International cooperation
EU-Japan: Digital health and ageing

Smart living environments for ageing people

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International cooperation EU-Japan: Digital health and ageing

Smart living environments for ageing people

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1. EU/Japanese collaboration: an overview

a. Goals

Many nations outside of the EU are facing the same challenges in caring for the elderly and collaboration and cooperation with international partners enhances synergies and innovation.

The purpose of this initiative is to develop smart living environments for an ageing society in conjunction with partners in Japan. The European Commission, The Ministry of Internal Affairs and Communications, Japan and The National Institute of Information and Communications Technology, Japan consider ageing of the population to be an opportunity rather than a drawback. The initiative proposed values the contribution that elderly citizens make to society and wishes to empower them to live fulfilled lives within their communities through the help of innovative solutions.

b. Background

Demographic change and the ageing of the population creates new challenges for society and, especially, for the elderly. Apart from health-related age impairments, such as chronic health conditions, declining cognitive abilities and increasing frailty, the elderly are at risk of facing situations leading to potential social exclusion and increased loneliness which greatly detracts from their quality of life.

Loneliness in the elderly is an important issue. The authors in Holt-Lunstad et al. (2015) found a 29% increased risk of mortality over time from social isolation and 26% increase in mortality risk from loneliness. Furthermore, social isolation in the elderly is correlated to an increased risk of cardiovascular, autoimmune, neurocognitive diseases, and mental health problems (Gerst-Emerson et al Am J Public Health). Moreover, social disconnection puts older adults at greater risk of depression and anxiety (Santini Z, et al. Lancet Public Health). In addition, loneliness has been linked with functional decline and decreased quality of life (Shankar et al Health Psychology).

Digital solutions, especially, those aimed at creating smart living environments for ageing people, have the potential to address these challenges. However, it is paramount to ensure user acceptance by incorporating user-centric design methodologies.

Eurostat in 2018 quotes life expectancy in EU-27 at 81.4 years for women and 76.4 for men. The number of Europeans aged 80 or older is expected to nearly triple in numbers by 2070, representing 28% of Europeans (Spasova et al., 2018). While in 2000, there were approximately five persons of working age per person aged 65+, today, it is three to one; by 2070, the ratio will be two to one (Eurostat, 2018).

Japan has the highest proportion of elderly in the world. People aged 65+ years represented 28% of the population in 2018 (World Bank). By 2030, one in every three people will be 65+ years. Furthermore, life expectancy at birth is the highest in the world at 87 years for women and 81 for men. Moreover, while the Japanese population peaked at 128 million in 2004, it is predicted to decrease to 90 million by 2070. These developments have also implications for the fiscal and societal long-term sustainability of elderly care, e.g. when considering having fewer potential caregivers being available to look after an increasing elderly population.

2. EU-Japan collaboration in Research and Innovation

a. Dialogue and identification of R&I collaboration topics

Digital technologies play a crucial role in empowering citizens to monitor their health status independently, prevent non-communicable diseases, and allow for feedback and exchange with health and care providers remotely. For the elderly citizens, digital technologies provide the opportunity to better monitor their health status independently, empower them to cope with comorbidities, loneliness and improve their mental health. Integrating digital health solutions into health and care services provision can greatly empower the eldery and contribute to autonomous and active way of living.

The European Commission supports the development and uptake of digital health innovation for the Ageing population throughout the EU, for example through the Active and Assisted Living Programme (AAL), the European Innovation Partnership on Active and Healthy Ageing (EIP-AHA) and its R&I actions under Societal Challenge 1 of Horizon 2020.

An inflow of public, and increasingly private, investment into making use of digital technologies over the last decade has laid the foundation for developing a growing age-technology sector in Europe. Home assistance for independent living, community initiatives for pooling of health, care and social services have seen an increasing number of solutions entering the market. Also being embedded in the context of an emerging silver economy, it creates opportunities for innovative businesses, creates jobs and contributes to overall growth. The potential of the silver economy also lies in the evergrowing end-user market.

In June 2020, the Commission has adopted the Report on Demographic change. The report sheds light on the drivers of demographic change in Europe, such as higher life expectancy, low birth rates and growing ageing population, among other things. The report also describes in detail the impact of demographic change on sustaining European economy, productivity, health and long-term care and public expenditure.

Following the report on Demographic change, the Commission is currently preparing a Green Paper on Active Ageing which shall be published in early 2021. The Green Paper will encourage policy makers across the EU to adapt their policies for the growing ageing population, and will focus on various topics dealing with the need to integrate digital technologies in the health and care provision across Member States.

For broad and sustainable success, multifaceted coordination across multiple policy domains at different levels – regionally, European, and internationally – and cross-sectoral ‘ageing knowledge’ is essential and action is needed. Collaboration between regions with similar difficulties and characteristics, like those between Japan and the European Union, as well as exchange of practices between the regions is fruitful in the adoption of digital technologies for better health and wellbeing.

With this in mind, in 2017, an international cooperation to foster smart living environments for ageing people was established between the EU and Japan, funding two dedicated cooperations- ACCRA and CARESSES- to streamline the regional efforts addressing the challenges associated with population ageing, and for the betterment of the living conditions for the elderly. The proposed solutions aim at utilizing generalized infrastructures such as cloud systems and open sources and incorporate approaches to ensure interoperability and future expandability. The collaborative work and shared experience between the EU and Japan subsequently enables a better understanding of

the notion of culture and the different expectations towards elderly care, to prevent potential stereotyping.

Developed care robots, with the perspective of turning them into marketable devices, are designed to be sensitive and adaptable to different sets of cultural values and care practices, as the development of culturally aware robotics requires understanding of the broader cultural environment. In addition, leveraging the interconnections of cultural values, situated practice, and the ways in which elderly people experience the world around them and interact with the robots is critical.

These collaborative projects aimed at suggesting new standards by the EU-Japan joint consortium in order to accelerate practical introduction of the results into societies while putting the user at the heart of the design process, ensuring greater sensitivity to socio-cultural specificities and thus greater acceptance. It was proposed that the solutions should run on open-platforms enabling data to be collected and analysed utilizing artificial intelligence. User-friendly interfaces enabled technology to be integrated into ageing people's daily lives and provide emotional support, with the proposed solutions incorporating multimodal interaction including voice-based conversation and gesture in order to help ageing people in the most effective and personalized way. Following ACCRA and CARESSES, the recently launched project e-VITA (European-Japanese Virtual Coach for Smart Ageing) will continue to strengthen cooperation between European and Japanese partners in the field of active and healthy ageing with the aim to establish new common standards and policies to be exploited and transferred across Europe, Japan and worldwide.

In particular, e-VITA will apply an innovative approach to virtual coaching empowering older citizens in Europe and Japan by promoting active and healthy ageing and preventing cognitive, physical, emotional and social decline. In the e-VITA project, the partners will jointly develop and connect innovative smart living solutions that address individual as well as cultural aspects and factors of active and healthy ageing and overall well being through AI, smart data analysis, and tailored ICT based interventions and real-life coaching. The coaching system is planned to be deployed and evaluated in the living environments of healthy older adults in the EU and Japan to assess its feasibility and efficacy with the main goal of securing independent living and prevention, helping older adults to live longer in their own homes with the possibility to act independently and to participate actively in society.

b. Relation to the Work Programme

The projects aim at developing and validating new solutions leading to the creation of smart living environments for ageing people. Furthermore, the projects needed to support independent, active and healthy lifestyles and make contributions to interoperability and standardisation.

The proposed solutions had to provide personalised advice and guidance to help with age and health related issues in daily life including amongst others: diet, physical activity, risk avoidance, preventive measures, lifestyle and activity management, leisure, social participation and overall wellness and health. The proposals also focused on fostering social participation and avoiding social exclusion.

The project work needed to be innovative and advance the current state of the art by utilising intelligent and interoperable information and communication technology (ICT) environments, access to relevant physiological and behavioural data, emotional computing, open platform and Internet of Things approaches. The proposals were based on cross-disciplinary research, involving: behavioural, sociological, psychological, medical and other relevant disciplines, including gender and cultural aspects. The proposed solutions should make use and further develop user interaction taking into account Artificial Intelligence methods for understanding the users' intentions, knowledge extraction and learning. It is essential that the proposed solutions understand user needs. They need to safeguard ethics, privacy, security and regulatory aspects and take gender issues into account appropriately. The proposed solutions should be unobtrusive and avoid attention theft or being an unnecessary distraction for the user.

The proposals need to be realistically tested in locations such as at home or in care centres, in order to demonstrate the expected benefits and impacts.

c. Expected impacts

Projects funded under Horizon 2020, The Ministry of Internal Affairs and Communications, Japan and The National Institute of Information and Communications Technology, Japan aim to develop and validate new solutions leading to the creation of smart living environments for ageing people. Furthermore, projects support independent, active and healthy lifestyles impacting on:

- Independent living, and quality of life of older persons compared to current state of the art;
- Usefulness and effectiveness of personalized recommendations and follow-up in terms of the goals of preserving physical, cognitive, mental and social well-being for as long as possible;
- Evidence of user-centred design and innovation, effective ways of human computer interaction, and user acceptance;
- Fostering social participation and reducing social exclusion risks;
- Validation of non-obtrusive technology for physical, cognitive, social and mental well-being;

3. Research and Innovation project and achievements: ACCRA

a. Summary

The aim of the project ACCRA is to enable ageing citizens in Europe and Japan to stay in their own homes for as long as possible. However, ageing citizens are at risk of age related impairments such as poor health, age related mental health issues, frailty and social exclusion. These factors will cause negative consequences for their independence, quality of life of those who care for them and the sustainability of healthcare systems.

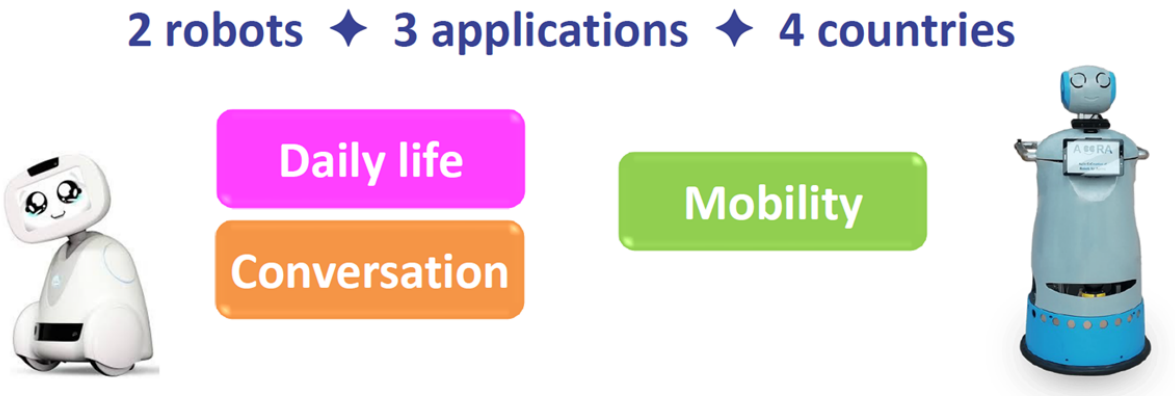

Figure 1: ACCRA key deliverables

The objective of ACCRA robotic solutions is to help elderly people to live independently. Robotics can contribute to an age friendly environment. The ACCRA partners focus on three main elderly needs identified during analysis: Mobility, Daily life, and Socialisation. The project aims to develop user centric solutions and a number or trials have been undertaken in France, Holland, Italy and Japan.

Recently there have been great advances in medicine, shorter hospital stays, limited discharge planning and the expansion of home care technology. As a result, informal caregivers, such as relatives, are being asked to assume a greater burden of care and over longer periods of time. Formal caregivers, such as carers, may become overworked and unable to provide the required care and attention which has negative impacts on their mental and emotional health.

b. Key achievements

The ACCRA solution accounts for different cultures across the EU and Japan and also a variety of individual preferences. The different applications have been co-created in different countries: Mobility Walking in Italy and The Netherlands, Daily Life in France and The Netherlands and Conversation rehabilitation in Italy and Japan.

The project develops and utilizes the methodology of agile co-creation which includes needs assessment, co-creation phase, experimentation and sustainability analysis. This agile co-creation process is applied iteratively to each application deployment.

The methodology is built on various approaches, methods and tools. As complementary methods, co-creation methodology with agile software development, experimentation, impact assessment and market survey are applied.

Figure 2: ACCRA: Visual perception by the robot during interaction

Artificial Intelligence (AI) is present in a wide range of application nowadays. AI used in robotic solutions, can allow the current robotic systems to increase in flexibility, perception, interaction, and learning capabilities, making them therefore less rigid, with an adaptable and rich behavior. The President of the European Commission, Ursula von der Leyen, announced in her political Guidelines, the aim for a coordinated European approach towards the human and ethical implications of AI as well as a reflection on the better use of big data for innovation.

Hence, in order to support a regulatory and investment oriented approach with the twin objective of promoting the uptake of AI and of addressing the risks associated with certain uses of this new technology, in February 2020, the European Commission published a White Paper with policy and regulatory options, to enable an ecosystem of excellence and trust.

By using machine learning methods, robots have more and more the ability to provide personalizable behaviours and appropriate and natural social interactions. These interactions may vary as a function of user's profile, preferences, and cultural background. The project also integrates IoT technology, such as sensors and QoS in the network.

The evaluation of robotic applications will include social expectations, safety, and acceptability to end-users (including caregivers). Furthermore, as differences between men and women in how they perceive technology have been reported in several studies, the co-creation and experimentation groups are composed of representatives from both genders. This will help project's stakeholders to design robots that are accepted by both men and women for end users (elderly) and formal and informal caregivers.

The project focuses on the deployment of two types of assistive robots:

Astro is an assistive smart robotic platform dedicated to mobility and user interaction. It has been designed for moving within unstructured home and residence environments and can call for help in case an elderly person falls. It looks like a robotic walking frame and helps elderly people walk and do exercises.

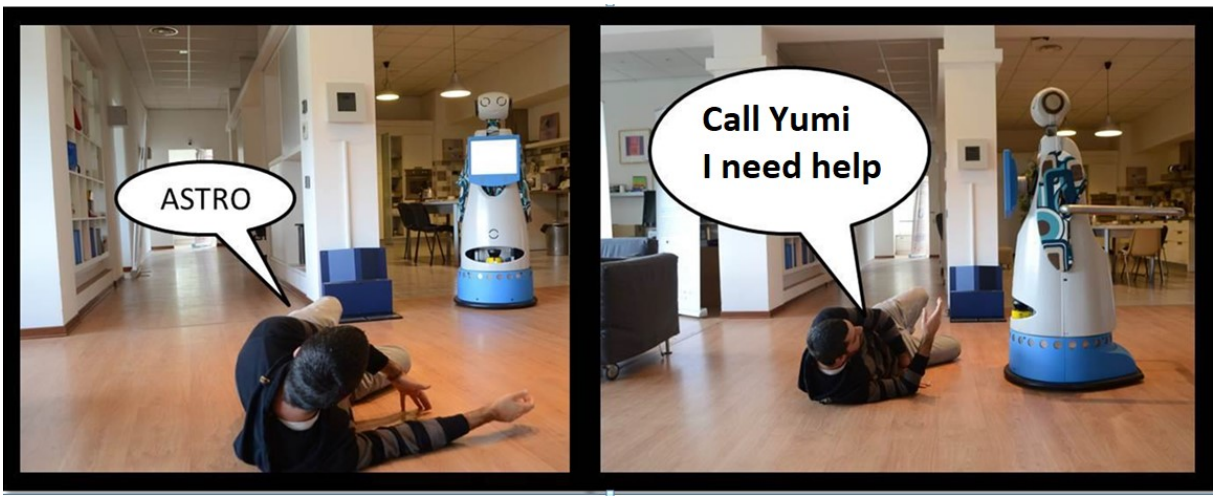

Figure 3: ACCRA robot assisting in case of a fall

Falling is a major clinical problem in elderly people aged 65 and over, affecting 30%–40% of those living in the community and 50% living in nursing homes. At least one-third of people aged 65 years and over fall once or more annually. Falls may lead to negative consequences such as immobilization and injuries and these consequences reduce mobility, independence, quality of life and life span (Barban et al. Journal of Physiotherapy).

Buddy is a small robot and designed as a home companion. Elderly people can talk to it, or he will entertain them by dancing or playing music. More importantly, he will remind them to take their medicine and manage their diaries so that they do not forget doctors' appointments.

Figure 4: ACCRA: One unexpected benefit of the project was that elderly people treated Buddy like a companion animal and formed strong bonds with the robot.

Figure 5: ACCRA: Astro robot assisting in mobility

The Mobility application helps people at risk of falls or returning from hospitals after falls. This solution focuses on walking support. The main functions are: Helping to maintain independent mobility, Post traumatic Support (rehabilitation) and Detection of the lack of movement. Regarding the safety needs, the solutions will integrate sensors to detect and analyse movement or the lack of it. The mobility solution contains different applications tailored to the needs of the user and the caregiver. The robot will interact with the user via the carer. In addition, ACCRA will utilise robot intelligence so that it can propose physical activities to elderly.

c. Dissemination, deployment and outlook

In conclusion, the project team has made great effort and achievements. The obtained data showed an efficient and synergistic collaboration between Europe and Japan, which has delivered relevant new results. With regard to the experimentation in pilot sites, partners delivered the study on the three sites. The detailed information obtained provided lessons to be learned and recommendations for future experimentations with robotic solutions not only from a technical, but also from an organizational and methodological point of view.

Much interesting information has been collected in particular on the usage of the robot to prevent falls in the elderly population and in daily life activities.

4. Research and Innovation project and achievements: CARESSES

a. Summary

The aim of the project is to maximize the acceptance of care robots and to see if cultural sensitivity enables the robot to be better accepted by the user.

CARESSES stands for Culture-Aware Robots and Environmental Sensor Systems for Elderly Support. It is a multidisciplinary, international project aimed at designing the first care robot that adapts the way it behaves and relates to the culture of the person it assists. The end goal is to create a culturally competent robot which understands that every individual is unique but can relate to elderly people by understanding their cultural environment, food and culture.

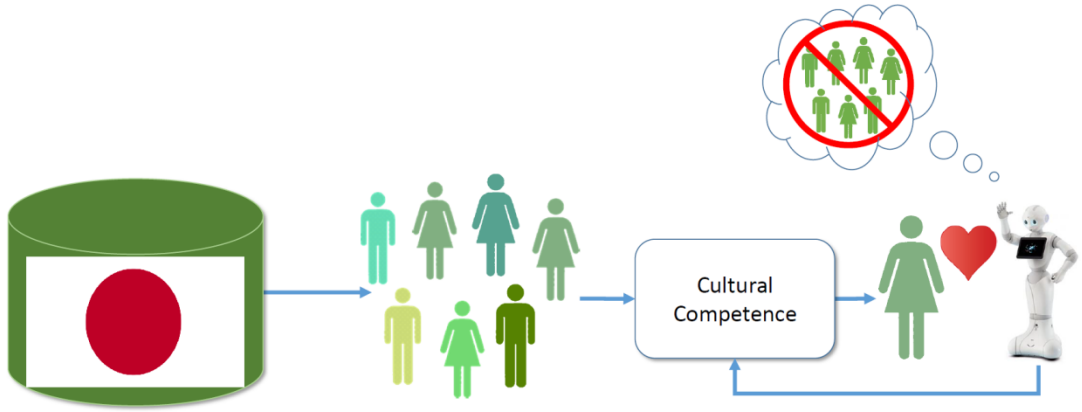

Figure 6: CARESSES: Cultural competence approach

b. Key achievements

In summary, the high-level objectives of the project were achieved. Positive results have been obtained especially related to emotional well-being and to user satisfaction and acceptance of the robot. The number of participants underlying the results enable us to gain valid starting points for studies to deepen the understanding and the observations have to be understood in this light. This does not allow the reader to draw broader conclusions, but should be used for deepening the understanding and knowledge and further enhancing research and innovation for targetted developments and deployment. The project is designed to study cultural aspects, and gives relevant insights beyond observations and tentative trends.

Project Vision

Global ageing populations are placing healthcare systems under pressure, care robots can assist human caregivers in some tasks and help to reduce the pressure on hospitals and care homes and improve care delivery at home.

To achieve this vision, it is critical that robots need to be accepted by older people and their formal and informal caregivers. Developing robots that are aware of the person they interact

with and model their behaviour accordingly should make them more acceptable to older people.

Goals

SCIENCE – The project explores whether cultural competence can improve the acceptance of health-care robots. It also studies how to make robots culturally competent.

TECHNOLOGY – The project aims to build a system that integrates the state-of-the-art in assistive domestic robots with scientific evidence associated with culturally competent robots.

VALIDATION – The project explores if and how cultural competence makes robots more acceptable and sensitive to the user's needs, customs and lifestyle.

Robots

To develop and test its culturally competent system CARESSES utilities Pepper a human-shaped robot produced by Softbank Robotics.

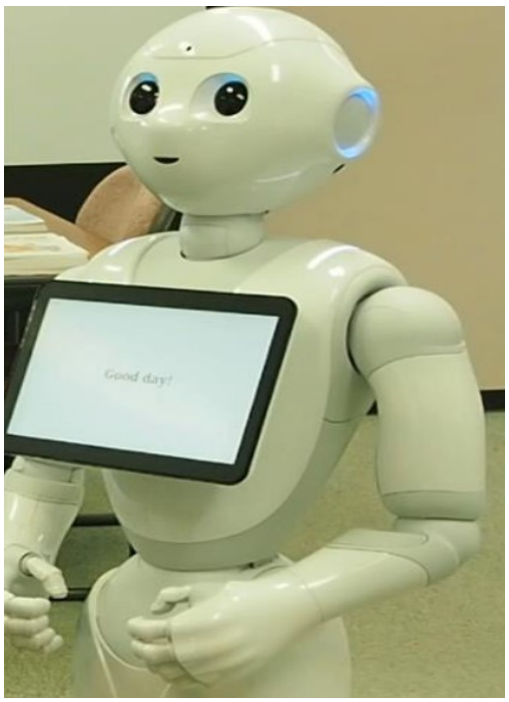

Figure 7: CARESSES: Pepper robot in interaction

Pepper is designed to communicate with people simply and naturally, through body movements and voice.The culturally competent robot helps older people in tasks such as reminding them to take their medication, encouraging them to keep active and eat a healthy diet, helping them keep in touch with family and friends through the internet, listening to their favourite radio stations, and reminding them about important cultural and religious festivals.

The robot will assist the caregivers but won't substitute them: it can remind a person to take a pill but it cannot make healthcare decisions. Physical operations such as lifting an older person or helping him/her sit down or walk are not among the robot's tasks.

In the UK, the robots will be tested in interaction with the residents of Advinia care homes, partner of the project. In Japan, the robots will be tested in the HISUISUI care home and in the iHouse, a 'smart' JAIST apartment fully embedded with sensors and actuators for home automation. The robot will also have the capability to support the independence of older persons living at home.

Cultural competence

"Cultural competence" refers to the ability of a robot to recognize a person's various cultural and personal traits, and to behave accordingly. The robot should be aware of factors such as age, education, family structure, religion and heritage (cultural awareness). It should take into consideration the person's cultural values, beliefs and attitudes about health and illness as well as their self-care practices (cultural knowledge).

The robot should be sensitive about the user's attributes like language, accent, interpersonal skills, communication skills, ability to trust others and to be compassionate to others (cultural sensitivity). The robot will communicate with Japanese, Indian and English participants utilizing completely different cultural references. Carresses artificial intelligence system includes three modules Cultural Knowledge Base (CKB), Culturally Sensitive Planning and Execution (CSPEM) and Culturally-Aware Human Robot Interaction (CAHRIM). The system advances the state of the art in the field personalized interaction.The ai component allowed the robot to be trained to recognize emotional responses

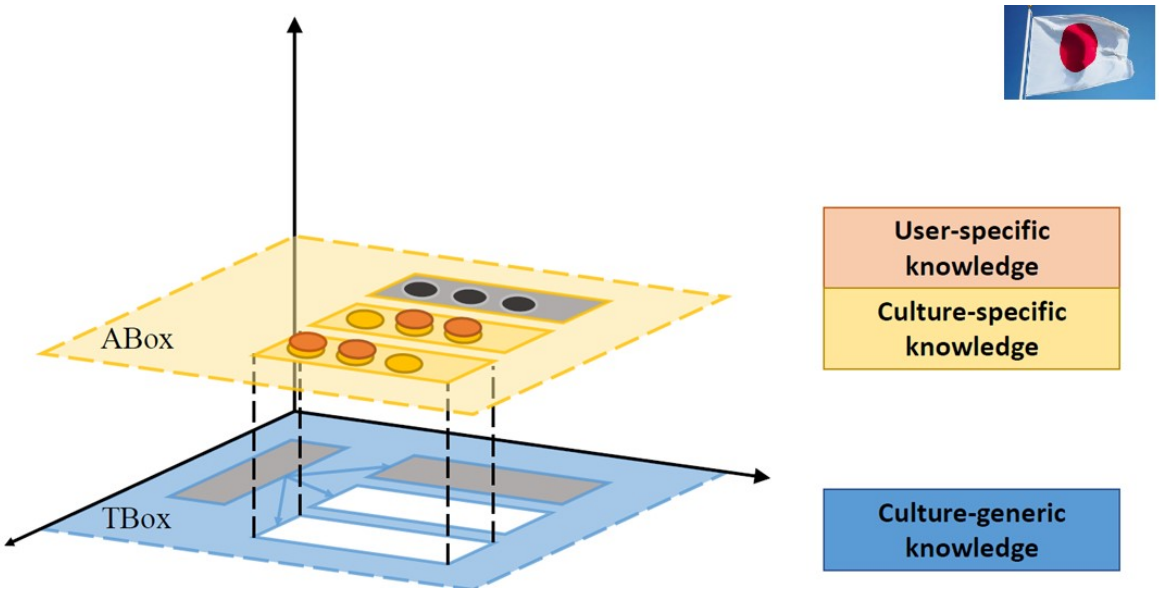

Figure 8: CARESSES: Cultural competence integration layers

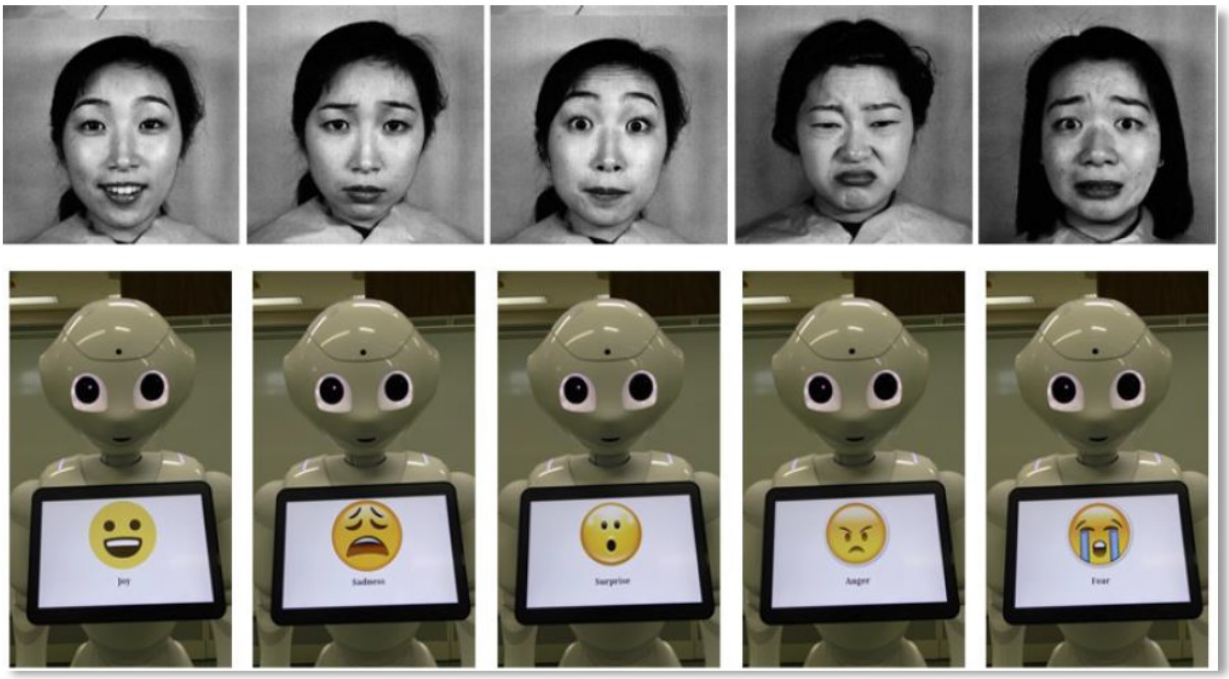

Figure 9: CARESSES: AI component allows the robot to be trained to recognize emotional responses-examples of face expression recognition

The rationale

CARESSES will design robots will be able to adapt how they behave and speak to the culture, customs and manners of the person they assist.

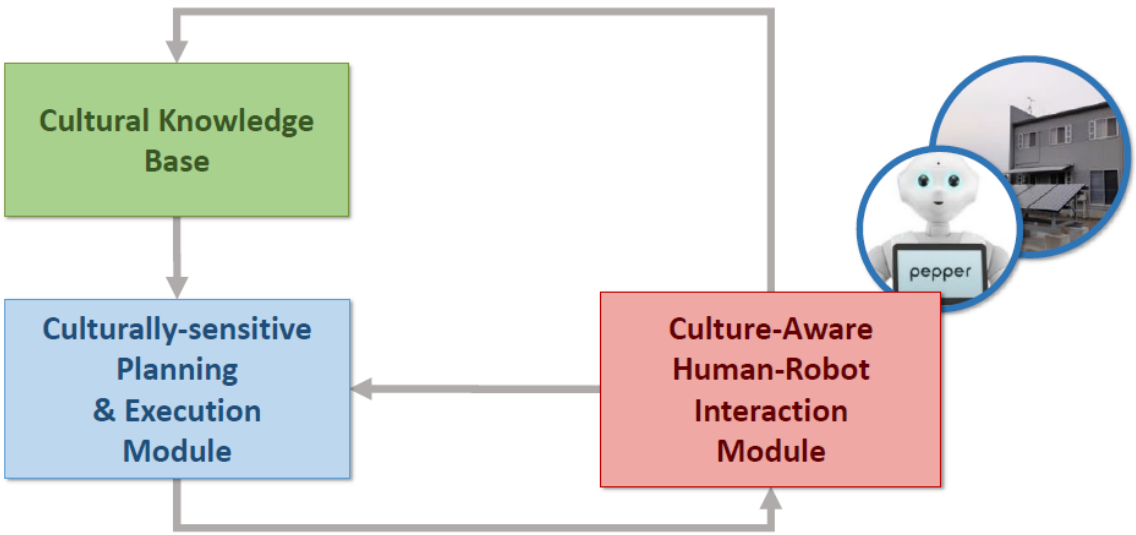

Figure 10: CARESSES: Cultural competence, knowledge base, planning, interaction

Culturally aware robot capabilities will include: communicating through speech and gestures; moving independently; assisting the person in performing everyday tasks (e.g. helping with to-do lists and keeping track of bills, suggesting menu plans); providing health-related assistance (e.g. reminding the person to take her medication); providing easy access to technology (e.g. internet, video calls, smart appliances for home automation); and providing entertainment. (e.g. reading aloud, playing music and games)

CARESSES' culturally aware robots have been tested at: Advinia Healthcare care homes (UK; project partner); the HISUISUI care home (Japan); the iHouse facility at JAIST (Japan; project partner), a duplex apartment that is fully equipped with sensors and smart appliances for home automation.

Figure 11: CARESSES: Pepper robot in interaction with persons

Care robots that are culturally aware and competent are likely to meet with greater acceptance from both the elderly and their caregivers.

c. Dissemination, deployment and outlook

In conclusion, the project team has made great effort and achievements. The data obtained showed an efficient and synergistic collaboration between Europe and Japan, which has delivered relevant new results. With regard to the experimentation in pilot sites, partners delivered the study on the three pilot sites with detailed information on each site. They provided lessons to be learned and recommendations for future experimentations with robotic solutions not only from a technical, but also from an organizational and methodological point of view. In addition, a great deal of interesting information has been collected in particular on the usage of the robot to prevent falls in the elderly population and in daily life activities.

The project team has set up a company to implement the results of this project in society and further dissemination and expansion of the research results is expected.

5. Research and Innovation project and achievements: IDIH

a. Aim of IDIH

The International Digital Health Cooperation for Preventive, Integrated, Independent and Inclusive Living (IDIH) is a 36-month Coordination and Support Action (CSA), cofounded by the European Commission (EC) under the EU's Horizon 2020 research and innovation programme, aims to promote and increase international cooperation to advance digital health in the EU and five Strategic Partner Countries to AHA through innovation. To this purpose, IDIH will identify shared priorities in all regions and set up a Digital Health Transformation Forum as a long-lasting and expert-driven catalyst to foster collaboration between the EU and the Strategic Partner Countries i.e. USA, Canada, China, **Japan** and South Korea.

IDIH key deliverables

- Report on Trends, Drivers and Enablers in AHA
- Panorama of the digital health RI landscape in AHA
- Briefing note on (priority) topics for the Expert Groups
- Guidebook for RDI stakeholders presenting funding schemes supporting various forms of collaboration in Digital Health between RTI stakeholders in the EU and the Third Countries, including a country fact sheet
- Guidebook for care providers and users in AHA

The objective

IDIH has set the following high-level objectives:

- Objective 1: Support the definition of common priorities to enhance strategic international cooperation in digital health for AHA in line with policy orientations;
- Objective 2: Provide specific contributions to the international dialogue in digital health for AHA;
- Objective 3: Facilitate the exchange between research, technology and innovation (RTI) stakeholders from the EU and Strategic Partner Countries in digital health;
- Objective 4: Foster international collaboration for digital solutions for healthcare benefitting the society and industry.

IDIH gives an overview of the digital health research and innovation (R&I) landscape in each region. In its reports, it focuses among others on the following elements:

- Digital health R&I priorities in a national and international context;
- Main challenges related to digital health;
- Specific challenges for the ageing population;
- Relevant key programmes and funding agencies;
- Most important players and networks in the field;

- Strengths and weaknesses in the regions;
- Major bi- and multilateral science and innovation (S&I) agreements between the EU and the Strategic Partner Countries;
- Good practices, success stories and added value for international cooperation.

b. Key achievements

The IDIH project has mobilised a large set of stakeholders:

- IDIH partners carried out 48 interviews with key opinion leaders
- Set up 4 high level expert groups including 30 professionals, 4 from Japan
- Engaged 23 user associations, 2 of them operating in Japan
- Top 6 Executive programme manager and policy makers active in AHA - representatives of each country including Japan
- Identified 50 different funding opportunities for R&I in the field of Digital Health for AHA (relevant programmes/initiatives) mapped in D2.4 Briefing note on (priority) topics for the expert group, 10 in Japan:
- Presented 32 different funding opportunities for international cooperation between the EU and the 5 Strategic Countries in the field of Digital Health for AHA (relevant programmes/initiatives) mapped in D2.1 Guidebook for RDI stakeholders, 3 in Japan
- Presented updated facts & figures concerning:
    - AGEING & CARE SERVICES:
        - The elderly population in the EU and in the IDIH Strategic Countries (among which, Japan)
        - Nurses in the IDIH Strategic Countries (among which, Japan)
        - Doctors in the IDIH Strategic Countries (among which, Japan)
    - RESEARCH & INNOVATION
        - Gross domestic spending on R&D in the EU and in the IDIH Strategic Countries (among which, Japan)
        - Researchers in the EU and in the IDIH Strategic Countries (among which, Japan)
        - Triadic patent families in the EU and in the IDIH Strategic Countries (among which, Japan)
    - HIGHLIGHTS ON PARTICIPATION AND FUNDING UNDER THE EFP
        - Participation and funding in the EU Framework Programme (2014-2020), reported also per country/region involved in this Guidebook (among which, Japan), as well as per type of participant and relevant topics (related to Digital Health and AHA)1.
    -

[1] As part of the IDIH D4.5 *Guidebook for care providers and users*.

c. Dissemination, deployment and outlook

In conclusion, the project will continue its consultation process with the different stakeholders mentioned above to validate its findings and act as a platform towards international collaboration in AHA. The final output of the IDIH is the creation of a roadmap for active and healthy ageing including the EU and International Strategic partners.

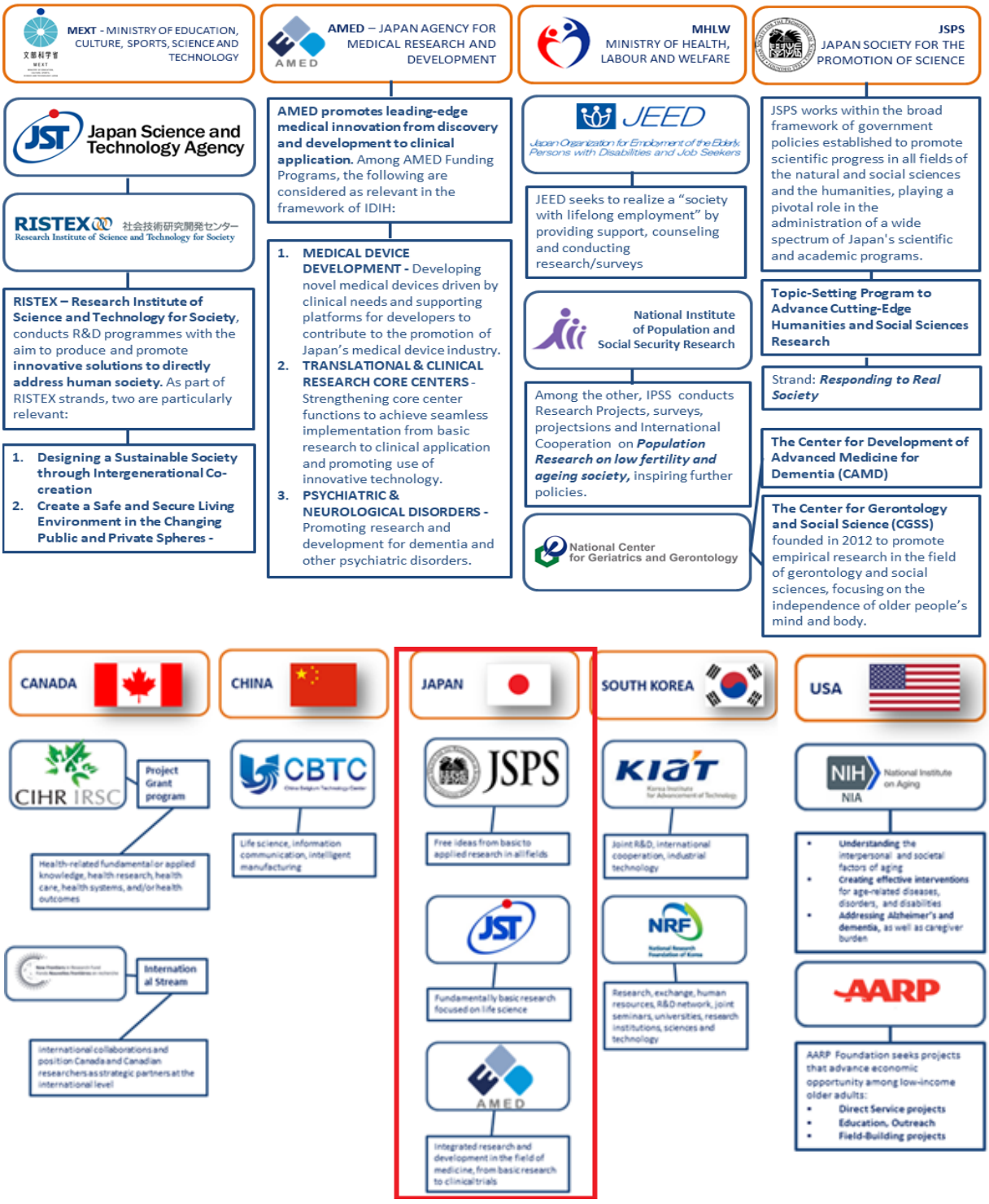

Figure 12: Infographics from IDIH D2.4 available at: https://idih-global.eu/wp-content/uploads/2020/06/D2.4_Briefing-note_final.pdf

6. Research and Innovation project: e-VITA

a. Summary and objectives

The main purpose of e-VITA is to improve well-being in older adults and thereby promote active and healthy ageing (AHA), contribute to independent living, and reduce risks of social exclusion of older adults in Europe and Japan. Therefore, the multidisciplinary consortium collaborating in this project will develop an innovative ICT-based virtual coaching system to detect subtle changes in physical, cognitive, psychological and social domains of older adult's daily life. Thus, the e-VITA virtual coach will provide personalized recommendations and interventions, for sustainable wellbeing in a smart living environment at home.

The ultimate purpose of e-VITA is to support older adults (with culturally sensitive ICT support) in maintaining and improving their individual well-being, mainly when affected by cognitive and physical impairments and hence, potentially, prevent the onset of associated end-stage diseases by empowering the older adults to better manage their daily lives and experience ageing as a positive process and meaningful period of life.

As one of e-VITA's novelties, emotional data generated by speech will be analysed. This information will be used among other data to determine individuals' state of well-being and to provide AI-based personalized strategies for sustainable interventions.

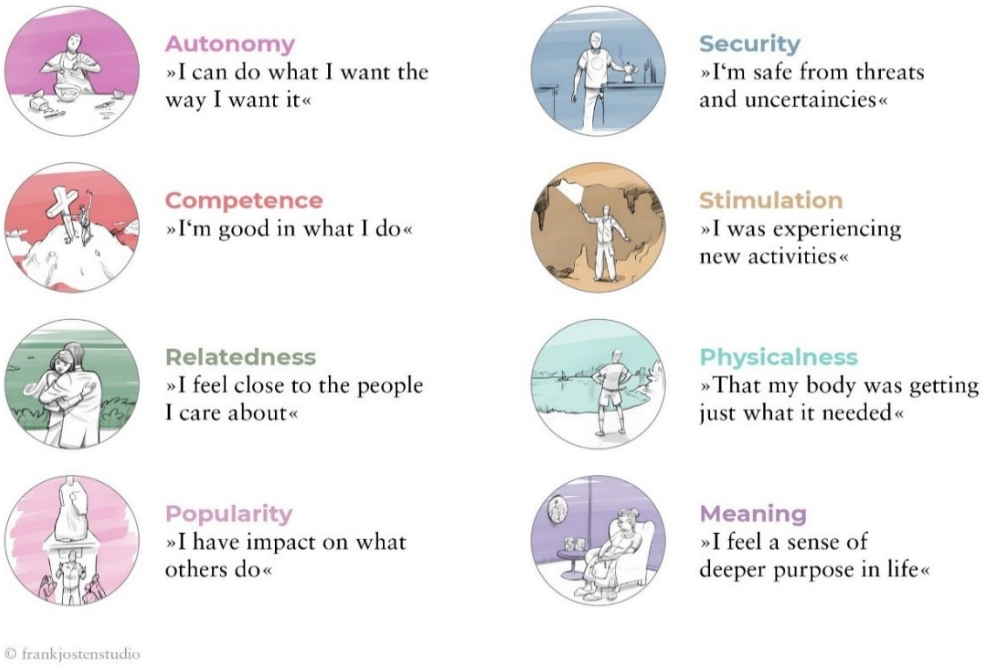

Figure 13: e-VITA will support the fulfillment of needs for older people through socially embedded technology in Europe and Japan.

Regarding future expandability, e-VITA is aiming for an open interface for other SMEs and NGOs to integrate their services and interventions into the virtual coaching system, hence, ensuring standards and interoperability for a sustainable use of the solution. Finally, the developed technology will also provide a social platform for end-users to engage with the community around them. The overall platform will also be based on a trustworthy ethical roadmap concerning data, services and security measures as part of the e-VITA project.

All relevant results and outcomes of e-VITA will be disseminated to policy makers and health/social authorities around Europe and in Japan.

The e-VITA partners know that end-user acceptance will be ensured only if the proposed solution responds to the real needs and practices of older adults in daily life. Therefore, the research and development of e-VITA will start from the needs and daily life practices of the target group (community-dwelling older adults in Europe and Japan), and NOT directly from the technology, so that the final solution can provide a good user experience and fulfillment of needs (see figure 1).

b. Expected Impacts

In Europe, as well as in Japan, demographic change comes with socio-economic challenges, and an increasing burden for health care systems. Therefore, a coaching system and framework for increased self-management of health, social connectedness and improved well-being is expected to provide a positive impact on the ageing societies in Europe and Japan.

The main impact of the e-VITA project will be to increase the use of smart living technologies for sustaining and improving the physical, cognitive, mental and social well-being of older adults through a better self-management of participation, health, autonomy and safety while ageing in Europe and Japan.

Instead of being prescriptive and abstract, e-VITA will individually encourage older adults to perform (culturally-sensitive) new practices that will increase their subjective wellbeing. And thus, e-VITA will enhance need fulfillment and satisfaction in different prevention domains and settings. Consequently, older adults will become happier and more satisfied with their lives, which also will improve and impact their social life and relatedness.

At the same time, e-VITA will have a strong socio-economic impact on related European and Japanese industries and SMEs, and on societies as a whole, as it will be exploited in terms of socio-technological innovations. The new coaching system for well-being and active & healthy ageing will be based on trustworthy AI and federated data technologies, and uses advanced dialogue techniques for natural language processing, as well as individualized devices like holograms, small robots or other innovative artifacts, which are also connected to the trusted community around the older adult users.

International collaboration between European and Japanese researchers, developers, companies, communities, and policy makers will be key in e-VITA, in order to establish the impacts mentioned above.

c. Project ambitions beyond the state of the art

The methodology will be based on participatory and value-based design approaches in real life settings, involving various end-users from different countries and cultures, and also the stakeholders around them, such as their informal caregivers or social services from the community.

Following these considerations, an important aspect of e-VITA is to establish new socio-technological approaches (and related policies) in Europe and Japan, and to implement them in real-life settings and practices of community-dwelling older adults and the stakeholders around them (see figure 3).

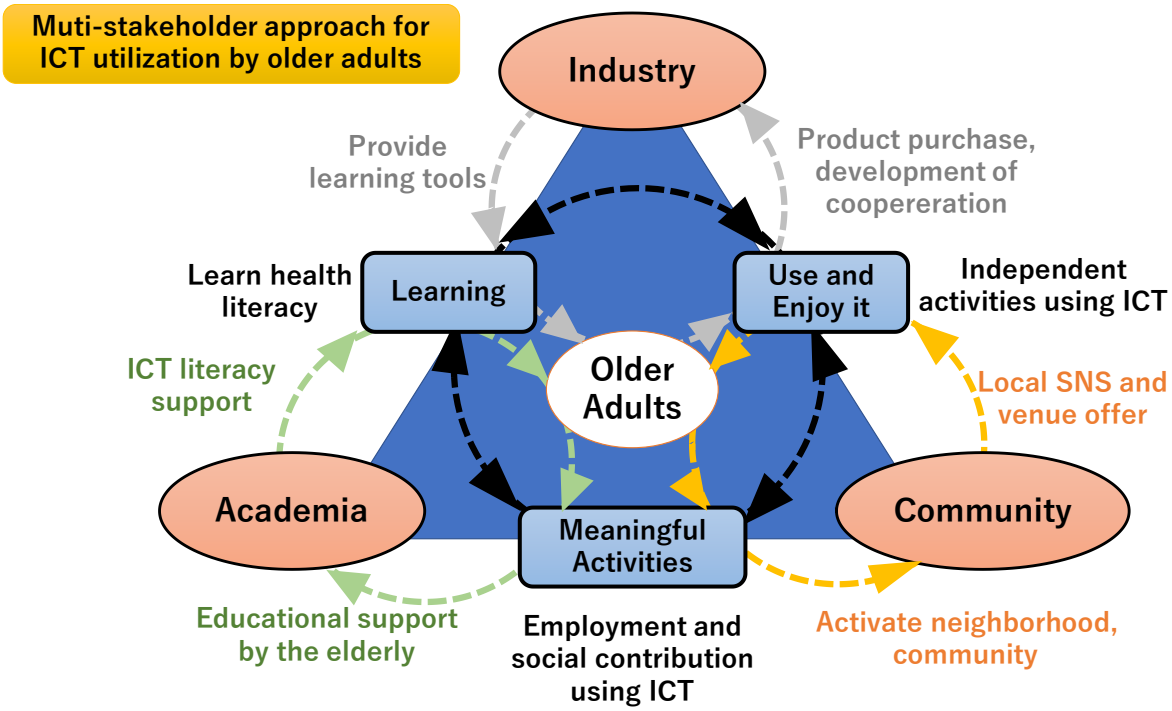

Figure 14: e-VITA socio-technology approach of participatory design and stakeholder engagement which will be deployed via real-life living labs build around everyday practices of the older adults (adapted from Japanese Ministry of Internal Affairs and Communication and e-VITA methodology).

Ambitions

The e-VITA project ambition goes beyond the state of the art in domains of socio-technology support for active and healthy ageing of community-dwelling older adults in Europe and Japan:

1) New approaches of participatory and value sensitive design for co-creation of well-being related smart living artifacts for older adults;
2) Updated standards and norms for interoperability of smart living devices and trustworthy AI in Europe and Japan;
3) Semantic knowledge graphs, natural language understanding and improved dialogue systems for active and healthy ageing;
4) Privacy awareness, control and trust in federated data systems for independent living of older adults in Europe and Japan;
5) Sustainable community support and stakeholder engagement while using smart living devices and connections to related social services.

Modalities of the Virtual Coach

The shape and modality of the e-VITA virtual coach itself will be customizable depending on user preferences, in a practice-based selection process which will take

into account the individual needs and preferences of the user. The devices to be considered and explored herewith are depicted in figure 4 below.

Figure 15: e-VITA devices for different use contexts of the coaching systems for community dwelling older adults in Europe and Japan (only one will be selected per person and setting according to individual preferences and needs).

Thus, e-VITA will represent itself as a socio-technical system, with smart devices at home, connected with advanced AI and dialogue systems, and an App for inside/outside use, that all support each other in various ways and link themselves smartly, not only to the older adult users, but also to essential stakeholders around them. This will foster a sustainable use, and thus provide several opportunities for societal uptake of new AHA solutions and policies in Europe and Japan.

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