (1) low technology referring to more traditional and mechanical assistive technology (such as grab bars) and (2) high technology referring to devices and equipment based on more advanced technologies. This book will focus on the high technology in which ICT, electronics, and automation technologies play an important role. Care technologies are further discussed as seven partially overlapping categories:

1. Assistive (communication and information) technologies
2. Safety and social technologies
3. Health technologies
4. Self-activation and personal development technologies
5. Design-for-all and ambient assisted living (AAL) technologies
6. Gerontechnologies
7. Hospital technologies and electronic health records systems

Each category of care technology is briefly discussed in the following sections. Examples of related devices, equipment, and applications are introduced, and
common terminology used in the literature is explained. This book contains more detailed chapters about the different categories of technologies, and the related chapters are referred in the text (Löfqvist 2005, Suhonen 2007).

1.1 ASSISTIVE TECHNOLOGY

Assistive technology is a very wide category among enabling technologies. It includes tools, equipment, and devices that are used to facilitate the operation and survival of a person with limited capabilities. In general, assistive technologies assist an individual to perform daily tasks or prevents injuries. These technologies compensate sensory, physical, and cognitive impairments, and promote safety for vulnerable individuals in terms of detecting and reporting health hazards. Assistive technology consists of devices that aid individuals in communication, movement, controlling the surroundings, performing daily activities, and in overall life management. Noncomputer-based assistive technologies include items such as wheelchairs, grab bars, Braille, and general solutions that make home environment more accessible. Technically more advanced equipment includes environmental management devices and videophone network. Assistive technologies also include a variety of equipment used in medical care, disease prevention, diagnostics, and rehabilitation (Huhtanen 2012, Lindeman 2009, Salminen 2010, http://www.papunet.net, http://www.thl.fi/apuvälaineet, http://www.tikoteekki.fi).

1.1.1 INFORMATION AND COMMUNICATION TECHNOLOGY

Information and communication technology as a subcategory of assistive technology includes technological devices that assist in reading, writing, speaking, and using a computer or a phone. Information technology includes special assistive equipment (software and hardware) enabling computer and mobile phone use, such as special key boards and mouse. Button mouse is an alternative to a standard computer mouse. The buttons of the mouse are easier to observe and push, and they can be customized according to the user’s needs and capabilities. In a head mouse, the head movements are followed with the help of a camera. Screen readers (software) can be used to read aloud text on the screen. Screen magnification software is another example of assistive computer software. Small portable electronic magnifiers or video magnifiers that can be used to magnify printed text or pictures are also available. In addition, assistive devices include alerting devices (such as blinking light) that can be connected for example to a telephone to indicate ringing (and for many other actions) (Huhtanen 2012, Lindeman 2009, Suhonen 2007).

Communication technology in terms of augmentative/alternative communication can be used to assist communication and social interaction in the case of temporary or permanent loss of speech ability. Alternative communication is used when a person is not able to speak, and augmentative communication is used when the speech is unclear or incomplete. Visual communication with graphics and signs are commonly used (pictures, photographs, written words, Bliss symbols, picture communication symbols, pictograms etc.). Technology to support augmented or alternative communication is apparent in devices that play prerecorded voice messages and
in hand-held devices that show a written message on the display and talk the text aloud. The text can be produced from symbols/signs as well. The communication panel can be controlled with fingertips, but alternative methods such as eye tracking and a forehead stick are also available. Computer-assisted communication in this context refers to a speech synthesizer in which a combination of computer/mobile devices and communication programs are most commonly used. Mobile apps are also available to assist communication. A smartphone or a similar device may work as a communication tool in face-to-face situations, but the symbols in the app can also be used to generate messages. The symbol-generated messages can be received as text messages on other phones. In addition, to communicate with various communication devices, a traditional communication folder is always needed. An example of a traditional communication folder system in Finland is TAIKE-board that works together with related Speaking Dynamically communication software (Huuthanen 2012, Lindeman 2009, Salminen 2010, http://www.papunet.net, http://www.thl.fi/apuvälineet, http://www.tikoteekki.fi).

Various sensors and ICT-related equipment can be used to develop assistive technology or as part of assistive devices. Some examples of novel sensor technology suitable for assistive devices are presented in Chapters 6–9. Generally speaking, while developing software, the special user groups (like older adults with naturally declining functions) should also be taken into account (e.g., Internet pages, user interfaces, and games). Design-for-all in terms of producing more accessible and usable software does not require huge efforts from developers; rather, it is only a mindset. Examples of mobile games and applications for special user groups are presented in Chapter 13.

1.2 SAFETY AND SOCIAL TECHNOLOGIES

In common with safety and social technologies is the aim of increasing security and independence of a person who typically has some limitations in functioning. The systems assist the person to be active by increasing the level of accident prevention and thereby the sense of security. In cases of an accident, the system assists to get the help fast. The technology can be implemented in a person’s home or in an assisted living environment.

Safety technology includes different security systems easily interlinked with other assistance, care, and surveillance services. Safety bracelets, safety phones, and additional integrated sensors are part of these systems. Traditional safety bracelets are passive in nature and require user to push a button to make an alert and call for help from a relative or a care provider. Smart bracelets measure the users’ activity and movements triggering the alert when any abnormality is observed in the registered data. The most advanced solutions offer possibilities to monitor activity-sleep levels and GPS tracking. Integration of different sensors such as smart floor, carpet, contact switches (doors, windows), bed occupancy sensors, and motion sensors enables a provision of extensive and complete safety systems. In addition to various sensors, the systems can be equipped with actuators (e.g., safety switches) and health technology (e.g., biomedical monitors). The devices operate in a network connected to a remote center for data collection and processing. The remote center monitors
the situation and initiates assistance procedures if required. The technology can be extended to wearable and implantable devices to monitor people 24 hours a day both inside and outside the house. The term **smart home** is typically used in this kind of safety-system-related context, although smart homes typically also include nonsafety-related equipment (such as building automation for energy management and indoor environment control) (Chan et al. 2009, Suhonen 2007).

Social technology is quickly emerging as part of home care systems. In addition to safety, social technology provides social interaction and virtual services such as active sessions remotely with caregivers and other service providers. These kinds of systems are important to avoid social isolation. They are also very practical solutions to provide services in rural areas. The aim of the technology is to assist in independent living by modern ICT through remote guidance and virtual services (see also health technology). Social networking technologies enable the creation of social networks and focus on building communities of interest that help users communicate, organize, and share with other users and with their care providers. Health TV is an example of social technology. It provides visual and speech connection (via broadband connection) from an easy user interface of the TV (Lindeman 2009, Suhonen 2007).

Although the aim of safety and social technology systems is to improve the quality of life, there are challenges as well. These challenges include false alarms and ethical issues related to the privacy of the user as well as data-handling properties, responsibilities, and rights, and also practical issues related to big data handling.

Social technology and safety are discussed further in Chapters 6 and 14. Sensor technologies and their possibilities are discussed in detail in Chapters 6–9.

### 1.3 Health Technology

Health technology includes self-monitoring- and self-care-related systems and equipment. These systems include monitoring and measurement devices (such as blood pressure monitors and other equipment typically used by healthcare professionals), ICT-related devices (mobile devices and computers), data connection (the Internet and mobile), and remote communication with medical professionals.

The term **remote patient monitoring** is typically used in this context. A wide variety of technologies are designed to manage and monitor a range of health conditions. Point-of-care (e.g., home) monitoring devices, such as weight scales, glucometers, and blood pressure monitors, may stand alone to collect and report health data, or they may become part of a fully integrated health data collection, analysis, and reporting system that communicates to multiple nodes of the health system and provides alerts when health conditions decline. Internet-based services include eHealth portals that offer health services, self-care services as well as healthcare and well-being products and information via the Internet. For example, a user can get consultation from a doctor via these portals and access different health-related tests.

A simple example of a relatively common health technology is an Internet-based self-care assisting system for monitoring blood sugar levels as part of diabetes self-care. In the system, user provides sugar levels to a server where they are available
to healthcare professionals for monitoring. Similar systems are also provided for remote blood pressure monitoring as well as obesity, allergy, and asthma treatment (Lindeman 2009, Suhonen 2007).

Chapter 10 provides an insight into the dilemmas and issues related to self-care systems and patient information sharing. Additional discussion can also be found in Chapter 5.

1.4 SELF-ACTIVATION AND PERSONAL DEVELOPMENT TECHNOLOGY

A fast developing and growing area of technology is the development of software, equipment, and systems used to support, monitor, and analyze personal development and performance. Many of these devices are first targeted for athletes for performance monitoring during a workout, but later they become very common for ordinary people. Typical sports technology includes pedometers, activity bracelets, and mobile apps that monitor activity levels and also remind the user to be active and cheerful. Heart rate monitoring is also very common. First separate heart rate belts and watches and later smart watches with integrated heart rate sensors are commonly used for investigating heart rates during a workout such as running or cycling. Smart sports watches typically provide other data as well. GPS allows the user to see the distance as well as speed. Some smart watches also have interface for making programs that utilize the sensor data for various purposes such as for sleep monitoring, epileptic seizure detection, activation, and stress controlling. Sensors such as accelerometer, gyroscope, magnetometer, pressure sensor, heart rate monitor, activity sensor, GPS, temperature sensor, and even sweat sensors are already in use or in the development phase. In the future, even more sophisticated sensors will be integrated into these wearable equipment (such as sweat analysis), making them even more useful for health and well-being. Many kinds of different sensors are also being developed for more precise purposes such as trajectory monitoring and monitoring of bodily functions. Although the technology may not originally be targeted for healthcare purposes, it provides huge possibilities after further development for rehabilitation and self-care. This equipment has the potential for encouraging people to be more active by 1) providing interesting data about the personal progress or 2) by increasing the feeling of safety because the bodily functions can be monitored and healthy stress level thus be maintained (Empatica E4 wristband 2015, Heikenfeld, 2014, Phillips 2014).

Gamification is also one of the recent trends. It means to make activities more motivating, playable game like. To give an example, gamification in health and well-being context may refer to making repetitive rehabilitation/exercising more motivating by providing some sort of meaning for the action such as a progress in a game. Health and well-being games may relate to physical fitness/rehabilitation as well as cognitive fitness/rehabilitation, and they typically contain some sort of tracking and assessment component. The game analytics offer tools and possibilities for diagnosing purposes and progress monitoring (Kiili 2010, Koivisto 2011, 2013, 2015, Lindeman 2009, Merilampi 2014, Sirkka 2012).
The term *exergame* is typically used when referring to games in which progress depends on physical exercise. Commercial game consoles already provide wireless game controller that may be used to track body movements and control various commercial exergames. Cognitive fitness and assessment technologies include thinking games and cognitive challenge regimens. Like physical fitness, the premise of cognitive fitness is that cognitive health can be maintained or improved if individuals exercise their brain. The emphasis may be, for example, to prevent or delay Alzheimer’s and related dementias. Many cognitive fitness technologies are computer or the Internet-based, and include assessment and tracking component. The health and well-being games can also be educational. Games also provide solutions for recreation, and by right kind of design, games can also provide various possibilities for special user groups. Mobile health games are discussed in Chapters 3 and 13 (Kiili 2010, Koivisto 2011, 2013, 2015, Lindeman 2009, Merilampi 2014, Sirkka 2012).

1.5 DESIGN-FOR-ALL AND AMBIENT ASSISTED LIVING TECHNOLOGY

In accordance with the *design-for-all* philosophy, everybody should be capable of participating in our society, with equal opportunities regardless of personal characteristics such as age, gender, ability to function, and cultural background (Design for All Foundation 2015, Kemppainen 2008, 16). When talking about equal participation, terms such as accessibility, usability, and universal design are also used. The meaning of all these terms is close to each other, and usually the context defines the usage of these terms. Terms *universal design* and *design-for-all* both mean that products, services, and environment should suit everyone or at least as many as possible, whereas built environments can be accessible and devices usable. Also term *availability* is commonly used when talking about the availability of information, services, products, and so on. However, it is important to remember that even though information is available, it is not automatically accessible.

It has been shown that for the 10% of the population accessibility is essential, for 40% necessary, and for 100% it is comfortable (Design for All Foundation 2015). Sometimes, solutions that are implemented for special features bring benefits to other users and increase overall usability and broaden the market. For example, the control of volume amplification in telephones was originally developed for people with hearing problems but was also found useful for anyone using a telephone (Mellors 2004, 15).

To be able to provide equality and equal participation, there must be products, services, and environments that are suitable for everybody. The ideal situation is when a single solution is suitable for all potential users and does not need adaptation depending on the user. That calls for good designing and planning. Sliding doors are good example of well-designed product that represents all the design-for-all criteria. The product respects the diversity of users, so that nobody feels marginalized and everybody is able to access it. The product is also safe to use and does not cause risks for health. Functional and comprehensible use is fulfilled as sliding doors always work in the same way and in most cases work automatically. The product is also sustainable, affordable, and appealing (Design for All Foundation 2015).
Isolated and special accessibility solutions should be avoided in designing and planning. These kinds of solutions do not directly improve design-for-all thinking and acceptance of diversity. Furthermore, it is not cost-effective and beneficial. Nevertheless, solutions cannot always be designed to be suitable for all (Mellors 2004, 15). For example, products such as prostheses need to be customized individually. Also, the wider the range of different sizes and models of shoes available, the better. If a product, service, or environment could not be made for all or it is not practical to be designed for all, it could be either adjustable, individual (range of products), compatible with commonly used accessories, or customized product or service. In some cases, it is also acceptable that solutions are compensated with good services or alternative solutions to the mainly used offering (usually solution made afterward) (Design for All Foundation 2015).

Design-for-all philosophy is not only of benefit to the end user, it can also offer benefits to business (Mellors 2004, 15). If possible, involvement of both the end users and the experts to all stages of the design process is recommended. Solutions that are designed according to design-for-all philosophy and in cooperation with the end users are usually effective and do not need further adaptations. These kinds of solutions and involvement also increase customer satisfaction (Aragall et al. 2013, 14).

Ambient assisted living (AAL) is related to design-for-all as it aims at living to full capacity despite limitations in the ability to function. AAL is one of widest categories presented, and it covers most of the technology described in this chapter except the hospital technology. However, typically AAL refers to elderly care.

In Pieper (2011), AAL is defined as follows:

Ambient Assisted Living (AAL) comprises interoperable concepts, products, and services that combine new ICTs and social environments with the aim to improve and increase the quality of life for people in all stages of the lifecycle. AAL can at best be understood as age-based assistance systems for a healthy and independent life that cater to the different abilities of their users. It also outlines that AAL is primarily concerned with the individual in his or her immediate environment by offering user-friendly interfaces for all sorts of equipment at home and outside, taking into account the fact that many older people have impairments in vision, hearing, mobility, or dexterity. Thus, it implies not only challenges but also opportunities for the citizens, the social and healthcare systems as well as the industry and the European market. The roots of AAL are in traditional assisted technologies for people with disabilities, design-for-all approaches to accessibility, usability, and ultimately acceptability of interactive technologies, as well as in the emerging computing paradigm of Ambient Intelligence, which offers new possibility of providing intelligent, unobtrusive, and ubiquitous forms of assistance to older people and to citizens in general.

To give some more examples, AAL covers smart home technologies discussed earlier in this chapter and many assistive equipment and devices such as robots and medication optimization equipment. Interactive robots may cooperate with people through bidirectional communication and provide personal assistance with everyday activities such as help them prepare food, eat, and wash or remind them to take medicine. The term medication optimization refers to a wide variety of technologies designed to help manage medication information, dispensing, adherence, and
tracking. Technologies range from the more complex, fully integrated devices that use information and communication technologies to inform and remind stakeholders at multiple decision and action points throughout the patient care process to the simpler, standalone devices with more limited functionality (Flandorfer 2012, Lindeman 2009, Wichert 2008).

It is also worth mentioning that nowadays the trend in modern households is to add intelligence and building/home automation such as remotely controllable or measurable devices and systems. The so-called Internet of things (IoT) in which smart devices communicate and collaborate (collect and exchange data) is very interesting in considering AAL, because they also have huge potential for assisted living. Adjustable and controllable lighting, temperature, moisture, air conditioning and ventilation, venetial blind, remotely measurable electricity consumption, remotely activating power sockets, and even household machines such as smart washing machines, stoves, refrigerators, televisions, WLAN cameras, audio equipment, and even smart self-watering flower pots are already available. Also smart and more secure locking systems and fire/smoke alarm systems are commercially available. The house key can be even implanted in a hand of a family member and access rights may be controlled with software. In addition, furniture and textiles are also becoming smarter and making the life easier.

AAL is discussed in Chapters 6 and 14. Sensor technologies and their possibilities are discussed in detail, for example, in Chapters 6–9.

1.6 GERONTECHNOLOGY

Because of the demographic situation of welfare states, the role of gerontechnology in well-being has been significant. Gerontechnology is a fairly general term. It includes technology from all the above discussed categories, and thus it is not discussed with examples but at more general level. The goal of gerontechnology is to develop age-friendly technology as well as help older adults to use existing technology. The ultimate goal of gerontechnology is to increase the older adults’ quality of life meaning being socially active, healthy, and independent up to high age. Gerontechnology aims at preventing age-related problems and supporting older adults’ strengths, compensating declining ability to function, supporting elderly care, and promoting related research (such as research and development to provide age-friendly product and service designs). Although gerontechnology is targeted for promoting well-being of older adults, the technology solutions are typically useful for other special user groups as well (Kuusi 2001, Suhonen 2007, Väyrynen and Kirvesoja 1998).

1.7 HOSPITAL TECHNOLOGY AND ELECTRONIC HEALTH RECORDS SYSTEMS

In this book, the term hospital technology does not refer to medical technology and devices such as surgery robots, EEG and EKG monitors, and other very special equipment used in treatment and diagnostics in hospitals. This book discusses smart
eHealth and eCare technologies, and medical technology is outside the scope of it. However, hospital data and information systems such as electronic health records (EHR) are discussed in Chapter 5.

EHR is a digital version of the traditional patient paper chart. However, the idea of an EHR is to combine traditional patient information (medical and treatment information) into other information used in health and social care. The definition of EHR and the data content is difficult due to various practices used. According to a review (Häyrinen 2008), the concept of EHR comprised a wide range of information systems, from files compiled in single departments to longitudinal collections of patient data. EHRs are used in primary, secondary, and tertiary care. The data could be recorded in EHRs by healthcare professionals and secretarial staff (recorded data from dictation or manual notes). Some information is also recorded by patients themselves (validated by physicians). Several data components are documented in EHRs, such as daily charting, medication administration, physical assessment, admission nursing note, nursing care plan, referral, present complaint (e.g., symptoms), past medical history, lifestyle, physical examination, diagnoses, tests, procedures, treatment, medication, discharge, history, diaries, problems, findings, and immunization (Häyrinen 2008, Suhonen 2007).

Hospital information systems and EHRs are essential considering various above-mentioned enabling technology devices and home care type systems and the information they produce. This information should be supported by the service system in general (politically) as well as by the patient records systems (technically). Integrating data from smart home-type systems with data from electronic patient or health records is still in an early stage. Several projects are in an advanced conceptual phase, some of them exploring feasibility with the help of prototypes. General comprehensive solutions are hardly available. In addition, a global electronic patient record system would be a huge achievement, but, for example in Finland alone, mainly three different patient systems are used. The challenge to build compliant systems is huge because the systems nowadays are different in each country. Law and legislations in different countries also differ from each other, which has to be considered as well (Chan et al. 2009, Knaup 2014, Suhonen 2007).

ICT-based service platforms and patient records systems, services, service systems, and data handling are discussed in more detail in Chapter 5.

1.8 PERSON-CENTEREDNESS OF THE TECHNOLOGY

Despite the category the technology belongs to, the most important issue to take into account in eHealth and eCare technology is the person-centeredness. Technology has to meet the real-user needs and serve its purpose. The technology must be usable and accessible and in many cases as invisible as possible. Technology resistance will typically arise if these requirements are not met. The user needs may not be obvious but rather challenging. For example, if a user with dementia wears a health bracelet, it provides safety and information independent on the location of the user. The technology is also easy to implement because no construction work or clinical operations is needed. However, the device may be scary and look suspicious, and it is then removed. In this case, the user may benefit if the technology
would be implanted, embedded into clothing, hidden as part of the apartment, or as part of ordinary and traditional equipment.

Additionally, the technology should not mean extra work for the professional staff or the individuals but in the contrary. Attention must be focused on implementing the technology: integrating it as part of the service system, offering easy procurement and distribution, deployment, and training as well as maintenance. Design-for-Somebody is a technology design and development philosophy defined by the well-being technology research group at Satakunta University of Applied Sciences (SAMK), meaning that not only special user groups’ needs but also an individual’s needs should be placed as the centerpiece in technology and service development processes. By going very deep into user needs, key features are found and high customer satisfaction is achieved. Although technology cannot be actually developed for each person separately, there are many similar persons to whom the same technology can serve. For example, the same technology can be modified according to a person, making it more individual, although 99% of it is similar to other users as well. For successful identification and interpretation of individual needs, the research, education, and working life experts from the fields of healthcare, well-being and technology, business, and so on, must be employed. Development processes must be conducted in close collaboration with beneficiary parties and organizations. Research and development of eHealth and eCare technologies requires constant and multidisciplinary knowledge updatation and agility to respond to changing demands and circumstances, making it a very challenging subject but also serving endless possibilities. Design-for-Somebody philosophy is discussed further in Chapter 3.

One of the challenges related to enabling technology is to measure the functionality and effectiveness (and revenue) of the technology. The research focus is shifting from pure technology development to usability and user experience studies, which is a good start as nonaccessible and nonusable technology definitely has no effect whatsoever. The research is in many a case qualitative (methods: observations, surveys, and interviews) to evaluate subjective experiences. However, the lack of metrics related to the health and well-being effects of the technology is a challenge to meet. There are many traditional tests that can be used to evaluate health condition, and one way to get quantitative research data is to make them electronic (see Chapter 13), but there is plenty of work to be done.

1.9 ETHICAL ASPECTS IN CARE AND TECHNOLOGY

Ethics and social responsibilities related to the current trends in technology and health industry development cover issues such as economy, legislation, and philanthropy. What is legal is not automatically ethical. As to legal aspects alone, laws and regulations vary a lot in different countries. In general, ethical codes and legislation lag behind in the pace of rapid technology development and deployment. Especially issues such as privacy, equality, and safety questions are commonly posed questions. How to assess the truthfulness, reliability, and ethicality of data available? Contrary to our willingness to protect our privacy, we are every day more and more exposed to uncontrolled dissemination of information about ourselves by being involved in social media or using mobile and smart technology (Boyd & Crawford 2011, Carroll & Buchholtz 2015, Howard 2014, Wadhwa 2014).
Certain categories emerge as key ethical issues concerning ethics of technology and care: gains or threats to human good, equity, and affordability of technology. The list of gains or noted benefits in the use of smart technology in a variety of care services from patient’s point of view is outstanding: improved independence and self-determination, improved communication between patients and various professional parties involved in care, improved follow-up facilities, improved patient satisfaction, increased social participation, and sense of inclusion. From professionals’ viewpoint, the benefits include issues such as cost-effectiveness, increased professional appeal, better service delivery in versatile service environments and contexts, improved monitoring and follow-up of care, service logistics and impacts of care, and enabling individualized but also equity of care supply (Albrecht & Fangerau 2015, Korhonen et al. 2015, Topo 2011, Zwijsen et al. 2011).

Ethical concerns in engaging technology related to care consist most commonly of issues such as technology load, impersonality of care supply and inflexible systems concerning the transfer of responsibility and control between various care suppliers, informational rights, equity and affordability of technology-based services, usability of technology concerned, need of constant user training and support services, and user safety and dignity (Albrecht & Fangerau 2015, Korhonen et al. 2015, Larsen 2012, Zwijsen et al. 2011).

When discussing the ethical topics, another aspect is the ethics and governance related to business and innovations. Recently questions such as ethical, responsible, and sustainable innovations have been discussed more often. UNICEF (2014) has set some generic ethical principles for technology innovations: (1) design with the user, (2) understand the existing ecosystem, (3) design for scale, (4) build for sustainability, (5) be data driven, (6) use open standards, open data, open source, and open innovation, (7) reuse and improve, (8) do no harm, and (9) be collaborative. Also some other frameworks for responsible innovation are presented to assist in reflexion and provide some overall guidelines related to technology innovation and governance (Carroll & Buchholtz 2015, European Commission 2015). Stilgoe et al.’s (2013) four-dimensional model for responsible innovations is presented as a showcase of complexities related to responsible innovations (Table 1.1).

Ethical aspects—like all of the chapters and themes in this book—would require an entire book devoted to each of the topics alone. However, this book tends to provide an overview of the eHealth and eCare context and technology solutions. The book does not try to cover all aspects and introduce all related technology due to the fact that it deals with rapidly developing field and emerging technologies. This book consists of three parts that discuss enabling technology from different points of view. The first section “Opportunities and Barriers of Smart Technology in Care” gives an overview of smart eCare and eHealth technology. The context as well as the needs, possibilities, and challenges of the technology is introduced. This section discusses the technology at a more general level, and detailed information is provided in the next sections. The second section “ICT-Based Platforms and Technology Examples” discusses the technology first at the system level. Both hospital-related platforms and home care systems are introduced and discussed. After introducing platforms, the second part continues with chapters that focus on the device level. Examples on novel sensors are presented to illustrate ongoing developments and further evolving
technical solutions. Common commercial sensors are also discussed as part of the platforms. The last section of the book “Case Studies and Field Trials” combines issues discussed in previous sections by introducing case studies and real-life pilots performed. Thus, this book gives an insight into future trends and emerging solutions.

### TABLE 1.1

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<th>Dimension</th>
<th>Indicative Techniques and Approaches</th>
<th>Factors Affecting Implementation</th>
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<td>Anticipation</td>
<td>Foresight</td>
<td>Engaging with existing imaginaries</td>
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<td>Technology assessment</td>
<td>Participation rather than prediction</td>
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<td>Horizon scanning</td>
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<td>Scenarios</td>
<td>Investment in scenario-building</td>
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<td>Vision assessment</td>
<td>Scientific autonomy and reluctance to anticipate</td>
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<td>Reflexivity</td>
<td>Multidisciplinary collaboration and training</td>
<td>Rethinking moral division of labor</td>
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<td>Embedded social scientists and ethicists in laboratories</td>
<td>Enlarging or redefining role responsibilities</td>
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<td>Ethical technology assessment</td>
<td>Reflexive capacity among scientists and within institutions</td>
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<td>Codes of conduct</td>
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<td>Citizens’ juries and panels</td>
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REFERENCES


