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Digital innovations for elderly people – sustainable solutions for the future

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1 Introduction

One megatrend called digitalization will change the everyday living throughout the society in a disruptive way as Christensen has described in his research work [Christensen et al. 2006]. New branches will grow up, old ones will collapse. Digitalization and artificial intelligence together will form in the future a market place, where services are available on demand basis 24/7, even globally. Those not connected to the internet access and not using the new applications, will easily drop out from the society as digital orphans [see Lahtiranta, 2014].

Ageing society is a worldwide phenomenon in post-industrialized countries in east and west as presented e.g. at Ispim Fukuoka in Japan in opening session by Takuya Nakamura and Noboru Konno. Japan is experiencing a “super-aging” society. People aged 65 and older in Japan make up a fifth of its total population, estimated to reach a third by the year 2050. The dramatic ageing of Japanese society as a result of low fertility rates and high life expectancy is expected to continue, and the population began to decline in 2011. Also in Finland, the birth rate in 2018 was the lowest in 100 years.

Changing population structure will lead to problems not only in the lack of personnel taking care of elderly people, but also in the lack of new taxpayers to guarantee the economic growth high enough to cover the growing costs of Finnish welfare society. Digitalization is a key to the effective and efficient service development.

In this paper we conclude the results of two futures workshops the first one held in March 2019 Finland and the another one held in May 2019 in China. Both session lasted

half a day, including a short introduction to the theme, facilitated work in small groups and finally, sharing the results.

In the first workshop 32 participants represented different backgrounds from the elderly people's ecosystem generally, having as a guideline the eyes of digitalization. Participants recognized taboos concerning elderly people's digital futures and defined futures headlines about the news – good or bad - concerning elderly people's life in the future.

In the second workshop held in China 16 health care professionals focused on elderly people's needs and solutions to meet the needs by digital tools. They worked in small groups and created possible solutions for Chinese elderly people. As a background information for the both workshops we used results from the survey made in 2018, where 55 elderly people were interviewed in South Finland (Meristö & Laitinen 2018). As a part of the visionary concept design in China we used existing scenarios for elderly people's independent living from the previous project run by Laurea UAS in Finland (Santonen et al. 2013).

2 Problem

Elderly people are a large group of citizens in the aging societies in the whole post industrialized world. At the same time, digitalization as a global megatrend will move societies towards eSociety. Elderly people today will differ from elderly people in the future, and variation between age groups among elderly even today is huge. (Meristö, T. & Laitinen, J. 2018)

Digitalization seems to be a key to the effective service development in the society creating economic sustainability. Savings concerning time and use of human resources will be one aspect in economic sustainability. Digitalization also has a significant role concerning social and ecological dimensions in the sustainability. An equal access of all age groups to the digital solutions enhances the social sustainability and the services in the society can be distributed with smaller carbon footprint in city centers and in rural areas.

Research questions are:

- I What are the specific sectors of elderly people's everyday life, where they need support?
- II What are the possible ways to support elderly people by digitalization and what kind of solutions and new innovations can be found to meet those needs?
- III How could these solutions promote sustainability i.e. how do these innovations cover economic, social or ecological dimensions of the sustainability?

Here we study the elderly people's needs, fears and wishes in the eyes of the use of digital advices in their everyday life as an aim to create new concepts to meet these recognized needs (see Kokkonen et.al. 2005).

3 Research design

The results will be based on two facilitated futures workshops in Finland and in China. The starting was to imagine the possible futures for the elderly people in long run. The participants in Finland represented different sectors from public and private organizations as well as from NGOs having roles as professionals and as elderly people's relatives and friends. Participants in China represented professionals from nursing sector.

Both workshops were facilitated according to the futures research principles, following the tasks of futures research (Amara 1981): imagination, analysis and participation. Imagination was tackled in Finland with two tools, taboo recognition and futures headlines, whereas in China in this part we used alternative scenarios. The tool for analysis in Finland was an impact wheel as a part of the mini-trend analysis, and in China persona cards created by the participants. In the participation part we used as a tool in Finland and in China Visionary concept design by answering also to the questions *to whom? why? how? by with advantage?*

In Finland, the workshop consisted of three parts: after the introduction the participants listed possible taboos concerning the life of elderly people in the eyes of digital services. They also used the concept of future headlines to describe the news published in the future to find out the new views to imagine the future. By using mini-trend analysis (including impact wheel analysis) the participants produced alternative opportunities to serve elderly people. These opportunities were then developed further towards visionary concepts (Kokkonen et al. 2005) for the future market according to the list, how to find mini-trends (Vanston & Vanston 2010).

The workshop in China consisted of three phases: first, the participants discussed the four scenario alternatives presented by the facilitator in the beginning of the workshop, then they created alternative personas cards for senior citizens in China in different environments, altogether six personas (e.g. Grini, I. & Gonera, A. 2018). Finally, participants described the special needs for the personas in each scenario and developed preliminary concepts to meet those needs.

The methodology used is a combination of futures research methodology and service design thinking. We used the tools as follows in the futures workshops.

Taboos are issues and themes usually kept in silence and if discussed, no consequences will be seen in practice. Taboos are often the reason for the unforeseen future, i.e. the new events and issues will arise as surprises, because there is no place for them in the mindset of the people. To see the future alternatives more precisely, the taboos have to be recognized and analyzed.

Futures headlines is a tool to improve the imagination and to get thoughts further to the future from the present situation. What if – questions will help the participants to open their minds to the new ideas. Futures headlines can be positive or negative news concerning the future. As short headlines, they also will conclude quite clearly the message, which can form a basis for the possible futures. Positive future headlines will give solutions to the loneliness of the elderly people and they will e.g. ensure the distribution of gourmet food even in the countryside, if applying these findings to the business development. Virtual glasses will provide new opportunities also to meet the intimate needs in close relationships or needs to travel, without leaving the home.

Negative future headlines rose up the threats of using technology: Digitalization can leave elderly people totally alone in their homes, having contacts only through net. The risks to give the passwords or other security details to criminals will also grow.

Scenarios are alternative outcomes for the future. Assumptions behind the scenarios are that there can occur in the future something currently inexistent, there is no certain information about future, thus the future cannot be observed and the future is not predetermined because the future outcomes can be influenced by proactive actions (Amara 1981). Furthermore, the interdependence in the world justifies a holistic perspective and interdisciplinary approach as proofed during last decades (e.g. Meristö 1991). In our case, we have used scenarios created for the independent living of elderly people in Finland (Santonen et al 2013) and interpreted to the Chinese culture with Chinese participants in the session.

Mini-trend analysis will use as a tool **the impact wheel**, where the certain trend, in our case digitalization and its impacts on the life of elderly people, will be analyzed through the lenses of impacts, both direct and indirect ones. By using impact wheel, the new insights will be discovered as a basis for the business purposes and service concepts supporting that. Impact wheel is a tool to discover the short-term opportunities not yet recognized behind megatrends that are well-known and accepted almost everywhere (Vanston & Vanston 2010). Digitalization is a megatrend influencing throughout the society both in public and private sectors as well as in the third sector and at the individual level of people in all ages.

Mini-trend analysis include seven ways to find new business opportunities already in a short term perspective, e.g. 2-3 years ahead, whereas megatrends will describe the new challenges in long run, 5-10 years ahead and even beyond. List to seek for minitrends is as follows (Vanston & Vanston 2010):

1. Follow the money (investors)
2. Follow the leaders (influential persons or companies)
3. Examine limits (physical, perceptual, practical)
4. Consider human nature (beliefs, motivations)
5. Take note of demographics (e.g. ageing, urbanization)
6. Analyze frustrations (troubles like long waits)
7. Search for convergences (potential interactions between trends)

Visionary concept design (Laitinen & Meristö 2016) workshop in March 2019 had focus on new products and services for elderly people. Service design methods (Yu & Sangiorgi 2017) were used together with futures research methods in facilitated co-creation process. In the visionary concept design session the participants in Finland analyzed possible consequences of digitalization for elderly people's life directly and indirectly by using **the impact wheel**, and third, **the business opportunities and visionary concepts** (Kokkonen et al. 2005) have been recognized and created based on **mini-trend analysis** (Vanston & Vanston 2010). In China, the participants used visionary concept design with the help of scenarios about the elderly people's independent living in the future, by creating visionary concepts on the needs met in each scenario.

The persona cards will describe the elderly person in focus according to his or her age, sex and living environment. Additionally also the ability or constraints regarding physical, psychological, cognitive or social dimensions as well as their digital activity, i.e. the ownership and use of digital devices in everyday life can be described in persona cards. In the workshop in China, the participants created the persona cards to the Chinese society by following the examples created earlier in Finland (see e.g. Weck et al., 2018).

The methodology used here is a combination of futures research methodology and service design thinking. In the toolbox there are several methods to use according to the situational understanding in the sessions. The professional skills of the facilitator will play an important role in the success of the work. The experienced facilitator will build trust and “read the group” sensitively to get a structured, but still imaginary situation to work together.

4 Findings

Business development based on digital tools and applications started more strongly in late 1980’s when mobile phones were widely available (Carlson, 1989). Early adopters were at that time found among business people, but also from the younger generation fond of entertainment applications. In Finland especially banking business has been a forerunner in applying digital services and solutions, whereas the other branches have been more followers (Meristö et al., 2002). Interviews among elderly people in Finland in 2018 showed, that the most commonly used device was the smart phone or a laptop. Still, a high share of the elderly people was using none of the digital devices (see Meristö & Laitinen 2018).

In China, the use of mobile devices is high. Still, elderly people in countryside can be easily left outside, told the participants in the session. In China, the participants formed for Chinese elderly people persona cards, focusing on those living in the countryside: 1. Male in age 75 yrs, in rural area, physical restrictions to go, lonely, need help from neighbors. 2. Female in urban context, age 60 yrs, low education level, limited skills in using digital devices 3. Female 85 yrs old in rural area, lonely, is afraid of smart phones, because doesn’t understand their logic 4. 80 yrs old female in rural area, reluctant to learn new things and to use digital devices, many diseases, difficulties to go 5. In rural area a male person in age of 70, no internet access, no smart phone, difficulties to see, memory problems, no driving license 6. Female (80 yrs), living in countryside with her husband (79 yrs), two sons living far away, has a smart phone, but is not familiar to use it. For these personas, needs were recognized in four alternative scenarios, which are 1. Wellbeing and safety through technology, 2. The rise of citizen society, 3. Market driven society and 4. Holistic wellbeing (Santonen et al 2013).

Based on the visionary concept design workshop the results from the taboo analysis will show some evidence of the issues left in silence. According to Cambridge dictionary taboos are something people usually avoid for religious or social reasons e.g. death is one of the taboo issues close to the life of elderly people. In the workshop participants discussed in seven smaller groups and listed then the taboos concerning the life of elderly people, keeping in their mind the digitalization trend, but also trying to get a broader view to the life of the elderly people from different perspectives.

Most of the taboos listed were related to the **need of human contacts** and social interaction. The biggest threat of using digital devices and services to take care of the elderly people is to stay alone, without any human contacts at all. Less attention has been paid to the risks, when the technology is not working or if the technology will be too powerful with its artificial intelligence (AI) features: who will then be responsible for the consequences? Elderly people are afraid of staying alone with robots and digital assistants, feeling themselves unsafe. On the other hand, their relatives and professionals also feel themselves more safe, when they know that AI is taking care of the elderly people. The participants in the workshop discussed these taboos in the terms of *digital abandonment* and *digital orphan* (Lahtiranta 2014). Need for human contacts is not restricted only to everyday discussions, but it includes also need for deeper friendship, love and sex, which seems to be even more taboo than the opposite concerning human vs. technology, showed the results of the session.

Another big issue in taboo discussion was **privacy, security and autonomy**. These three were related to each other, too. Distant monitoring opportunity at home can be a safety issue for the professionals and volunteers, but vice versa to the elderly people themselves. When “big brother is watching you all the time”, you can lose your privacy and feel, that for those perhaps with non-honorable intentions you are not in safe in your own home. When you are not skillful enough to use those digital devices, it will also increase the feelings of unsafe. By mistakes the elderly people can cause safety and security problems, or on the other hand, they have to accept continuously the help from the other people, which will reduce their autonomy. It is not so easy to express in words the need for help, when carrying these type of fears and uncertainties in your mind.

We found new business opportunities to meet the future challenges. Taboos recognized in Finland show some evidence of the issues left in silence. Taboos are something people usually avoid often for cultural reasons. Taboos belong to the need of human contacts and social interaction. Another was privacy, security and autonomy. The fear of not being able to manage new technology or of the threat concerning safety and security in digital connections form one barrier not to adopt the newest technology without hesitation.

In a facilitated futures workshop the impact wheels were created in each of the smaller groups, together 7 groups and 32 people. Each of the groups had the same task: to create first the direct and indirect impacts of megatrend called digitalization on the life of elderly people and then to analyze these impacts through the eye classes of min-trend list with its seven alternative lenses (Vanston & Vanston 2010).

The seven in smaller groups produced impact wheels have been here analyzed based on data-driven content analysis, forming as a result nine direct impact sectors from digitalization to elderly people’s life: 1. Health 2. Wellbeing 3. Safety and Security 4. Information 5. Communication 6. Economy 7. Logistics 8. Everyday life and 9. Technology. Based on these nine sectors, there are several indirect impacts based on digitalization, e.g. medical services, smart medicine, shopping services, nutrition, alarm services or even getting friends and new contacts, and furthermore, on the next level as an impact e.g. food automat, virtual travelling or self-monitoring, which can be seen already close to the visionary concepts or at least themes for the future services and products needed to meet the challenges concerning the digitalization in the life of elderly people (Figure 1).

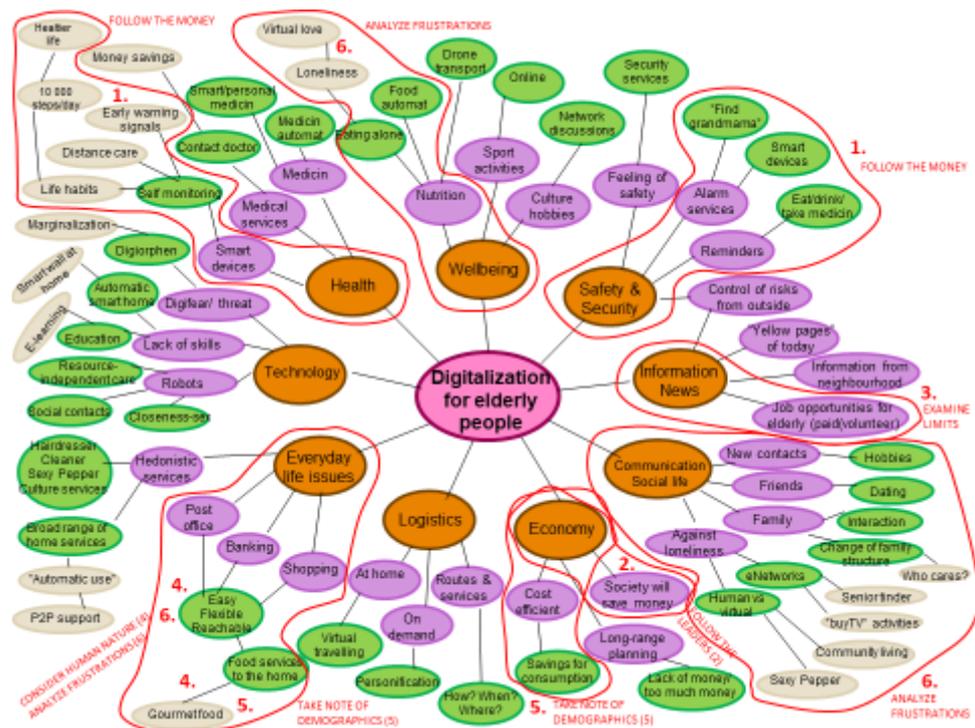


Figure 1 Impact wheels created in futures workshop: a summary based on content analysis of the seven group works.

Following the list of seven ways to find mini-trends from number 1 to number 7, the workshop participants found several opportunities to develop business based on the needs and challenges recognized in elderly people’s everyday life. Numbers marked to the figure 1 above will show the root of the mini-trend list where it has been discovered, e.g. number 1. means Follow the money or number 6. Analyze frustrations.

As a summary, the business opportunities based on this workshop results are related to:

How to avoid loneliness and add one’s wellbeing? Develop virtual communication services and tools for not eating alone or even for virtual love (6. Analyze frustrations)

How to get early warning signals from the changes in health conditions? Develop distance care services and easy to use smart devices for self-monitoring to get information and expert analysis based on that (1. Follow the money)

How to decrease the feeling of unsafety and insecurity of both elderly people and their relatives? Develop a cost-effective, easy to use concept e.g. to install alarm services, including precise reminders concerning everyday issues like remembering to take the medicine or taking care of the economy (1. Follow the money but also 2. Follow the leaders)

How to make the everyday life easier for the elderly people having not skills to manage smart devices and services nor having children or other friends to help them? Create customer-oriented holistic service concept for shopping, banking or postal services keeping in mind terms easy, flexible and reachable, e.g. food services on demand to the home (4. Consider human nature 5. Take note of demographics 6. Analyze frustrations)

When piloting and implementing the digital services based on the new concept ideas, not only the future, but also a persona history and the present situation have to be considered carefully (Figure 2).

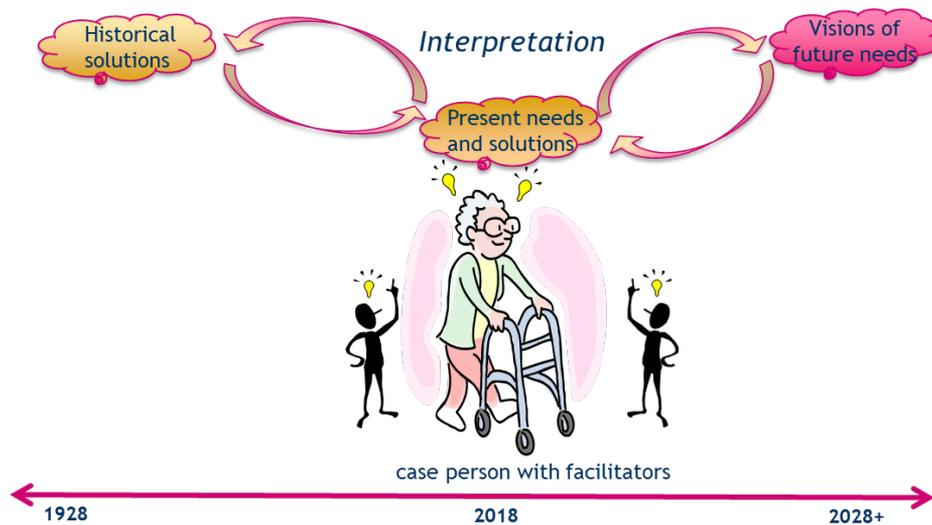


Figure 2 Retrospective and visionary concept design

Usually, visionary concept design will play the main role in the service design process, but if we want to be sure to get acceptance to the new solutions in the market more widely, we should also look backward to find out those elements elderly people are familiar with, in order to get the threshold lower for the acceptance of the new service or device. We call it retrospective concept design, which can be easily combined to the visionary concept design in practice (Meristö et al. 2014).

When thinking in the terms of sustainable development the visionary concepts can be divided into three groups of possible innovations, i.e. from economic, social and/or from environmental viewpoint. Some of them will fulfil only one aspect of sustainability, whereas some of them more. Results from workshops in Finland and in China have been summarized in the table 1 as follows.

Table 1 Visionary concepts created for elderly people in Finland and in China divided into the categories of sustainable development.

	Economic	Social	Ecological (EHS Enviroment, Health, Safety)
Finland	<ul style="list-style-type: none"> • Proactive care/early warning signal systems (saving money, when not getting ill or at least no need for personnel costs) • Robots and Digital services with AI apps especially in rural areas and in the areas with long distances • Time and money savings when using digital services in the whole value chain of health care, and in the whole eco-system, including also volunteers and NGOs as a part of the ecosystem (helping in safety and security, distributing information and adding the awareness of the risks to avoid them) 	<ul style="list-style-type: none"> • Wellbeing apps (e.g. self-monitoring, nutrition advices for proactive staying healthy) • Communication and social life apps e.g. against loneliness, getting new contacts, for daily interaction • p2p support apps also face to face in the neighborhood, also against technology fear /digi threat feelings 	<ul style="list-style-type: none"> • Logistics apps (transportation services both people and goods) • Everyday life issues and services e.g. nutrition, security, etc. • Automatic smart home/operating environment, saving energy, water etc. in a sustainable way • Distance care (distance-services over net)
China	<ul style="list-style-type: none"> • Apps for comparing supply to the personal income level (what is affordable for me?) • Education for elderly people through TV to get digi as a part of their everyday life (China is a huge country, this is a economical way to educate) • Automatic wifi in the living environments (easy to use, no extra skills needed, no need for personal education and this will be a huge saving, too) • Local market place in the net: easy to find, no extra transportation costs (for food, medicine, other goods and services, too) • p2p training and education in digital skills in the community 	<ul style="list-style-type: none"> • Simple contact buttons e.g. for neighbourhood help • Red button for distress / urgent help need • p2p learning, without stress • Apps promoting social activities in groups/with neighbours • Information flow apps in the whole ecosystem, not only among professionals • Promoting children/grandchildren to educate elderly people for digi case by case, starting with apps, they show interest in or they have need for e.g. locating services → motivation / need based services (and education) • Community service point to the net, easily to find, easy to use • Robots at home/ at communities for shared use (playing and learning together) 	<ul style="list-style-type: none"> • Shopping online easy as a starting point (no need to travel long distances) • Device design user-centric (size, easy to use, not too sensitive touch screen for elderly, using colours, voice, pictos, larger text etc.) • Apps for proactive uses to avoid risks, also concerning holistic wellbeing (measuring pulse, promoting for activities, medicine dispenser, hobbies, social interaction etc.) • Digi-pets not only for social uses, but as a tool to educate and to motivate to learn use digi devices • Security in web apps have to express clearly, not in a threat-driven way

As the answers to the research questions, the specific sectors of elderly people’s everyday life, where they need support are especially things related to loneliness, but also concerning the security of using digital devices. Peer to peer advisor teams will motivate them best, but also the new, demand driven applications for the urgent needs will form a good basis for the development work towards successful innovations. These solutions can also promote the sustainability not only in the elderly people’s life, but widely in the society covering economic, social and/or ecological dimensions of the sustainability in China and in Finland as summarized in the table above.

5 Lessons learned

Many promising digital health innovations do not make it to the market, even if they have their background in a user-centric and customer-oriented innovation process. Still, a sustainable business model is difficult to find (Albert 2018). Each business model has to analyze from several viewpoints, e.g. if the user and decision-maker are from public, private or consumer sector and also, what is the cultural environment in each market area or in the specific country. The findings will drive digital innovations for active ageing and increase demand for new services. The motivation for the actors in the field can be promoted via sustainable benefits the innovations can bring to them from many different viewpoints as shown above in the table 1. Economic and social benefits often go hand in

hand, whereas environmental benefits will cover often health and safety issues according to EHS criteria (table 1).

For elderly people the health issues will play an important role in their lives, and the digital doctor advisory services instead of the traditional face to face visits would be a valuable add to their wellbeing. Digital devices and services will enable for elderly people an opportunity to stay at home longer. Visionary concepts developed here have brought to the discussion the fear of loneliness and the lack of feeling of safety and security.

Not only individual elderly people, but also firms and institutes working with elderly people need more information. Caring houses and medical centers and academic researchers among business stakeholders should consider, what kind of digital services and devices can be provided to elderly people to deliver them a better wellbeing and healthier life at home. Difficulties concerning physical or cognitive restrictions should be analysed carefully in all aspects of everyday life and to provide solutions to help them instead of to put more stress on them.

Product and service design should face the difficulties recognized and then develop new more customer-oriented digital devices for elderly people [Grini & Gonera, 2018]. Thus, the elderly people are not a homogenous group. The transition in a society will divide the younger group from the oldest group quite sharply: those from 55 to 64 years old are still in working life and at the work they will use digital devices anyway (Meristö & Laitinen 2018).

China mostly follow the Market-driven alternative, and the markets are in megacities, whereas in rural areas people live like in citizen-centric scenario. In countryside, people in China also live in scenario 3, getting wellbeing and safety through technology by using WeChat. Scenario 4 Holistic wellbeing is quite unknown in China in spite of the strong role of the society in people's life.

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