

# TECHNOLOGICAL SOLUTIONS FOR AN AGEING POPULATION

New Perspectives and Opportunities for Business Development



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## TIIVISTELMÄ

Tämän opinnäytetyön tavoitteena on lisätä ymmärrystä liiketoimijoiden näkökulmista ja mahdollisuuksista suunniteltaessa ikääntyville ihmisille teknologisia ratkaisuja avustamaan heidän arkeaan nyt ja tulevaisuudessa. Ikääntyvien ihmisten tarpeet muodostavat valtavan potentiaalın uusille teknologisille innovaatioille, palveluille ja tuotteille, jotka tukevat ikääntyvien itsenäistä ja aktiivista elämää. Heidän monimuotoisia ja eriäviä tarpeitaan ja teknologiaosaamistaan on kuitenkin tarpeen tutkia ja yksilöidä, jotta voidaan tarjota toivotunlaisia ratkaisuja.

Tämä opinnäytetyö toteutettiin tutkimuksellisena työnä, joka koostuu teoreettisesta viitekehystä ja laadullisesta empiirisestä tutkimuksesta. Tutkimus toteutettiin puolistrukturoituina ryhmähaastatteluina kolmessa eri senioripalvelutalossa. Saatujen vastausten ja kirjallisuuskatsauksen perusteella analysoitiin ikääntyneiden ihmisten asenteita ja mieltymyksiä teknologisten ratkaisujen ja palvelujen suhteen.

Yhteenvedona voidaan todeta, että ikääntyville suunnatun teknologian tulee olla helppokäyttöistä ja luotettavaa ja tarjota turvallisuutta jokapäiväiseen elämään. Palvelusuunnittelu ja monitieteinen lähestymistapa mahdollistavat toivotunlaisten teknologisten ratkaisujen tarjoamisen ikääntyville ihmisille. Lisäksi yksilön huomioiva, humaani lähestymistapa sekä oikea kanavointi ja menetelmät tarjoavat ikäihmisille parhaat mahdollisuudet tutustua käytettävissä olevaan teknologiaan ja siihen liittyvään tietoon.

**Avainsanat** Teknologia, ikäihmiset, palvelumuotoilu, liiketoiminta

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ABSTRACT

The aim of this research is to introduce perspectives and opportunities for businesses to be considered in designing technological solutions for older people to support their everyday life now and in the future. The needs of older adults generate a huge potential for new technological innovations, services and products which assist them to live independent and active life while aging. However, their divergent needs and technology knowledge need to be further studied and identified to provide them with the preferred solutions.

First, this research-based thesis presents the theoretical framework in which the literature is reviewed and discussed. This is followed by the introduction of the employed qualitative research method. Semi-structured focus group interviews were conducted in three senior service homes which generated the empirical data of the preferences and opinions of ageing people with regard to the technological tools and solutions. Finally, the results of the qualitative research are presented.

As a conclusion, ageing population consists of a range of individuals with different physical, cognitive and social conditions. They prefer easy to operate and reliable technologies that provide them with safety for everyday life. Service design and interdisciplinary approach allow to deliver desired and preferred technological solutions for aging people. Furthermore, individualized and humane approach as well as the right channeling and practices provide optimal settings for the ageing people to become acquainted with technology and related information available.

**Keywords** Technology, ageing, service design, business

**Pages** 45 pages including appendices 4 pages

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## 1 INTRODUCTION

The implications generated by the shift in the age structure affect the society thoroughly (Parjanne, 2004). Not only will this pose an increased demand for work force but also the pressure on financial system and economic growth as well. However, it creates enormous opportunities for the businesses as there will emerge a huge potential for new innovations generating from the needs and preferences of ageing population. Moreover, solutions enabling prolonged independent living and active ageing are substantial.

Technology development is rapid and occupying new fields to an increasing extent. Solutions enabled by digitalization and technologies are widely applicable in today's modern world. Technology plays a prominent role in aiding to tackle the challenges confronted in the society and moreover in the healthcare and welfare services. Innovative and emerging technologies provide substantial effectiveness allowing aging people to stay active and independent longer. Moreover, this comes momentous when considering the increased life expectancy rate. In addition, secure, financially stable welfare state is dependent on healthy citizens and people's health is essential for economic growth as well. (Parjanne, 2004).

Like other age-groups, ageing people should be distinguished as a heterogeneous group, not a group of identical characters. Ageing is an individual process meaning that people differ from each other at older age in terms of the cognitive, social and physical features. However, health and well-being technology does not always meet the preferences deriving from older people. The number of technological equipment and services constantly increases, yet, the customer is not given a central role in the design. Moreover, ageing population may consider it challenging to deal with the expanding markets of the most advanced technology and a great volume of information.

The research questions are as follows:

1. What do businesses need to take in consideration when designing assisting services and devices for ageing population to support desired and independent living?
2. How to assist and encourage older adults to trust and take advantage of technological solutions and devices existing on the market as well as a high volume of information?

## 2 DEMOGRAPHIC TRANSITION

The population is experiencing an enormous shift towards a considerable number of older people. When reaching year 2049, there should be more 60-year-olds and older than people of age under 16 (Age International, n.d.). That has not happened ever before in the past. By the year 2060, expenditures correlating with age such as health care and pensions are predicted to increase among 27 countries in Europe up to 30% in terms of GDP according to the European Commission estimates (Ahtonen, 2012). Europe is one of the fastest ageing continents in the world with 23,2 million people being over 60 in 2014 and their number is predicted to increase to 28,9 million in 2030. North America and Oceania come second with 25,3 million (Age International, n.d.). Alternate and innovative solutions for traditional practices become crucial not only to guarantee financial equilibrium but also to maintain adequate level and ensure equality in health and social services as well as to cover the work demand in the society tackling with the situation of demographic change.

In addition to demographic transition, Finland has been experiencing a fast advancing trend where a growing share of people of all adult age groups are living alone. From the 75-year-olds almost fifty percent live alone (THL, n.d.). People who live alone generally tend to have fewer social connections and activity compared to those who live with someone. (Kauppinen, Martelin, Hannikainen-Ingman & Virtala, 2014). Thus, this event indicates transformation of societal and social behavior that will have implications to the society in the future which in turn outlines practices of business. However, for older people such a way of living may require certain procedures and special organization to permit them to live alone and sustain their independent living for as long as possible. Technological devices and equipment as well as diversity of services addressed for older people living alone will have unquestionable potential in the markets. Ageing people have needs divergent from those of younger generations therefore designating a particular sector of markets.

### 2.1 Silver economy

Currently, the silver economy is the third largest economy in the world among sovereign nations (European Commission, 2018). It covers the population of 50-year-olds and over with a range of people as regards their income, well-being, position and cultural and social relations. This economic system provides market from the disadvantaged persons with poor health, for the most part of women experiencing loneliness, isolation in social sense and addiction, to the 1960 century-born healthy and vigorous pensioners (Cornet, 2015, p. 319). With another definition:

“all types of goods and services for older adults and ageing population, including extending the working life, volunteerism and active citizenship of older people” (Klimczuk, 2015, p. 77).

Hereby, silver economy certainly covers a wide and diverse range of characteristics. It is important to perceive a comprehensive and clear picture of what are the needs and desires of older individuals as well as what the process of aging entails, providing alleviation on addressing the demographic challenges (Keller, Sliepcevich, Vitello, Lacey & Wright, 1987).

The vast age structure transformation entails not only immense societal issues but substantial opportunities to be exploited in terms of new innovations as well. Older adults as a customer segment together with digitalization can be regarded as a substantial opportunity for the development of novel innovations, services and products to the stage of covering international markets. (Parjanne, 2004; Mäkitalo, 2016). In spite of this the whole potential and opportunities emerging from the silver economy may be difficult to recognize by the businesses and investors. Fortunately, the phenomenon begins to be approved by national and European Union policymakers since the potential that the silver economy encapsulates is enormous and opportunities in the scope of Europe are remarkable (European Commission, 2018). Properly approached the phenomenon enhances not only the societal situation with challenges such as monetary policies, welfare concerns and equality but business growth as well.

In forthcoming years, the patient-worker-ratio will rise to a level where providing equal and relevant services will be challenging. Labor demand will be substantial as it is experiencing a peak for the consequence of the sociodemographic changes. According to the estimates, rapid dependency ratio decline generated by the demographic change will be evident already in year 2020 which increases the demand for machinery-based services and the challenge of work transition. The development and refinement of technology instrumentally affects the workforce supply. (Linturi & Kuusi, 2018, p. 122–127; Rynnänen, Kinnunen, Myllykangas, Lammintakanen & Kuusi, 2004, p. 29; see also West, 2015).

## 2.2 From treatment to prevention

The practices in welfare sphere have long been defined by a model in which factors negatively affecting health and well-being are tackled at the stage where they already have become problems. First and foremost, impairments of health, ailments and diseases induce undesired distress to people by negatively affecting physical and mental condition. Moreover, treatment procedures, for the most part, cause relatively high and unnecessary expenses for the society. Such costs could be mitigated and even prevented as adoption of divergent perspective and proactive approach could



provide considerable savings. Costs generated from health and social services are affected by and correlate with health and performance capabilities of older people.

Ministry of Social Affairs and Health & Local and Regional Government Finland (2017) align the essentiality of healthy and functional aging as the most prominent countermeasures on demographic transformation in their quality recommendation for the years 2017–2019. Furthermore, the probability of living independently increases and the quality of life improves as a consequence of good state of health enabling aged people to be an active part of the society. The need for treatment and care appears at a later stage, and this helps keep the costs down. (Parjanne, 2004). In addition, improving health and preventive measures parallel with care procedures constitute to ensuring sustainable healthcare in the future (Ryynänen, Kinnunen, Myllykangas, Lammintakanen & Kuusi, 2004).

There is a need for a long-term policy in regard to the anticipation of the age structure transformation (Parjanne, 2004). First of all, this requires policy makers and authorities from national level as well as municipality and private sectors to discuss and revise procedures in order to correspond better to the situation both at present and in the future. European Innovation Partnership on Active and Healthy Ageing addresses a high value on three aspects in their Strategic Implementation Plan that are to be considered, determined as the life stages: screening and early diagnosis, care and cure, and active ageing and independent living of older individuals. The Plan aims to enhance the quality of life and health of the population in Europe, specifically targeted on older people, promote and maintain the effectiveness and durability of health care and social care, and support the business opportunities to increase the competitiveness of the EU market. With these actions it is objected to increase the average number of years of healthy life by 2 in the European Union area by 2020. To enhance the preventive approach, comprising early diagnosis, screening and similar measures on older persons, innovation on technological as well as on organizational and process level is required. (European Commission 2011).

### 3 INNOVATIVE TECHNOLOGIES AND DIGITALIZATION

A wide range of emerging technologies with the capacity to revolutionize practices enable the enhancement and facilitation of lives of people. Technological solutions are expanding steadily covering extensively the latest innovations from autonomously functioning vehicles and machines communicating with each other to robotics and algorithms. (West, 2015). In the healthcare sphere, technology provides a broad scale of capabilities and possibilities to be exploited among the services by means of its intricate and divergent characteristics. Novel applications are a good example of the diversified set of existing solutions. (Mulvenna, Wallace, Moore, Martin, Galbraith, Haaker, Moelaert, Jansson, Bergvall-Kåreborn, Castellot, Melander-Wikman, Bengtson, Isaksson & Nugent 2010). Technological and digital solutions enhance the experienced life quality as well as the security in life of older people and assist to cope at the home environment. These solutions also improve the access to services and alleviate the communication with family members and health care services. (Mäkitalo, 2016).

Innovations both encouraging to good decisions and generating supportive environments are substantial through all life. Assistive technologies facilitate the improvement of quality of life of older people. It is a significant part of active aging which refers to the acknowledgement of physical, social, and mental well-being potential through the entire life. The principles enable old people to be engaged in the society in accordance to their requirements, desires, and abilities, at the same time catering them with assistance involving efficient protection and care. (WHO, 2002).

Assistive technologies can facilitate in a variety of tasks, for instance, in recording of different measurements such as blood pressure, blood sugar and other long-term monitoring measures from sleep to movements. Moreover, the range of assistive technologies includes inventions such as electronic sensors, video monitoring, fall detectors, pressure mats, health monitors and cooker controls that contribute to the secured and safe living of the older people in their own homes which is generally preferred over living in institutions. (Miskelly, 2001). The report published by Ministry of Social Affairs and Health notes that people are able to execute tasks independently as systems or devices are responsible for an increasing number of tasks (Lehto, 2016, p. 13). The innovations mitigate the required work force as the tasks requiring presence can be prioritized by use of digital solutions. Technology solutions assist professionals in the healthcare sphere to execute tasks in smarter ways while they make it possible to provide patients with more focused and individual care. (Mäkitalo, 2016; VMware, 2016). For example, workers in home care services and healthcare centers can invest their time more systematically when all the data of the patient needed is available from a certain system as the customer may have provided it in advance. Data provides information of the patient instantly when needed by the doctor or a medication dispenser

doses medicines for the patient at a predetermined time which reduces the need for a healthcare worker. Similarly, these solutions provide the means of convenient monitoring for family members as well.

Leikas (2008) states the significance of the ubiquitous technology which she notes to provide enhanced possibilities to benefit older people to use services and products when the interaction potentiality is properly addressed and designed. Besides, technological development has the potential to enable the smart environments, invisible technology as well as the ambient intelligence to approximate to the everyday life of an ageing person. Internet of Things (IoT) is a good example of omnipresent technology. It designates the interconnected network between devices and objects. (Xia, Yang, Wang & Vinel, 2012).

### 3.1 Health and well-being technology

Technology in the field of health, generally, is referred as health technology, a sub-concept of technology. Health technology can be further distinguished to health and well-being technology as concepts. Emphasis on well-being technology is on enhancement and sustainment of people's well-being, health and capacity to operate. Well-being technology includes systems and equipment comprising of for example activity tracking devices such as heart rate monitor and pedometer, a phone with a video feature and a service television. (Viirkorpi, 2015; Forsberg, Intosalmi, Nordlund & Suhonen, 2014; Sic! Fimea, 2018). Health technology, on the other hand, is addressed to assist specialists operating in the service of health and social care. It covers the equipment from monitoring devices and beds to software and medication dispensing robots. They require a CE-marking which designates that the product is obliged to fulfill safety, health and environment related demands to be marketed in the EU and the European Economic Area. (SiC! Fimea, 2018; EUR-Lex, 2008).

Key sub-concepts for the health and wellbeing technology are stimulating technology and telecare. Stimulating technology provides solutions for recreational mind and body experiences, entertainment and experiences for senses. Telecare refers to customer healthcare that is performed using communication technologies or information networks. It allows the health care practitioner and the patient to communicate from different locations employing video or speech connection. Different measures can be monitored on the patient such as weight or blood pressure as the health care practitioner receives the data through the system. Safety and property protection of people, environment and animals are also notable matters which safety technology, a sub-concept of technology, aims to support and improve. (Äijö & Tikkanen, 2019, p. 173; Forsberg et al., 2014).

### 3.2 Age technology

When viewing technological approaches on developing and exploring purposes to assist and support desirable ageing by services, devices and environments the term age technology is used. Age technology pursues practices contributing to pleasant everyday life and independent living of ageing people. The term gerontechnology is also used, usually to combine gerontology, the research on ageing, and the research from the technical sphere. The principal aims are to prevent the problems from occurring, to support strength capabilities, to compensate weakened abilities, to support work in the care field and to contribute to research. (Kaakinen & Törmä, 1999). Ageing decreases the ability to perform fundamental functions when mobility, senses, fine motor skills, muscle strength and memory deteriorate. The aim of age technology is not only to support the ageing individuals but family members and health care persons as well. (Forsberg, Intosalmi, Nordlund & Suhonen, 2014).

Gerontechnology also pays particular attention to the principle of accessibility which emphasizes the maximized accessibility and safety, functionality and ease of use with regard to products, services, built living environment and communication channels. Another central factor is the permanence of living environment which underlines the opportunity to live in a familiar environment despite the alterations on performance. (Forsberg et al., 2014).

### 3.3 Environment supporting safety and functionality

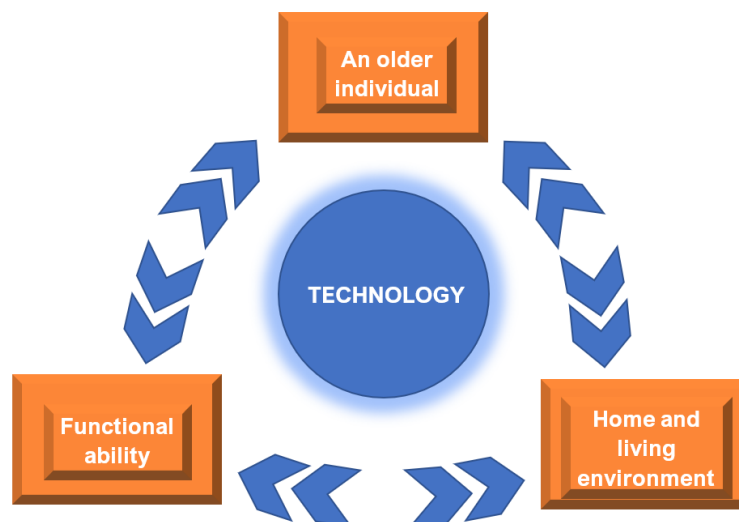


Figure 1. Äijö & Tikkanen (2019) review technology as a compensating and integrating factor between an older individual, functional ability, and home and living environment.

According to a study by Nykänen (2007), older people expected to meet functional and domestic problems at home in the future. Deteriorated health and mobility as well as the disability to execute domestic tasks were identified as functional barriers to live at home. Poor location of some facilities was regarded as an obstacle as well. Own home as a living environment is admittedly a good place to live for an older individual from the physical point of view when the functional and design aspects have been considered. However, an older person may be suddenly unable to live independently if his or her health unexpectedly deteriorates. Furthermore, as regards innovating and designing tools and solutions for older people to support active ageing, individualism will be increasingly essential like the principle of accessibility (Leikas, 2008).

Fundamental in designing technological solutions for old and ageing people is the design for all approach, gerontechnology and individually designed products and assistive tools (Figure 2.). Design for all approach refers to solutions that are fundamentally created to serve people despite their characteristics such as age and physical abilities. In addition, as it contributes to the emergence of universal and common solutions it provides easiness to use assistive equipment. The aim in the designing for the ageing is to create safe and convenient environment with as few limiting functional factors as possible. These are the focal points in accessibility design and participatory design as well. It is essential to consider the wide variety of consumers and to involve them in the design of both the physical and object environment and, for example, in the development of applications. (Topo, 2013; see also Leikas, 2008).

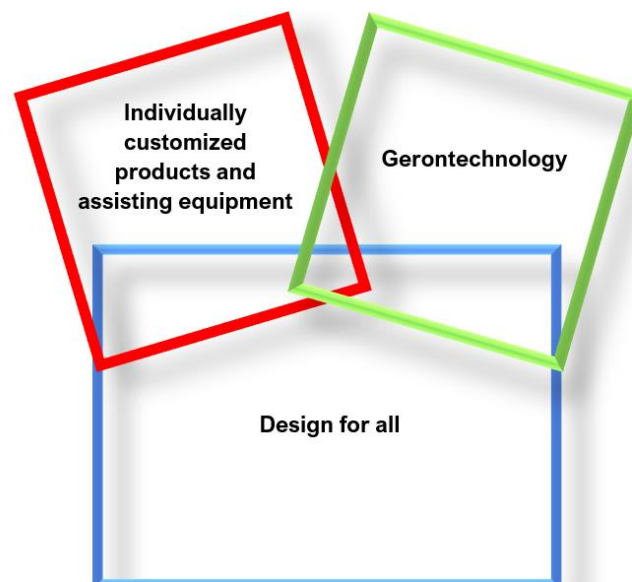


Figure 2. The focal points of designing technologies for ageing people adapted from Topo (2013).

## 4 THE PREFERENCES OF AGEING PEOPLE WITH REGARD TO TECHNOLOGY

The sociodemographic background of ageing people in the future will certainly be different from that of the contemporary older adults (Flandorfer, 2012). There will be older individuals in need of care services, and they will be more critical and aware of the services available and therefore more likely to demand them (Hämäläinen, Lanne, Jännes, Hanski, Rytkönen, Reisbacka 2014).

Diversity between different generations is substantial, and this is seen in the desired services. Older generation includes people with a wide variety of knowledge and skills in terms of technological knowledge. In the future, there will be even more technology-oriented people in the world with more expertise which affects the desired quality of services. In addition, sufficient adaptation to technological and societal changes requires adequate abilities and know-how which correlates with the quality of life and active capacity management of retired people (Parjanne, 2004). According to studies conducted on technology perception and utilization among ageing people, usability and usefulness can be generally identified as the most substantial factors. (Leikas & Lehtonen, 2007; Wessman, Erhola, Meriläinen-Porras, Pieper & Luoma, 2013).

### 4.1 Technology acceptance and utilization among older and ageing people

Statistics show that older Finnish people are diligent Internet users: 80% of the people between 65 and 74 years use Internet (Tilastokeskus, 2019). According to Niehaves & Plattfaut (2014) Information Technology (IT) and the Internet are detected to be substantial in permitting seniors to be able to live independently for an expanded time frame. Essentially, however, older people are not able to use and take advantage of IT and particularly the Internet as effectively as other age groups. Different barriers greatly limit the usage and general acceptance of digital technology. One instrumentally contributing factor on the poor knowledge on the usage of technologies is the misplaced design. A highly important element on the overall design is how technology can be used where either the accessibility requirements of aging caused by sensory impairments have not been considered or the old age is rather excessively emphasized. (Leikas, 2014, p. 104–105).

### 4.2 Technology Acceptance Model

A spectrum of different ideologies and theories have shaped the extensive research on psychology-grounded model of technology acceptance. Acclaimed and influential ideology for particularly focusing on computer acceptance is the Technology Acceptance Model by Fred D. Davis. (Niehaves

& Plattfaut, 2014). It introduces the concept of two factors predominantly affecting the acceptance of information technologies: perceived usefulness and perceived ease of use. In his research Davis (1989) defines perceived usefulness as a variable which is to describe the level of utilization of an application among people with regard to expected contribution on their job performance. Despite viewing the usefulness of the application in positive light usage may be regarded poor if efficiency advantages are not at the same level with the effort required for the use or the system is presumed arduous. This portrays the perceived ease of use, which has been proposed to affect usage in addition to usefulness.

HCI, Human-Computer Interaction, describes the interaction between human and technology. Several factors, from information systems and ergonomics of devices to social interaction and learning, are critical in defining how sufficient and efficient this interaction is. As a field of research, it emphasizes user-centered design on information technology sphere. (Leikas, 2008). The expectations, fears, motivations and lived life of the individual affect the way the user perceive technology, whether it is useful or undesired. With regard to older people, Topo (2013) proposes, that the motivation is related to the reach of services. For example, the number of Internet and computer users among older people has increased parallel with the increased supply of computer related services facilitating the communication.

## 5 BUSINESSES TARGETING OLDER PEOPLE

Viable for businesses is the ability to form the actions to correspond to the current state of the markets and the ability to widen the scope of the business activities to the future. In order to obtain new customers and simultaneously maintain the current ones it is necessary for the service provider to improve the service-related expertise as well as the ability to innovate, in addition to follow the change of the markets. (Miettinen, 2011, p. 29).

Essentially, technological development defines how projects on information and communication technologies excel to achieve their objectives. Difficulties may be encountered, for example, at the implementation stage of delivering prototype or application to production and markets. In addition, significant contribution in financial terms is required and potential application may not be advocated by the current social environment or infrastructure. (Topo, 2013).

### 5.1 Value proposition

Catering a specific need or a problem of a customer creates value for customer segment (Osterwalder et al., 2010, p. 23). The value proposition can be labelled as a critical contributor to an organization's operations to gain a competitive edge, and here the customer viewpoint is a fundamental element (Rintamäki, Kuusela & Mitronen, 2007). It is important to notice the changes in the value sought by customers when there are changes in the environment as well as in the needs and experience of customers (Almoatazbillah, 2012, p. 68). The Business Model Canvas introduces different elements for promoting value proposition. On one hand they can be comparable to solutions currently offered in the market with enhanced specificities, on the other hand, they can be completely new and innovative offers for benefitting the customer. (Osterwalder et al., 2010, p. 22–25).

Companies co-create value with the customers for instance by engaging customers in the designing process of new products to develop and improve services and products or by requesting them to leave reviews to create value for others seeking a specific product. (Osterwalder, et al., 2010, p. 29; Ojala & Pöyry, 2012, p. 194). Frow & Payne (2007) state the significance of the co-creation when aiming to deliver a superior experience for the customer.

### 5.2 Channels

In order to provide the value proposition and interact with the customers the organization needs different channels, essentially in the sense of distribution, communication and sales. Channels can be specified as awareness raising, value proposition evaluation by customers, leading the customers



to purchase the products and services, value proposition delivery to the customers and providing support after the purchase. Channels have a central position in contributing to the customer experience as they represent the customer touch points. (Osterwalder et al., 2010, p. 26). Winer (2001) emphasizes their importance as each interaction with the customer can foster the continuity with or cause a loss of the customer. Company can reach the customer through either owned or partner channels or their combination. Furthermore, owned channels may be operated on direct practices such as through web site or own store, or indirectly for example through retail or organization-operated stores. Partner channels provide means for indirect practices covering of a wide extent of alternatives, such as a web site owned by a partner business, or a wholesale distribution. Owned and partner channels differ in efficiency, as owned channels may impose higher expenses but, yet, higher revenues. With partner channels company may expand the scope and take the advantage of the partner abilities but with lower margins. (Osterwalder, et al., 2010, p. 27).

### 5.3 Partnerships

Partnership for a company can be a tactical cooperation between non-rival partner or a competitor, collaboration project for generating new business, or alliance between buyer and supplier. Improvements in interconnectivity and more coherent services as well as refined cooperation do not only serve the customers with more convenient amenities but also the service providers with increased competitiveness. (Osterwalder et al., 2010, p. 38–39). It is important to see collaboration as an advantage rather than hindrance for business. By cooperating businesses can operate in a greater perspective and presumably with better outcomes (Haapala, 2018, p. 11). Similarly, in a report of Ministry of the Environment (2017) it is argued that cooperation between experts from variety of fields is valuable for complete customer knowledge where partnerships should be initially exploited, and subsequently recruiting diverse professionals for growth purposes. Chesbrough & Schwartz (2007) point out the effectiveness of co-development partnerships as they encompass a great potential to innovation development through the business model.

### 5.4 Customization

Customization has increased its significance lately where certain needs of customers are considered in the design of services or products. Especially in the industry of electronics targeted for consumers design may be regarded as rather significant part of the value proposition. Ease of use and convenience are substantial elements as well. (Osterwalder et al., 2010, p. 23–25). The Blue Ocean Strategy by Kim & Mauborgne (2005) points out the importance of value innovation which emphasizes eliminating the competition by the means of creating perceivable value for customers while

simultaneously promoting the business and thus unlocking a novel market area.

## 5.5 Service design

In the 21st century, there can be seen an enormous expansion in the use of service design procedures and measures and the customer experience has begun to be recognized as an important element in business (Häyhtiö, Kyhä & Raikisto, 2017, p. 92; Reason, Løvlie & Brand Flu, 2015, 49). Opinions and views of the customers have a strategic role in the process of designing services and products. Surveys measuring customer satisfaction and customer consultation in the designing process cannot be described any longer as sufficient procedures to cover the role of the instrumental participation of the customer in the process. The aim is to build a new kind of a partnership where instead of seeing the customers as objects of the services, they are to be an influential part of developing the services. (Niskala, Kairala & Pohjola, 2017, p. 7–9).

The needs of the seniors offer many possibilities contributing to innovation and therefore to the creation of new businesses, services, companies and products. (Parjanne, 2004). However, Nordlund, Stenberg, Forsberg, Nykänen, Ranta & Virkkunen (2014) point out that older individuals have not been included in the design process of new equipment. Older people evade modern technology since they are not provided training or instructions to use it and the design poses difficulties such as too small buttons. In order to become aware of the demands and needs of older adults it is necessary that their opinions are inquired. It is important to create authentic interaction where the person's statutory rights to participation, self-determination, and influence are considered. This interaction is always conducted in their own language. Furthermore, Räsänen (2019) argues that older people can evaluate very competently their requirements to services.

### 5.5.1 Customer-centered approach

The concept of design, first and foremost, encapsulates the interaction between products, people and technology as it previously has been dominated by terms of use, production, actions, materials and shape. In service design, user centered approaches in terms of development and reviewing are widely used. Transformations in technological, financial and social settings correlate with demands and issues of people. In service creation context, the value creation is highly addressed (Miettinen, 2011, p. 23–26). Prahalad & Ramaswamy (2004) state that the popularity of consumer experience with the individualized approach is increasing in terms of value creation. The company may achieve remarkable leverage through the co-created value such as the exclusive experiences which can be identified as influential novel sources. Interactions and dialogue among the customers,

businesses and communities of consumers are forming a platform of markets.

### 5.5.2 User-centered and participatory design

According to the standardization of User-Centered Design Processes for Interactive Systems by International Organization for Standardization the method aims at the development of systems concentrating on the ease of use of the applications (Heinilä, Strömberg, Leikas, Ikonen, Iivari, Jokela, Aikio, Jounila, Hoonhout & Leurs, 2005). User-centered design was gaining increased attention already in the 1990s. Also, it was recognized that for the consumer product to be superior, strategical threefold approach must be implemented: the product must simultaneously address the usefulness, usability and desirability. (Sanders, 1992, p. 49–54). User-centered design engages older users in the design process of services and products which ensures developing and finally delivering desired outcomes to satisfy the end users' needs. It can be described to be multidisciplinary in characteristics involving competence and expertise from different fields such as engineering and graphical design. Such an approach should be employed in designing technologies for older population as sociology, ethnography and related research fields provide important information on attitudes and views of older people. They have a crucial role in contributing to the design of and predicting services and development of technology in the future. (Heinilä et al., 2005; see also Leikas, 2014, 108). Sanders & Stappers (2008) draw attention to the transformed environment with present intricacy challenges where customer-centered product design does not sufficiently comply. The design should be targeted for the experiences encountered in the future by people and societies in the time of the rapid development of vast information possibilities.

According to McClelland & et al. (2005) the products and services will properly cover the end user needs from the functional as well as from the qualitative point of view when the end users are involved in the design process. Also, it allows the convenience of the use to be achieved and problems in the usability can be kept at the bare minimum or eliminated. The figure of a five-phased participatory design model by Demirbilek & Demirkan (2004) (Figure 3.) visualizes the roadmap of a participatory design. Older people engage in the design process by assessing the development of proposed concept and introducing ideas and specifications at several phases together with the designers, therefore contributing to the desired and appropriate products. Thus, they contribute to the production of well-functioning outcomes that cover the requirements of the end users profoundly and, moreover, sustain and support the independent and secured living of older people. Cozza, Cusinato & Philippopoulos-Mihalopoulos (2019) state in their study the importance of participatory design: it drives and contributes to the proper and comprehensive nature of living today as well as in the future, forged by a variety of actors. Also, they point

out that a widespread present of technologies has affected the design inclination.

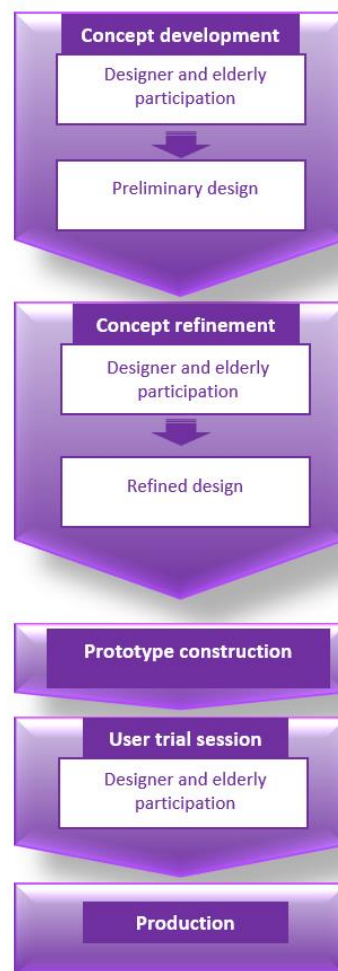


Figure 3. The phases of the participatory design model adapted from Demirbilek & Demirkan (2004).

### 5.5.3 The desired outcome with the use of piloting and iteration

Iteration and pilots among prototypes can be described as substantial elements in the service design. Avoiding too complete services or products allows capacity for adjusting and shaping the end product to meet in the best possible way the end user requirements. Iterative design employs the repetitive practice on the development of design solutions, as well as the experiment and assessment. Instant notions on the functionality and feasibility of the final outcome are allowed through the continual refinement and processing. (Miettinen, 2011, p. 23).

The assessment of customer's demands is interfered by both the range of how people live and what they value as well as the constant prolongation

on functional abilities. However, the envisioning procedures should be fostered and developed with regard to intervention of new service and product requirements and innovation. (Parjanne, 2004).

## 6 METHODS

Qualitative research method was chosen to collect the primary data for this research. It creates a convenient way to generate an extensive understanding of societal phenomena since it provides a variety of aspects and dimensions to review (Tilastokeskus, n.d.a). Focus group interview as a qualitative research method was used to study the research questions. In focus group interview, essentially, the data generates through the communication and exchange of views between a group of interviewees. The interaction within the group contributes comprehensively to the emergence of new insights. (Morgan, 1997). In addition, Fern (1982) stresses the effectiveness of focus group interview grounded on his study findings: two focus groups consisting of eight persons is comparable to ten one-to-one interviews as regards generating new ideas.

### 6.1 Focus group interview

The focus group interview is instrumental for studying people's behavior and opinions and, furthermore, for indicating how they think and what affects their viewpoints. The method provides a facilitating environment as the group dynamics may activate and assist people to form and express their views more explicitly in contrast to individual interview. Group interaction is essential in gathering information as it involves the group members to comment on and to exchange views and experiences as well as ask questions. In addition, it supports uncommunicative participants or participants that may consider it challenging to express opinions to engage in conversation started by other group members. Another meaningful issue is the possibility of people to participate in spite of their possible disabilities such as poor writing and reading skills. Some people may experience discomfort on one to one interviews and group interview can positively affect the responsiveness in that sense. Similarly, proposed relaxed settings of focus group may contribute to developing comfortable atmosphere and thus affect the expressiveness. (Kitzinger, 1995).

It should be considered that the number of participants in the focus group is preferably limited to be between six to ten persons. Although a greater or fewer number of participants may affect the discussion, the variation is acceptable. (Morgan, 1997). Powell & Single (1996) argue that the unfamiliarity between the participants should be taken into account in order to avoid incapacitating of expressing genuine and candid notions.

Kitzinger (1995) states the relevance of focus group with regard to studying behaviors and thoughts of older people as there could appear severe possible restrictions. They may have physical deteriorations such as reduced ability to produce speech or hear, or they may have some illness causing impairment. In groups, arranged cautiously in this respect, others can assist if a person is unable to clearly state his or her own views. Similarly, the

response rate could be higher in a group interview compared to an individual interview. In a group, a person may infrequently contribute to the discussion or the discussion generated by others can function as a stimulating and encouraging factor finally allowing even less responsive participants express their thoughts. However, there may arise challenges in interaction if each individual has a distinct impairment. (Kitzinger, 1995).

A focus group interview can be conducted as structured or semi-structured. It depends on the level of moderator contribution and standardization. (Morgan, 1997). In both, a moderator facilitates and controls the direction and progress of the interview. Depending on the fashion of the interview, at first the moderator may observe the discussion by listening at background but whilst the interview proceeds, engage in the discussion by encouraging the conversation to continue further if it seems to be ending otherwise. Also, moderator can foster the debate of the contradictions and thoughts that might arise among the interviewees. (Kitzinger, 1995).

A structured interview is particularly employed by researchers that have a rigid determined plan of action. A structured interview uses a standardized approach involving a structured guideline with the prearranged content and the research questions. In addition, the moderator does not pursue a discussion or insights which are not directly related to the topic. Whereas, when the research is explorative in nature a non-standardized interview is chosen. The object is to explore the views and interests of people and achieve novel knowledge. In less-structured interview moderator does not dominate the discussion to the extent of a more standardized, structured interview and the content is more flexible. This enables the discussion to proceed depending on the interests and insights of the participants. Thus, the interview can trigger a vigorous discussion among the interviewees and may generate unexpected issues to arise providing a considerable substance of the studied phenomenon. (Morgan, 1997).

## 6.2 Interviews

The interview questions used in this research were designed and formed by the researchers, research manager Marina Weck, Professor Nina Helander and senior lecturer Tarja Meristö, of a Foundation for Economic Education granted research project Desirable Future for Aging People: Perspectives and Business Opportunities for the Assistive Technology. Author of this thesis participated in gathering the empirical data and generated her own analysis to answer the presented research questions in this work. The questions were addressed separately for both users and non-users of technology aiming to consider and discuss the use of technology from many aspects. The interview question forms can be found in the appendices (Appendix 3.) of this thesis.

The data was gathered through seven semi structured focus group interviews. They were conducted in three senior service homes in three different cities in Finland: Lumo senior housing complex in Kerava, senior housing complex Tullinaukio in Hämeenlinna and Esperi Care Frans Emil in Tampere. They have the service systems provided for the residents including such as dining possibilities and social activities. Furthermore, for instance, Tullinaukio accepts only residents of age 55 and above. These senior homes were selected for their relevance to this research in respect to the age of the residents, their housing management models and locations. Kerava with 36 254 and Hämeenlinna with 67 532 residents differ considerably from Tampere, demographically the third largest city in Finland, with the population of 235 239 (Tilastokeskus, n.d.b). Furthermore, Kerava represents people of metropolitan area while Hämeenlinna and Tampere are being located closer to Mid-Finland. In addition to focus group interviews, one interview was conducted in Hämeenlinna health care center. Project manager at the health and eHealth services at the city of Hämeenlinna, Ilona Rönkkö, and representative of state's flagship project of developing and supporting home care services for older and family care, Annukka Kuismäki, were interviewed.

Each interview session consisted of two focus groups. In total 41 people participated in the interviews. Of these 26 were women and 15 men. There were slight discrepancies within the size of the groups, while the minimum number of members was four and the maximum eight. Moreover, focus groups were rather mixed in age. The mean age of the overall participants was 74,5, the youngest participant being 66 and the oldest 90 years old.

The focus groups were formed by means of roughly separating two types of health and wellbeing technology users with regard to the interview questions in each session: users and those who have not used or used it to a little extent. The agenda of the interview consisted of 19 questions to users and 17 questions to non-users over the theme of health and wellbeing technology. 14 similar questions were presented to both groups, and users were presented 5 and the non-user group 3 group related questions.



## 7 RESULTS

Data from the interviews were analyzed by employing the content analysis method. The aim was to identify the phenomena and semantic patterns of the researched subject from the data which the data-driven approach intends to achieve. However, the data analysis was theory guiding -oriented since the analysis was connected to the theory in a sense of assisting in the process of the analysis but was not directly based on it. Theory guiding shaped content analysis does not aim to test the theory but to create new notions and reflections to emerge. (Tuomi & Sarajärvi, 2009, p. 95–96).

### 7.1 Diversity of technology knowledge

According to Kuismin (interview 7.11.2018), older people and The Councils of Older people, the municipal representatives of older people that convey essential information on the preferences and perspectives of the aged, emphasize the heterogeneity in this group. They remark that three sorts of technology knowledge and proficiency can be distinguished: sovereign users, people that can use technology when assisted and those who are unable to use technology. Sovereign users are very eager towards technology and comprehensively adopt technology solutions to use. Also, they attend actively test and piloting procedures and assist others in using technologies. Next group presents those who are interested and willing to use technology when they are provided with some assistance. Third group involves older people that are incapable of using it due to the incompetence or another restrictive factor such as an impairment. These all three groups should be considered in the designing processes of digital services and technologies in order to avoid exclusion of people who are not able or do not want to use technology solutions.

### 7.2 Utilization of technological solutions

Despite the variations in age and utilization level of technology among the participants the results did not indicate a clear disparity in views or mindset as regards technologies and digital inventions: a clear majority considered technological solutions complex and intimidating. Also, the knowledge on the topic varied between the individuals regardless of whether the person was identified as a technology user or not. The wide range of technology knowledge in the group of ageing people was emphasized by the interviewees. Some of the participants told about extensive use of technology and viewed it easy to use while some reported about poor technology knowledge, thus, considering the use of it difficult and challenging. Many persons informed about the elementary school being their highest level of education.

“Not everyone understands, we are not all so wise and smart, and all that, we are all so different.” (Woman).

In general, the participants were interested in technology and the solutions it provides. 38 persons out of total 41 participants reported in the background information form to be concurrently a technology user or having used technology, thus, indicating the vast amount of the participants to be users. However, only a few reported the use of health and well-being technologies in particular, although health was considered as a meaningful value when viewing the future. The most prominent reason not to use technology emerged to be the incompetence in this respect. Similarly, some of the participants reported of their reluctance to use or to learn to how to use technological innovations. One person told that she uses smart devices and is interested in technologies but prefers to use them as little as possible in order to foster traditional service practices such as customer service while they are still provided.

The use of health and wellbeing technology was mostly restricted to blood pressure monitoring and blood sugar measuring devices. One has used an activity tracker and a safety bracelet was used by two. The safety bracelet was considered practical since it was supposed to provide safety. For instance, one person reported she preferred to wear it when her spouse leaves the house and she is left alone for a while. However, it was discussed that the reliability of such alarm systems raises concerns to some extent, which consequently impacts the trust. Some of the participants had used ineffective systems: instead of help arriving instantly, it took an inappropriate amount of time from the transmitted alarm to receive the actual help.

The health-related information and communication technologies, eHealth platforms, were mentioned in the discussions several times. Three informed in the background information form that they have used such services. The use concerned mainly personal online platforms, Omakanta, Minun terveyteni and Oma olo, that provide record of treatments, prescriptions, laboratory results and other related information on person's health. In addition, health sites that provide reliable information on health and wellbeing were used by a few. People who have used eHealth platforms were satisfied with the functions they provide since they reduce the number of visits to the health care provider and doctor as well as people are able to arrange medical appointment online, thus allowing them to have more free time. They considered the performance of the systems as rather good, for example, the results can be received fast and post-surgery service was experienced laudable on an application whose feedback function was considered convenient. However, it was stated that at least Omakanta would require additional clarity and simplicity in order for it to provide a more convenient user interface. Some people criticized the long waiting times of digitally provided results, especially with regard to municipal health care centers. In addition, a few noted that reference values may

vary between different health care providers which causes confusion and, furthermore, affects trust.

For the most part, the use of technology was limited to smart devices as many denoted the use of the smart phone and tablet as well as desktop and laptop computer. In addition, many reported the use of other digital devices in general or particularly at home. Communication was one of the primary purposes, largely covering phone calls, text messages and emails. Social media platforms were used by some of the participants and they were stated to be a convenient communication medium. Furthermore, Facebook has provided a means of being in touch with relatives as they can see the activity of their family member on social media: if there is no activity within a certain time it can be a cause of concern. Other subjects included general Internet usage, entertainment purposes such as reading, listening to music and games, information searching, news, genealogy and using bank services online.

Games were regarded as positively contributing to and supporting a person's cognitive condition when the game was considered challenging. Similarly, nostalgia games were perceived as providing convenient entertainment and experiences, and positively impacting well-being. It was remarked that they could involve particular features such as different landscapes of home or country environments, virtual reality glasses, familiar music and scents, and photos of loved ones, for evoking memories.

### 7.2.1 Lack of knowledge and trust

People reported about being interested in technologies, but there appeared a couple of reasons for the shortage in use of health and wellbeing technology, and technologies in general. People seemed to have different premises: the respondents reported of having no need to use technologies, but, also, received data indicated rather clearly the lack of information and trust on technology in general which affect the utilization rate. In addition, fear was significantly affecting the utilization rate as well. The lack of training and technology related incompetence lead people to be afraid and lacking courage to use technology. Also, it was pointed out that the learning is experienced to be increasingly difficult and challenging as one gets older.

“...such dangerous-looking devices where those things pop-up and come and go, so does your own information go somewhere bad place? Those devices make one so scared that you dare not open this file when you don't know.” (Man).

“You certainly need the training and the guidance and the courage. That now you can use this so well and safely. That's probably the biggest thing for people of our age.” (Woman).

On one hand, most of the participants considered health and wellbeing technologies intimidating due to their inability to use them but, on the other hand, participants conceded them to provide safety after being acquainted with them. In addition, participants considered them to facilitate everyday life. For example, automated blood sugar measuring device and medication dispenser were reported to be potential to provide security and convenience.

Another issue harmfully affecting the trust and will to use technologies among the participants was the protection of digital systems and devices. People were concerned about hackers and the security of digital systems as well as about the functioning of different digital and technological smart devices and systems if there occurs a failure caused by a thunder or such. In addition, the differentiation between valid and invalid information available, for example on the Internet, was regarded challenging due to the enormous amount of the information currently existing. Strong verification procedures were regarded excruciating due to the excessive number of passwords that are needed to remember, but they were also seen as contributing to trust in the systems. However, ensuring ethical measures as regards reviewing and managing the information considering individual's health and other documentation by different institutions and authorities was presented to be a concern to some extent. For example, it should be ensured that the material of the secure monitoring devices set on person's home is only allowed to be accessed by people that are permitted and that the patients should be informed when their data has been reviewed.

“...there has to be some sort of assurance that the service provider must be able to sell the thing to the users certain of the fact that when the user starts to use the services he can be sure that this information will not spread to the whole neighborhood.” (Man).

Implementation-related training was stated as important. The interviewees stated that they need a particular and individual, level of knowledge adjusted guidance in order to first learn how to use and then successfully adapt technological devices in their daily life. Person's slowness in operating technological and digital devices, as well as his or her background should be considered in designing technological solutions which would provide mitigated intimidation to use them. As a facilitator to use for example Internet and specific web pages could function events providing information on health and wellbeing technology or technology in general, as one would not try to search them on their own. Moreover, groups small in size were preferred in order to allow enhanced possibilities for the people to engage in the session and ask questions and generate discussions, and thus fully exploit the assistance provided.

“For some people it takes longer to understand things and they need slowness when others understand at the first time.” (Woman).

“The elementary school base doesn’t help that.” (Woman).

Pilot and experimental projects were seen as a potential way to contribute to design technologies since they would enhance the possibility to bring well-functioning solutions to the markets and respond to customer needs more profoundly. Furthermore, consumers should be involved in the process already at an adequate, early stage.

Participants emphasized the characteristics of their generation which they felt were often paid too little attention. They remarked that the guidance on technology is often regarded unfavorable for the reason that the level of competence of an older people with regard to the technology is not considered. Older people should not be compared to younger generation that are accustomed to technology.

“It requires such a tighter-fingered instructor, that this is what you press, this is what you press, and this is what you press. That those young people will help, but they are too fast: that this is how it goes to the bank and now this is paid.” (Man).

### 7.2.2 Ease of use and clarity

Ease of use and clarity were viewed as the primary means in technological and digital devices and services in order for them to provide ageing people the comfort and convenience to use them. The ease of use and general clarity could encourage people in starting to use technologies as concurrently they may feel uncertain and fear using it since the functions are regarded too complicated and overwhelming.

“The older you get, the weaker it becomes. Then we, I would say, that at least myself, I belong to the generation when there weren’t such technical devices.” (Woman).

“As few of these switches and knobs as possible in these devices.” (Man).

Similarly, people criticized the ease of use and interpretability of written instructions. It was pointed out that information on the instructions invariably appears to be overly extensive compared to what is required to perform in practical terms for the device to function. This easily causes confusion to people as the information could be presented more concisely and with the most principal contents instead of translations of the instructions in many languages and trivia. However, in contrast, some of the interviewees discussed that the instructions are too limited on the contents which negatively affect the use of technological devices and services.

One interviewee reported about her incompetence to use and her incomprehensive understanding as regards the function of technological devices.

She may have been instructed how the device, acclaimed to be easy to use, functions in the store, but she does not manage to use it at home. She was afraid of pressing the wrong buttons or even breaking the equipment. As some equipment may have several functions that are difficult to comprehend, one participant drew the prospect of an interactive guidance which can be followed during the use of some equipment or service where the user is instructed gradually right after performing a certain function required.

“Or then it needed to be such instructions, if, for example in this case the problem is with using the microwave, that there is one info window, you press on it and then it asks you next what temperature. You press on it, there will be a new question. But only one thing at a time. But things are not arranged that way, there are 17 different things, no one can see how it plays. ” (Man).

Kuismin (interview 7.11.2018) states, that the background may affect the technological knowledge of older people. Many have worked on agriculture and, thus, may have obtained poorer competence and understanding compared to those who have worked on services or industrial jobs in the city and therefore with more technology related tasks. Due to the rapid technological development and the constant change of the environment and service solutions seniors in ten years will be more accustomed to and have higher level of adaptability towards digitalization and technology. They are more familiarized with technological devices and services in contrast with the older people now.

### 7.2.3 Aesthetics

One interviewee pointed out that the aesthetics of the devices should be paid more attention to. This was supported by the others as well and especially women regarded this aspect important. She proposed that the gadgets and equipment should be designed more attractive. As one example can be taken a safety bracelet that has a rather modest appearance with usually gray color and very plain design. In this instance, a convertible wristband would be convenient and bring added value as the outlook of the wristband could be changed according to the preferences of the users. Interviewee reported that a friend of her has refused to acquire a safety bracelet only for the unattractive design.

## 7.3 Factors contributing to trust in and use of technology

In addition to ease of use, functionality on the technological devices and services was regarded as a critical contributor to trust and use technology. This was perceived from people’s own experiences or from peer reviews and experiences of the use and quality of technologies. Prompt information delivery was regarded significant value as well when it comes to

technological systems. Significance was addressed on the interconnectivity and coherency over the technological and digital solutions. This would facilitate the use of devices and systems, since if they functioned properly together, there would not be a need to acquire additional services or equipment. It was stated that the convenient and easy to operate services should be ensured for the consumers, for example effortless communication between family members even if they do not have identical devices and systems.

The participants stated that when the knowledge on technology increases it consequently reinforces the trust in this respect. Thus, they reported it to be important to ensure the technology information availability and support equality by inhibiting the exclusion of people to reach the information. Authorities were reviewed significant in influencing the experienced trust on and supporting individuals in their choice of the technology. They were considered a reliable source to provide recommendations and counseling of technology solutions and possibilities available since they were regarded to obtain up-to-date knowledge of technology, its quality and its functions.

Kuismin (interview 7.11.2018) argues that despite public operators having a substantial role as an intermediary between the business and consumers, the businesses should move more vigorously into the consumer market. Currently people are accustomed to public operators to provide technological solutions, generally favoring certain technologies, by the means of subvention which is largely due to the consumers experience of the extensive costs. Similarly, the subvention-focused approach should be mitigated within the businesses implementing market operations. In the consumer markets people are entitled to choose from a variety of different devices and operators available the most suitable ones that correspond best to their needs. In addition, the income level of older people should be considered. Moreover, better interconnectivity within the technologies would optimally serve the customers where IoT plays a prominent role.

### 7.3.1 Costs-benefit ratio and reputation

It was stated that expensive costs could be a restrictive factor in acquiring technology. In addition to ease of use and user-friendliness, reasonable pricing was considered influential in examining technology solutions. Purpose of use, durability and life expectancy of certain devices and services were considered with regard to the costs. Yet, some informed about inexperience and unawareness that were generating uncertainty in assessing the costs on different solutions available. Furthermore, investments on additional features that are required to a device or system to function was considered inconvenient and therefore interconnectivity between technological tools was reported to be relevant.

“...that it can be used interconnected, that it's not limited to a particular service but has capacity for multitasking performance...” (Man).

For a few, brand and reputation affected the trust and therefore the overall opinions and impressions on choosing technology devices and services. Familiar and well-known, and for some, domestic brands were more preferred options. If a person has been familiarized with a brand or device it would not be easily changed as other manufacturers may have products with different functionalities, thus, requiring the user to execute a learning process of new functions which was considered laborious. In addition, intuitions and emotions were also told to affect the selecting and acquiring of technology to some extent.

### 7.3.2 Human proximity

Constant decrease of traditional communication practices as they are replaced by technological solutions raised concern among the participants, now and even more in the future. They considered social communication in person as preferred alternative over the actions taken by technological or digital solutions requiring a non-traditional interaction. For instance, phone calls were favored over text messages. Some of the people were upset since their family members or friends do not call or visit – which they regard important – but send text messages instead. Yet, some of the participants reported about valuing rapid technological communication possibilities as they desired fast and effortless means to communicate facilitating the everyday life.

“Though I have family and the kids are pretty close, they don't call every day and ask how I am doing. So, that seems to be, at least here now, suddenly thinking, important.” (Woman).

“That personal communication is shrinking..” (Woman)

Furthermore, it was discussed that the scope of digitality and automation have been extensively increased and the participants pointed out that caution should be pursued in this respect since the consequences may be unpredictable. The omnipresent digitalization, thereby, has led the people in a sense to be obliged to use the solutions of this kind. One participant stated that people and especially older people should not be forced to use them as the ability to do things with your own hands should be sustained as it is an important part of mental health.

“I would argue that there is no pressure now put on people, especially on the older ones, to switch heavily to digitalization. Because this hand skill should be retained by the old people, too. (Woman).

Assistive technology devices and services for home such as robotics were not rejected altogether but the assistance conducted by a human was preferred, however. The interviewees valued human home care service workers and pointed out that they do not want them to be replaced by robots.



It was stated that human contact should be preserved in the future since humanity and human interaction cannot be replaced by any technological devices such as robotics. They were considered frightening especially in a sense of they are to conduct health care services and communication tasks at people's home. However, robot vacuum cleaners or other daily used electronical solutions like smart homes were regarded potential. Also, it was discussed that the work can be executed by sharing it between a human and a robot, for example in cleaning. Robots were preferred not to be responsible for everything since excessive use of robotics may result in some human functions, for example physical and cognitive, decreasing as they are not necessary to use anymore. However, robot was viewed as having the advantage of quickly detecting an emergency situation and alerting it.

“You have to be able to use your own hands and brains and do it yourself and not have to do everything with the assistance of robotics.” (Woman).

#### 7.4 Desires for the future

In general, participants viewed stating desires and expectations for the future rather difficult. The technological development was considered overwhelming to some extent and keeping up with the pace was reported to be a cause of concern. Similarly, some were concerned about the deteriorating memory that negatively affects the operations in everyday life and is connected with the use of technological equipment. However, some of the participants reported that they wish the technology solutions to arrive more rapidly in order to learn and be able to use them. Technological inventions and solutions related to social networks and communal activity in addition to cleaning were mentioned and viewed potential. Health care was hoped to improve especially in regard to obtaining the access to and being provided with treatment and reaching the doctor.

“You could set it up in a way that you could change machines weekly if you had to stay tuned.” (Woman).

Most of the interviewees reported that they would prefer to live independently and at their own homes for as long as possible and avoid being placed in a nursing home. Overall health and longevity as values were regarded important to be sustained in the future. Also, it was stated that they do not want themselves to be regarded as a burden or a problem for the society and other people, especially not for their family members. Some type of a monitoring was viewed prospective as a means of controlling the state of health of people. Some of the participants mentioned they have had controlling rounds conducted by the service personnel of the senior home they live in and they were considered important for the security they provide for the people.

## 8 CONCLUSIONS

The general aim of this research was to identify what businesses should take in consideration when designing technological assistive devices and services to support desired and independent living of ageing population. In addition, its aim was to find out how older people could be assisted to adopt comprehensively new and the most advanced technologies existing in the market as well as adopt the high volume of information. The results of the qualitative research of this thesis support the information and findings that were presented and discussed in the theoretical framework.

### 8.1 Designing assistive technologies for ageing people

It is essential to observe the older population as a separate, distinctive group demographically as well as from the physical, cognitive and social condition point of view. Older population consist of a range of individuals with different characteristics and needs, and technology knowledge varies greatly in their age group and, furthermore, not everybody is able to employ technological solutions. They may have limitations or reluctance to use technologies such as declined capacity to learn or principles that require that traditional devices and services should be provided and maintained together with the technological solutions. The procedures and practices aimed at satisfying the requirements and desires of ageing people have been developed and enhanced, yet, old people clearly experience that their needs have not been satisfied.

Ageing people desire individual living as they grow older, and they regard the safety aspect of everyday life substantial. In addition, digital and technological devices and services should be easy to operate and provide security where motivations, fears and the background of people impact how technology is perceived. This emphasizes the significance of the user and participatory service design models in the concept development and implementation process of new digital and technological products and services in order to allow the desires of ageing people to be observed. Ageing people as end users should be involved in the design process preferably from the very initial, concept creation phase or they can be invited to develop and improve existing solutions. Their participation facilitates the business operators to perceive the actual needs and preferences of ageing people which consequently ensures the delivery of the most appropriate and valued technological solutions for the ageing population to assist and support them to live actively, safely and independently longer. It is also important to provide them with alternative options for technological solutions since not everybody is able to use it. Furthermore, some of the older population may be willing to use specific digital services but, for example, would like to meet their doctor personally since it provides them the opportunity of human contact.

As desired end product and services positively contribute to the end user's attitudes towards and the utilization rate of the provided solutions it positively affects the experienced expenses both at the individual as well as at the societal level. Preventive measures can be expected to be better assured as technological innovations contribute to support healthy and functional living with diverse range of solutions and thus ultimately reduce expenses with regard to ageing such as health care costs.

An interdisciplinary approach provides the means of delivering functional and desired technological solutions to assist and ensure ageing people to live conveniently and safely. Such a method considers multiple aspects in designing technologies for older people in addition to generating great partnerships and co-operations contributing to the emerge of unexpected and innovative solutions. This is of an advantage both to the businesses and to the ageing as customers as they are provided with value with the solutions generated. In addition, coherency and integrability over the digital and technological solutions should be paid attention to and reinforced in order to allow fluency and efficacy for older population in using technologies. For instance, more open interfaces of the systems would provide immense advantages.

In order to ensure that ageing population becomes acquainted with and employs the advanced technologies and perceives the available information, particular approaches are required. Humane proximity should be sustained, and humane and individualized approach nurtured as they allow comfortable and attentive settings for the older people for contributing to their potential to understand and learn. This further impacts the experienced reliability and trust with regard to technological solutions.

Older individuals should be provided with arguments and persuaded of the secured use and reliability of technology. According to Leikas (2008) Ellis & Allaire (1999) and Rogers & Fisk (2000) state that on one hand ageing people experience fear towards information technology but on the other hand, it can be mitigated by the effect of positive experience and accumulating knowledge of information technology. Peer-to-peer experiences are significant in this sense in addition to transparency as regards providing information and reviews on technological services and products the company produces. Consumers can provide their evaluations and experiences of technologies for example on some specific online platform or application, or in the website of a company. Communities, especially online, have increased their popularity among companies. Customers can share information to each other, while at the same time, businesses become more aware on the behavior of their customers. (Osterwalder, et al., 2010, p. 29). They can be self-formed, for example on social media, or companies can contribute to the community development by such means as providing customers information or encouraging them to produce information to each other (Ojala & Pöysti, 2012, p. 194).

## 8.2 Adoption of technologies and the high volume of information

Adequate distribution is of foremost importance in order to provide older people equal access to technological devices and services and to ensure that they reach the understanding of information available and know how to use them. In this respect, collaborations and partnerships between stakeholders and different operators contribute to provide information of technologies for the ageing population. They denote a great significance as they enable diverse channels to be exploited as well as provide great business opportunities. This can be conducted for example between different institutes, operators on the third sector and businesses such as municipalities, health care centers, libraries, pharmacies and different associations and organizations. For instance, seminars, group teaching and personal consultation could provide means to deliver the information for the people. Simultaneously this allows to observe the insights from the people that contribute to the increase of knowledge on the perceptions and desires of older people towards technology and thus the designing and development of the devices and services.

Channels should be selected and assessed to confer comprehensively the capabilities to reach the ageing customers, whether they live in their own homes or senior homes, with enhanced possibilities to social communication for example in the form of social premises and communal activities. Furthermore, physical disabilities and other related challenges brought by ageing may contribute to the increased loneliness. Hereby, counselling conducted by visiting older people at their homes would provide great means for them to reach the information and get acquainted with technology, and moreover, contribute to their social life. According to Older People Services Act (980/2012), the municipality is obliged to provide counselling services such as guidance of health care, social and related services and support for independent living, well-being, health and functional capacity of the ageing people, being in line with their individual needs and given in the right time.

It is important for the business operator to continue the dialogue with the customer after the attainment and engagement such as providing the customer relevant and important after-purchase assistance with regard to the use of the tools and solutions of technology. Personal assistance is important in this regard as it affects the creation of a solid relationship and its longevity, thus affecting the business prosperity. According to this research and literature review, ageing people as consumers value security and trust. Through individualized, personal assistance they could be guided and orientated to use and exploit technological and digital solutions that include self-service functions to an increasing extent such as eHealth and telecare services. Dedicated, personal service concentrates to provide older population individualized assistance and considers their specific needs. Deep and dedicated customer relationship greatly impacts the

views and thoughts of the older customers and consequently affect the trust with regard to technological and digital solutions provided.

### 8.3 Limitations of the research

Focus groups as a qualitative research method are a good technique to reach better understanding of different phenomena. However, the activity and enthusiasm of the involved participants affect both the volume of the received data and the participants' willingness to respond profoundly to the research questions. Consequently, this affects the constitution of the in-depth information and the generated analyze and created conclusions.

The focus groups were quite appropriate in size although some of them were rather small. This did not pose a concern if the involvement of the participants was active, however. Instead, more restriction arose from the fact that the research was narrowed in the sense of including only ageing people living in senior service homes which may influence their perspectives to view the discussed subjects. This supports conducting data also from people living alone or with someone in detached houses. Similarly, although there is no information gathered about the economic status of the participants, more disadvantaged population, for example with more disabilities, or persons with little or no income should be surveyed to reach more comprehensive knowledge of the perceptions and views of ageing with regard to technologies. This could be conducted in person for example through municipal institutes such as health care centers or by visiting people's homes or societies.

### 8.4 Ethicality

This research was conducted by following the good scientific practices. Ethicality and data protection were properly conformed in accordance with statutory procedures. People were informed of the arranged interview sessions well in advance and participants attended voluntary the interviews, as well as no one was forced to take part in them. Everyone who attended the interviews were obliged to fill out a permission for the research to use anonymously the gathered data (Appendix 1). Resulting data and documentation of the research were conducted and stored in accordance with the requirements of scientific knowledge.

### 8.5 Discussion

Although the topic of how older adults perceive and view technologies and digitality has been studied to a great extent this research further contributes to support the previously generated knowledge and conclusions. The qualitative research provides substantial insight on the desires and needs of the ageing population with regard to digital and technological innova-

tions and solutions. They are a potential consumer group with a great purchasing power, yet, it is necessary that their needs are successfully discerned and widely paid attention to, from the initial concept designing to the final production phase. Without such procedures it would considerably affect their potential to become technology users.

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## INTERVIEW

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**PERMISSION TO USE THE DATA OF THE INTERVIEW**

## Appendix 1

You are participating in an interview of a research project “Active Digiage: Desirable future of ageing people” that is conducted by Häme University of Applied Sciences, Laurea University of Applied Sciences and Tampere University of Technology.

The purpose of this interview is to reach understanding and gather information of the future needs and desires of ageing people, utilization rate of health and wellbeing technology and related benefits, threats and trust. This information is also needed for service providers and technology developers in order to better develop and provide new product and service solutions for independent and high-quality living at home for ageing people.

We ask your permission to use the information gathered in the interview in the research project “Active Digiage: Desirable future of ageing people”.

The identity of the contributors to the material is not identifiable.

I give my permission to use the material gathered in the research project “Active Digiage: Desirable future of ageing people”.

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Name

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Place and date

**BACKGROUND INFORMATION FORM**

## Appendix 2

Are you a user of health and wellbeing technology?

- Age
- Gender
- Educational background
- Do you live alone or with someone?
- What challenges/restrictions do you have in everyday life?  
Examples:
  - physical challenges (e.g. mobility, sight, hearing etc.)
  - mental challenges (e.g. challenges related to mental health)
  - cognitive challenges (e.g. memory related problems or difficulties to understand instructions)
  - social challenges (e.g. interaction with people, making friends etc.)
- Have you used digital devices such as smart phone, tablet, lap top computer, desktop computer, other digital devices at home?
- In which way do you typically use them?



**FOCUS GROUP INTERVIEW QUESTIONS**

## Appendix 3

## Questions addressed for users of health and well-being technology devices

- What digital health and wellbeing technology devices you have in use?
- How long have you used these digital devices?
- How would you develop these devices or related services?
- What positive have these devices given to you?
  - Benefits, for example safety, accessibility
- What is negative about using these devices?
  - Sacrifices and threats for example possible violation of privacy, monitoring

## Questions addressed for non-users of health and wellbeing technology devices

- Why have you not used/will not use digital devices of health and wellbeing technology in the future?
  - Examples: expensive/vast costs, no need, lack of information, another reason?
- What positive do you think this equipment could provide you?
  - Benefits, for example safety, accessibility, up to date information of the state of health, reduce unnecessary visits to doctor etc.
- What negative do you think using this equipment could entail?
  - Sacrifices and threats for example possible violation of privacy, monitoring

## Questions addressed for users and non-users of health and wellbeing technology devices

- Are there hindrances in use of digital devices and what are they?
- What would assist in starting to use digital equipment?
  - Example: practicality, devices that are easy to operate, easy to use instructions, group teaching, personal teaching

- Do you generally trust others? Do you generally trust in the functionality of systems and technology?
- Do you trust the ethicality of technological solutions?
  - For example, the respect and self-determination of the user, privacy policy, data reliability in documenting /preserving and data transfer in health care
- Do you consider what reputation a system/technology has? How does this affect your attitude to the system/technology and your trust in it?
- Do you assess the costs and benefits of using technology? How do you assess them?
- Do you believe that most state/local health care agencies/authorities operate with integrity and in a competent manner when using technology?
- Do you feel protected by the procedures, rules and regulations provided by state/local health care agencies/authorities in case something goes wrong?
- How does this affect what you think about the technologies that these state/local health care agencies/authorities offer?
- What makes you trust the technology the most?
- What every day routines do you need assistance with or services?
- Do you have such problems or needs in which you think digital equipment can assist in everyday life? How?
- What kind of things concern you with regard to the future?
- What kind of things do you wish for the future?