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# Meaningful Technology for Seniors: Viewpoints for Sustainable Care Service Systems

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## Abstract

Information Communication Technology (ICT) and Robotic Technology (RT) are considered as a key element to make elderly-care sustainable. However, the development and implementation of these technologies for elderly-care are still problematic. Especially for the application of these technologies in different countries, differences in care practices, policies and cultures could become barriers. To overcome these issues, the analysis of elderly-care from the service system perspective is a promising approach. In the scheme of Japanese-Finnish collaborative project "Meaningful Technology for Seniors: Safety, Comfort and Joy (METESE) -Models of Digital and Human Networks," this paper proposes important viewpoints toward care service systems for developing and implementing meaningful technologies for seniors and elderly-care, based on the literature/document survey on elderly-care and care technologies.

## Keywords
Elderly-care, Service Systems, Technology

## 1  INTRODUCTION

Aging population has become a serious concern in many of developed countries. Growing government expenditure and lack of care workers are constraining the quality of elderly-care and furthermore the quality of life for elderly people. Japan has already become a super-aged society and confronts these serious challenges. The ratio of population over 65 years old in Japan was approximately 25.1% (2013), ahead of all the other countries (OECD 2015). Finland, one of the Northern European countries known with generous social welfare is also confronting these challenges as the aged population increases (approximately 19.1% in Finland, 2013).

Information Communication Technology (ICT) and Robotic Technology (RT) are considered as key elements to make independent life of the elderly more comfortable and make elderly-care sustainable (Obi et al. 2013, Sugihara et al. 2015). Elderly-care technologies are also anticipated as a rapidly growing industry. There have already been various research projects to develop ICT/RT for the elderly and elderly-care, but most of the existing projects focus on domestic or regional problems. Considering the global situation of aging, an international study on the situations of elderly-care in different countries would be effective for developing and applying better technological solutions to common or individual problems in each country.

In addition, elderly-care consists of multiple stakeholders such as the elderly, their family/relatives, caregivers, managers of service providers, municipalities and governments. The requirements for ICT/RT and its implementation process should be based on the understanding of these stakeholders and their relations as a network (Wallin et al. 2015). With this service system perspective, cross-cultural transfer of best practices, technologies and technology-based services for the elderly would become possible. To realize this, an international, cross-cultural comparative study covering broad aspects of care service systems is needed. Though there have been several comparative surveys and studies on social security policies, welfare systems and care services among several companies (OECD 2005, Campbell et al. 2010, Rhee et al. 2015), few studies have focused on differences of care service systems in different countries, aiming at developing and implementing ICT/RT for the elderly.

Under this circumstance, a Japanese-Finnish collaborative project "Meaningful Technology for Seniors: Safety, Comfort and Joy (METESE) -Models of Digital and Human Networks" was launched in 2015. This project aims at developing an integrative approach to develop, implement and evaluate meaningful technologies for the elderly, based on the understanding of care service systems in both countries. As the first step toward this purpose, we introduce important viewpoints on care service systems in Japan and Finland for ICT/RT development and implementation, based on a document/literature survey.

## 2  BACKGROUND AND APPROACH

### 2.1  Service system perspective

In this study, we put service system as its theoretical basis. As many of general terms among scholars do not have specific definitions, service system also has various definitions (Edvardsson and Olsson 1996, Alter 2008, Maglio et al. 2009) and has not had a sole, integrated

definition yet. Here we introduce several important features we emphasize in this project.

- Multiple stakeholders interacting with one another

Elderly-care services usually contain various kinds of stakeholders such as the elderly, their family/relatives, caregivers, managers of service providers, municipalities and governments. From the service system perspective, these stakeholders are mutually related and interacting as an actor network (Basole and Rouse 2008, Spohrer and Kwan 2009). They, not only service providers but also customers use their resources and create values (Edvardsson and Olsson 1996). Roles, interactions, resources and requirements of these stakeholders should be taken into account for realizing better service systems.

- Socio-technical nature

From the service system perspective, technology such as ICT/RT is considered as a part of the system to create value (Alter 2008, Vargo and Lusch 2011). Qiu (2008) stated "a service system essentially is a social-technical system, focusing on engineering and delivering services using all available means to realize respective values for both provider and consumer." Social-technical or socio-technical, which explains a status of combined social and technical components to accomplish tasks (or value) in a system (Appelbaum 1997) is one of the fundamental features of service systems, especially when we aim at developing meaningful technologies for seniors in care service systems. For the development of technologies for service systems as socio-technical systems, two points should be taken into account. First, not only the development of technological components for a service system but also the development of social components such as process, organization and in the case of service systems, whole network should be taken into account (Appelbaum 1997, Maglio et al. 2009, Akaka et al. 2013). Second, the participation of stakeholders in the design of technologies and overall systems is essential. Participatory Design (Greenbaum and Kyng 1991) and other related approaches would be effective for development of technologies in service systems, especially for the technology development focusing on the life of the elderly (Leikas et al. 2012). Continuous redesign and innovation of the system are also needed to adapt to changing environments and situations with the participation of stakeholders inside (Sundbo and Toivonen 2011, Watanabe et al. 2015).

- Institutions

When we study different kinds of service systems comparatively, the understanding of the societal and cultural background of these systems is important. For example, Akaka et al. (2013) pointed out the importance of understanding on cultural contexts in service systems from the aspect of international marketing. Elderly-care is strongly related to human life, and is affected by the cultural aspect (For example, Dilworth-Anderson et al. 2002). In addition, public service is strongly influenced by governmental/municipal policies and regulations. These visible or invisible rules, which Vargo and Lusch (2011) stated as 'institution,' should be considered for the development of technologies in service systems.

## 2.2 Survey

As a preliminary study in the METESE project, we surveyed relevant literatures, data and documents with the aforementioned theoretical perspectives of service systems. Our aim was to grasp characteristics of care services systems in both countries which could affect the development of meaningful technologies. We extracted several viewpoints to be investigated further in the care service systems which include stakeholders, their interactions and institutions. Based on these viewpoints, further studies are being planned or conducted.

In this study, we mainly surveyed the following materials.

- Statistics on elderly-care

As basic information of the elderly-care in both countries, we surveyed public statistic data on the elderly-care such as demographics, finance for care services and actual demand/supply.

- Literatures on models and practices of elderly-care

Elderly-care is one of the most important topics in our societies and there are numerous literatures on elderly-care. We surveyed the literatures mainly on models and practices of elderly-care in both countries and others. Since the service system concept used in this paper is broad and with various aspects, we explored potential elements affecting development and implementation of technologies for seniors.

- Project reports and literatures on technology development and application for the elderly

There are also a plenty of R&D projects to develop technologies for seniors and elderly-care. We investigated relevant project reports and literatures on technology development and application for elderly-care. We mainly focused on how technologies were developed in the existing projects.

## 3 CARE SERVICE SYSTEMS IN JAPAN/FINLAND

### 3.1 Elderly-care system in general

First, we introduce national elderly-care systems in both countries.

Japan has adopted a long-term care insurance system for elderly-care since 2000. Citizens with the age of over 40 years join the insurance system compulsorily and those with the age of over 65 years are able to receive care services based on the insurance fee, after the assessment of care needs (Hayashi 2014). The system scheme and operation have been reviewed and modified almost every five years. Care recipients are required to pay 10% (or 20 %, according to their income) of the charge and the rest is paid by prefectural health insurance organizations. Financial sources of these organizations are equally from insurance premium and public expenditure. The expenditure for long-term care (government and compulsory contributory health care financing) was 1.9% per GDP in 2013 (OECD 2016), and further increase is being estimated.

In Finland, the welfare system is developed in line with the Nordic welfare model, which is characterized with

universal services by strong public sectors based on tax funding (Taperi et al. 2009, OECD 2013). Elderly-care is provided by the subsidies from the government, taxation of local municipalities and in some cases, user's payment. The expenditure for long-term care (government and compulsory contributory health care financing) was 1.4% per GDP in 2013 (OECD 2016), which was lower than the one in Japan. However, the sustainability of the elderly-care system is also an important issue in Finland and being continuously discussed and reformed (Ministry of Social Affairs and Health 2011).

## 3.2 Service providers

In Japan, many of elderly-care service providers belong to private sectors. The elderly and their family can choose services they need according to their care / support level based on the prior assessment and care plan by a care manager (Hayashi 2014). In the Japanese long-term care insurance system, municipalities' main role is an insurer. They provide "(1) collecting insurance premiums, (2) managing fund, (3) assessing care needs, and (4) paying remuneration to service providers through a prefectural health insurance organization" (Hayashi 2014).

Meanwhile, municipalities in Finland have a more direct role in providing care services (OECD 2013, Anttonen and Karsio 2016). In most cases, municipalities provide care services directly to the elderly. There are also private service providers, but their services are procured by municipalities, and then provided to the elderly (OECD 2013). Municipalities mostly assess care needs for the elderly and determine required services for them. Thus the elderly have smaller freedom of choice in selecting the services.

## 3.3 Service types

Elderly-care services can be largely separated into two types: care at home such as home care and day care, and care in institution. As shown in Table 1, 2.8% of the population over the age of 65 years in institutions and 9.8% at home in 2011 in Japan. In Finland, 4.9% of the population over the age of 65 years received long term care in institutions and 7.4% of this population received care at home (OECD 2013). One thing we should point out is that the Finnish government has been promoting 'deinstitutionalization' that is to replace traditional institutional care with home care or residential services with 24-hour care assistances (Anttonen and Karsio 2016). Though this new type of residential service is categorized in care in institution in OECD statistics, traditional institutional care facilities have already been significantly replaced (Anttonen and Karsio 2016). These new types of services are increasing also in Japan, for example, elderly housing with care services (MHLW 2013). While the concept "aging in places" has been widely accepted (OECD 2005) and implemented in the policies of both countries, the boundary of care at home and care in institution is getting blur (Anttonen and Karsio 2016).

Table 1: Rates of care service users among the population over the age of 65 years in 2011 (OECD 2013)

|  | Japan | Finland |
|---|---|---|
| Care in institution | 2.8% | 4.9% |
| Care at home | 9.8% | 7.4% |

## 3.4 Roles of family and community

The traditional family-based care model has confronted difficulties through civilization and consequent change of family structure. As the third kind of support for elderly in addition to formal care services (care at home and care in institutions), informal care allowances have been installed in Finland (Anttonen and Karsio 2016). Informal cares are able to receive some financial support by applying to municipalities. Though the form of families has changed, they are still considered as important care resources for aging in place. As another trend, co-housing meaning that the elderly live together at the same building to help each other, is becoming popular (Jolanki and Vilkko 2015).

Aging in place is a common concern in Japan. Traditionally, East Asian countries including Japan were known as the ones with a strong culture of "family care" (Liu and Kendig 2000) and its influence is still strong. A problem of "elder-to-elder care," which means an aged son or daughter takes care of his/her parent (Nagasawa 2015), is a typical phenomenon of this culture. In Japan, the concept of "integrated community care system" has been introduced as a government policy for elderly-care (MHLW 2013). This concept is to provide integrated services of housing, medical care, elderly care and health promotion within a certain area to prolong the life at home. Within this concept, it is expected that municipalities and local communities take more active role to correlate citizens and services.

## 3.5 Technology for elderly-care

Since ICT/RT is considered as effective solution for the sustainable elderly-care, various research projects and public support have been conducted. In Japan, a series of policies promoting ICT development for welfare have been issued and practiced since 90's (Obi et al. 2013). According to Obi et al. (2013), there have been five major technology categories which industries and researchers work for in Japan: health, safety, independence (in living), mobility and (social) participation. Recently, robotics has become an important R&D target to provide an effective solution for sustainable elderly-care (The Headquarters for Japan's Economic Revitalization 2015). To promote the R&D of care robotics, Robotic Care Equipment Development and Introduction Project has been conducted since 2013 (Robotic Care 2013). The R&D of 8 key development areas have been supported: wearable transfer aids, non-wearable transfer aids, outdoor mobility aids, indoor mobility aids, toileting aids, bathing aids, monitoring systems for nursing care homes and monitoring systems for private homes. In addition, there have been several research projects to increase the productivity and quality of elderly-care services from the service research perspective (Chino et al. 2012, Nishimura et al. 2013, Fukuda et al. 2015). These studies stress the importance of user participation in developing technologies.

In Europe, Ambient (Active and) Assisted Living, aiming at independent living of the elderly at home, has been an important research topic in R&D for the elderly (AAL 2015). Since 2008, more than 150 projects have been funded. Many of them have been implemented as business with organizational support (AAL2Business 2012). Some projects such as UniversAAL (Hanke et al. 2011) provide open platforms for implementing developed technologies in the society. Though these projects applied developed technologies to different countries, but in most cases only in Europe. In European research projects, user participation is one of the major topics. Especially from the service research perspective, user participation is highly anticipated (Wallin et al. 2015). For example, KÄKÄTE project (2010) studied how easy-to-use technology can be applied to support independent living and safety of older people as well as the work of the persons taking care of them.

## 4 DISCUSSION AND CONCLUSION

We identified the following viewpoints and related challenges on care service systems.

- Care at home and in institution: requirements of the government, the elderly and their families

While government policies in both countries aim at the shift from care in institution to care at home, there are some difference in their approaches and requirements. What are the institutional, cultural, practical requirements and challenges to realize this shift in both countries? What kind of care is actually anticipated in relation to the daily life of the elderly? What kind of role technologies can take concerning this shift?

- Role of municipalities and private service sectors

One of the most significant differences between Japanese and Finnish elderly-care systems is the major providers of care services: municipalities in Finland (Ministry of Social Affairs and Health 2012) and private service sectors in Japan. Meanwhile, Finnish municipalities also "purchase and use" private services as a part of their care services. How do municipalities and private service sectors separate their roles? Does this separation of roles affect the requirements for ICT/RT? How do business managers of private service sectors consider their care services as business? And how would this separation of roles change in future?

- Community-based care: informal carers and third sector

Community-based care is a shared vision to be achieved in Japan and Finland (MHLW 2013, Anttonen and Karsio 2016). This also stems from the upcoming shortage of budget for formal care. Informal carers (in many cases, families and relatives) and third sectors need to take important roles in this vision. Meanwhile, their roles are strongly affected by the cultural factors. How different are their roles? How can technologies support and integrate their activities for sustainable care service systems?

- Co-development of technologies: technology developers, users and other stakeholders

The design / development of ICT with users and stakeholders is one of the effective approaches to adapt ICT to service systems (Niemelä et al. 2014, Wallin et al. 2015, Watanabe et al. 2015). In different cultural settings of both countries, how could the co-design and development process and its results be different? In addition, it is a challenge to involve the elderly in a design process. What kind of approach can we take to involve the elderly in design?

These viewpoints will be initial assumptions to explore means to realize meaningful technologies for the elderly in both countries in METESE project. According to these viewpoints, we are investigating further on the care service systems to contribute to their sustainability by means of ICT/RT.

## 5 ACKNOWLEDGMENTS

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