S H A P E S

Smart and **H**ealthy **A**geing
through **P**eople **E**ngaging in supportive **S**ystems

D9.1 – SHAPES Ecosystem Building, Findings and Breakthroughs

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Table 1 Revision History

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Table of Acronyms and Abbreviations

Table 3 Acronyms and Abbreviations

Acronym	Full Term
AAA	Agile Ageing Alliance
AAL	Ambient Assisted Living Programme
AI	Artificial intelligence
CEF	Connected Europe Facility
D	Deliverable
DoA	Description of Actions
EC	European Commission
eHDSI	EHealth Digital Service infrastructure
EIP on AHA	European Innovation Partnership on Active and Healthy Ageing
EU	European Union
FHIR	Fast Healthcare Interoperability Resources
HL7	Health Level 7
IA	Innovation Action
IHE	Integrating Healthcare Enterprise
IoT	Internet of Things
ISO	[International Organization for Standardization](#)
IT	Information technology
KPI	Key performance indicator
LSP	Large-Scale Pilots
M	Month
PT	Pilot Theme
RTO	Research and Transfer organisation
SHAPES	Smart and Healthy Ageing through People Engaging in Supportive Systems
SSHLC	Innovative Supportive Systems for the Smart, Healthy and Active Ageing at Home and in Local Community Environments
SWOT	Strengths, Weaknesses, Opportunities and Threats
T	Task
WP	Work Package

Keywords

Ecosystem Building, Digital Health Network, eHealth, Stakeholder Analysis, Dissemination Activities, Foresight Exercise

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Table of Contents

List of Figures

List of Tables

Executive Summary

At this half-way point of the SHAPES project, deliverable 9.1 summarises the activities and results undertaken in the project that aim at understanding and **building the SHAPES ecosystem**.

This report draws on the **findings and breakthroughs** that have emerged from three work package 9 tasks (of T9.1 Co-creation Think Tank for European Integrated Care, T9.2 Innovation Watch, Cross-fertilisation and Foresight Exercises and T9.3 Building Strong Networks and Liaisons).

The summarised findings **support the activities carried out in six other work packages** (WP3, WP5, WP6, WP7, WP8, and WP10).

Specifically, this report provides **five main insights** into

- a consensual understanding of the mission and vision of SHAPES,
- an in-depth stakeholder analysis of the players of the SHAPES ecosystem,
- the preliminary efforts to include external stakeholders in the discussions to assess and improve the actions of SHAPES,
- the results and implications of the co-creation think tank workshops, and
- the results and impact of the identification and testing of new digital solutions.

The overarching goal of this work package is to facilitate the **sustainability of SHAPES' outputs** and to support the formulation of general **recommendations for eHealth-based integrated care**.

During the second half of the project, therefore, the stakeholder analysis will be deepened. SHAPES will reach out to all relevant stakeholders in order to further capture and reflect external views.

This wider outreach and associated data analysis are crucial to successfully integrating the activities of SHAPES in a heterogenous **eHealth ecosystem that spans many different health and social care systems in Europe**.

1 Introduction

SHAPES is a European innovation (IA) action to facilitate active and healthy ageing. It comprises and connects a heterogeneous set of stakeholders on both multidisciplinary and international level. The network of these stakeholders, their interaction and underlying processes are part of a large ecosystem spreading over different European health and social care systems. In parallel to forming its platform, pilots and digital solutions, which are all interconnected with understanding the lifeworld of older people and substantial ethical requirements, SHAPES aims to ensure sustainability for its actions beyond the project's runtime. The basis for this sustainability is for SHAPES to understand the ecosystem in which it operates and aims to provide assistive services and recommendations to help facilitate active and healthy ageing. The acquired knowledge will enable SHAPES to actively form and build its ecosystem of reference to ensure uptake and long-term integration of the project outputs.

1.1 Rationale and purpose of the deliverable

This deliverable describes and summarises the work of three work package 9 tasks: T9.1 Co-creation Think-tank for European Integrated Care, T9.2 Innovation Watch, Cross-Fertilisation and Foresight Exercises, and T9.3 Building Strong Networks and Liaisons, which all started in M1 of the project. The document provides the status of the SHAPES Ecosystem Building, in M24 of the project, bearing in mind its aim to achieve sustainability of the ecosystem after the end of the project.

Based on open and creative discussions, networking, interactive workshops, and cross-fertilisation activities, this deliverable:

- provides preliminary findings and a resulting set of factors emerging from the SHAPES ecosystem that influence the sustainability of outputs of the project,
- comprises the current result towards a mutual understanding of the SHAPES vision, mission, concepts and work.
- further summarises the results of the foresight exercises that assist in the identification and selection of new digital solutions and cross-pilot sites for the pan-European pilot campaign of the SHAPES Platform
- helps to assess the relevance and impact of the gathered findings and conclusions.

The discussions towards these results involved internal and external stakeholders to facilitate and contribute to the SHAPES co-design and co-development of analysis, approaches, use cases and solutions.

1.1.1 Deliverable Objectives

As defined in the DoA, this report describes the building and enlargement of the SHAPES Ecosystem via networking and cross-fertilisation activities. It presents the main findings and results of the activities developed within the Think Tank for European Integrated Care, considering the status quo, the innovation watch, and the exercise of foresight.

At the halfway point of SHAPES at M24, this report is the first iteration of the ecosystem building tasks and results report that serve as the basis for the second phase of the task until the end of the project in M48.

1.1.2 Key inputs and outputs

Key Inputs:

This report draws on the activities in T9.1 Co-creation Think Tank for European Integrated Care, T9.2 Innovation Watch, Cross-fertilisation and Foresight Exercises and T9.3 Building Strong Networks and Liaisons.

Various inputs also came from the work of work package 3. In M18, Work Package 3's D3.5 provided initial input towards a SHAPES Collaborative Governance Model, which constitutes the central building block of the ecosystem building process. D3.5 provided a definition for governance and identified general key stakeholder types of SHAPES governance, who are at the same time, stakeholders of the SHAPES ecosystem. The identified stakeholders serve as a basis for the stakeholder analysis in this report. Further to this, D3.2 Scaling-up Improved Integrated Care Delivery V1 provided an analysis of case reports from the deployment of person-centred technology-based solutions supporting integrated care programmes. The lessons learned from that dialogue with project external actors have been fruitful for the development of a vision regarding factors to consider in technology adoption in care-providing organisations.

Key Outputs:

This deliverable puts forth a considerable number of factors for successful integrated care, liaisons, and networks for the further actions of the ecosystem building to be considered in WP3, WP7 and WP10. These factors arise from the ecosystem stakeholder analysis, the SHAPES mission and vision, as well as the networking and think tank activities.

Additionally, the Foresight Exercises conducted in WP9 show a potential expansion of portfolio of influencing factors and digital solutions and services that facilitate active and healthy ageing to be developed and implemented in the SHAPES platform and

benefitting other technically enabled systems that support healthy ageing and assisted living at home.

1.2 Structure of the document

This deliverable comprises five chapters.

Chapter 1 introduces the ecosystem of SHAPES and the rationale, objectives, and key inputs and outputs of this report, as well as describing the deliverable's structure.

Chapter 2 focusses on the creation and management of the SHAPES ecosystem. It covers five main topics: a definition of what the SHAPES ecosystem is, a stakeholder analysis, the work towards a mutual SHAPES vision and mission, the creation of stakeholder-oriented pitches for the distinct introduction of SHAPES to all its stakeholders, and the results of the networking and liaising activities. Chapter 2 also outlines the activities undertaken for the dissemination of SHAPES results to external stakeholders with the aim of informing them about SHAPES and gaining insights from outside the consortium for ecosystem building purposes.

Chapters 3 and 4 focus on the methods and results of networking and cross fertilisation activities.

In particular, Chapter 3 provides insights into the 2020-2021 co-creation Think Tank workshops on European Integrated Care and an outlook towards the upcoming think tank meetings in the beginning of the second half of the SHAPES project.

Chapter 4 summarises the results of the foresight exercises that aimed to identify and define the impact of new digital solutions that SHAPES will consider in order to expand its portfolio to ensure growth and sustainability.

Chapter 5 provides a conclusion of the presented ecosystem building work and an outlook for the second phase of T9.1, T9.2 and T9.3 during the last 24 months of the project.

2 Creation and Management of the SHAPES Ecosystem

Work package 9 and in particular task 9.1 aim to support the development of the SHAPES governance model in WP3, and the requirements for the creation and management of the SHAPES Ecosystem as the basis for achieving sustainability after the end of the project. To do so, project partner, CCS, aimed to create a mutual understanding among the consortium members of the SHAPES vision and mission which is the basis for shaping and framing the ecosystem.

This chapter summarises the current status of the mutual vision and mission of SHAPES, the resulting implications for the SHAPES ecosystem, and outreach activities undertaken to disseminate the work and results of the project.

2.1 Open Discussion Forum

Task 9.1 aims[1] to foster an open and creative discussion forum to generate a common understanding of the SHAPES vision, concepts, and work involving relevant stakeholders in the scope of the SHAPES' action. Additionally, T9.1 promotes a set of dedicated discussions. These facilitate and contribute to the SHAPES co-design and co-development of analysis, approaches, use cases, and solutions (which will be represented by and integrated in the SHAPES Platform and deployed in the large-scale piloting activities).

To achieve these goals, T9.1 partners participate in all the relevant SHAPES meetings (such as monthly WP9 meetings, project management board meetings, General Assembly meetings, and dedicated discussion meetings on the topic). Additionally, Think Tank meetings, Dialogue Workshops, conferences, social media, and interviews foster these discussions and the dissemination of results.

2.2 SHAPES Vision and Mission

Based on an iterative process with T9.1 partners, CCS outlined the SHAPES vision and mission to create a mutual understanding among the project consortium partners.

Vision:

The European population is ageing and the average lifespan is increasing. However, this increased lifespan is not necessarily associated with continuing health and wellbeing. As a result, there is a growing need to reduce the increased risk of injury,

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[1] Many of the tasks mentioned by SHAPES continue throughout the whole of the project duration. Hence, they are referred to in the present tense in this deliverable.

frailty, and long-term chronic conditions for older people, and – when these occur –, manage them better.

SHAPES envisions providing and integrating smart and easy-to-use services that help older people to continue living independent, active and healthy lives – and their formal and informal carers to assist them in living as such.

SHAPES strengthens the efforts of the European Union (EU) to mitigate the (negative) effects that the ageing population will have on health and care by providing:

- new models of long-term support and care for older individuals,
- strong cooperation among all stakeholders of health and care for older individuals,
- services that assist professional and informal caregivers,
- integrated and economically sustainable tools.

Mission:

SHAPES aims to facilitate long-term healthy and active ageing and the maintenance of a high-quality standard of life for older people in Europe. The combined expertise of the multi-disciplinary SHAPES consortium enables it to study and understand the lifeworld of older people and to develop and integrate meaningful user-centred digital solutions and services: this is its mission.

SHAPES aims to provide helpful or supportive digital solutions and services to promote active and healthy ageing, through constructive activities. This activity includes that the digital solutions and associated processes (such as development, testing and implementation, data collection, data exchange and data protection) focus on the needs, requirements, and rights of older people to ensure their trust in and empowerment by SHAPES. SHAPES is also committed to understanding how older people would like to use the digital solutions, and how these solutions should look, feel and operate, as well as how best to ensure accessibility for older people in their use of the digital solutions.

SHAPES is therefore building, piloting, and deploying a large-scale, EU-standardised open platform that will span the heterogeneous health and care systems in Europe. The SHAPES platform will provide non-discriminatory access to a broad range of technological, organisational, clinical, educational, and societal solutions that will facilitate healthy and active ageing and a high-quality standard of life. Additionally, SHAPES will establish digital services, proactive care models, and recommendations to foster the interaction of in-home and local community environments with health and care networks. The SHAPES approach will provide high-quality integrated and seamless care directly in the homes of older users.

2.3 Definition of the SHAPES Ecosystem

As guidance to the consortium, the term "SHAPES ecosystem" was defined in the SHAPES Terminology v1.0. The SHAPES ecosystem is the network of relevant users and key stakeholders who are working together in the SHAPES project to scale-up the SHAPES platform and its digital solutions. This term is based on the EU's Pilots and Platform Plateau of the Digitisation Focus Area (DT-ICT and DT-TDS calls) and the EC recommendations for the Large-Scale Pilots.

2.4 Ecosystem Stakeholders

For the ecosystem building tasks in WP9, we also consider external stakeholders that do not work in, or are not yet involved in, the SHAPES project in order to aim for scale and sustainability after the end of the project. Essentially, WP9 aims to consider all stakeholders that are relevant for SHAPES, including their interactions and their dependencies. This approach is the basis for SHAPES to determine how to best interact within its ecosystem, to achieve its long-term goals, and to provide services and information for all the stakeholders involved.

Deliverable D3.5 – Initial SHAPES Collaborative Governance Model identified broad key stakeholders of SHAPES governance, which are the public sector, the private sector, payers and the third sector, which comprises civil society, non-profit and/or charitable organisations, philanthropies, think tanks, academia and individuals. As these stakeholders are essential for the governance of SHAPES, they are also essential for the SHAPES ecosystem. This chapter provides a more detailed view into SHAPES' ecosystem stakeholders that are part of the stakeholder domains identified in D3.5. As an inherent feature of the health and care sector, there is a heterogeneous set of SHAPES ecosystem stakeholders. To achieve successful ecosystem building, it is essential to analyse the involved stakeholders, the underlying relationships among them and their role within the operations of SHAPES as depicted in the following overview (Figure 1). A more detailed description of the stakeholders to be involved follows in Annex 1.
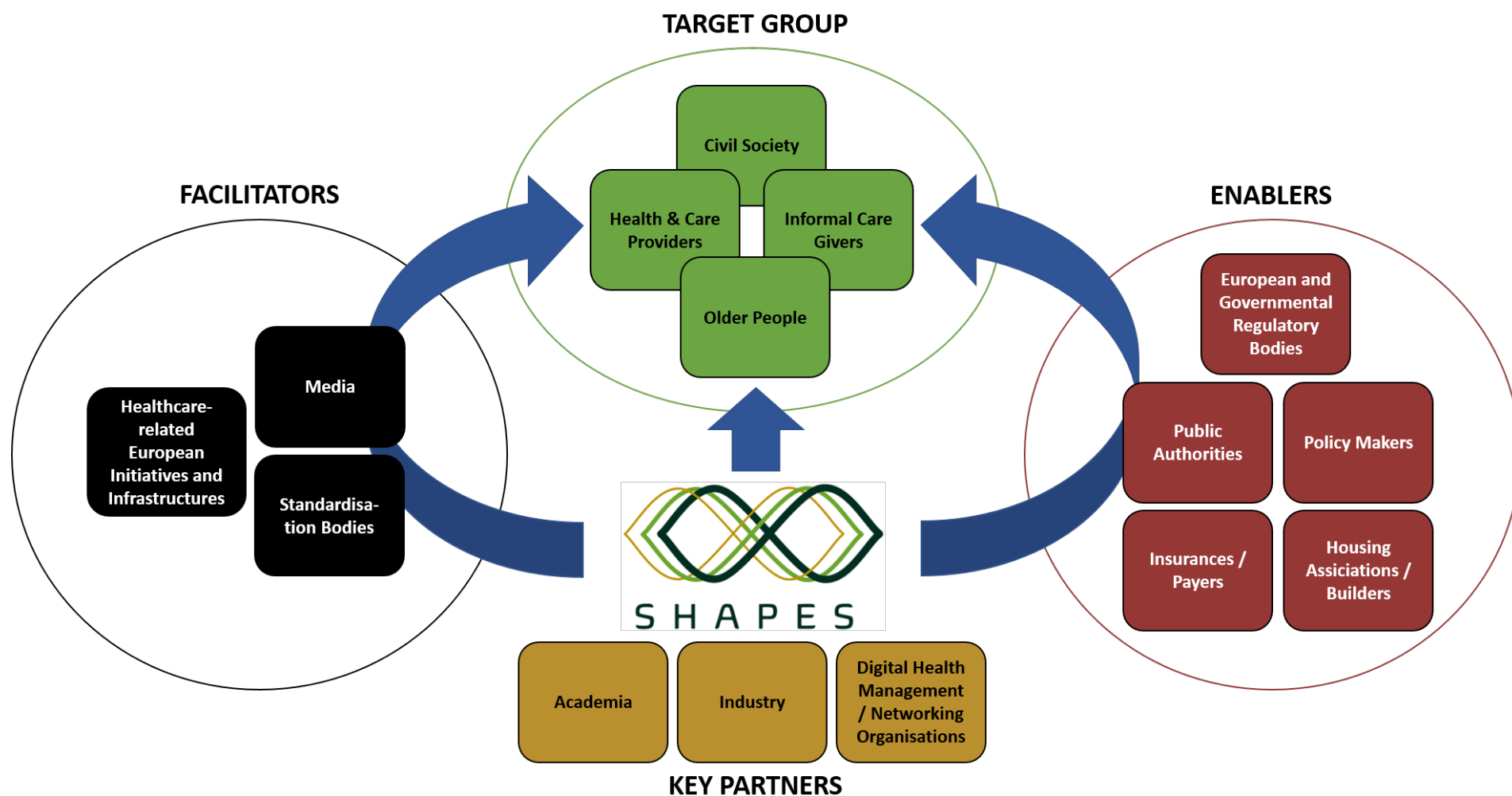
Figure 1: Overview of the SHAPES Ecosystem stakeholders.

2.5 Stakeholder Pitches

In an iterative approach with T9.1 partners, CCS designed chosen stakeholder-oriented elevator pitches that briefly describe the core of SHAPES by considering each stakeholder's role in the SHAPES ecosystem. To convey the information provided in the elevator pitches, UAVR and CCS created visuals of a question-and-answer smartphone chat for the SHAPES dissemination activities, such as hosting the visuals on the SHAPES website. All visuals related to these stakeholder-oriented elevator pitches are available in Annex 1 of this deliverable.

2.6 Stakeholder Engagement Plan

Annex 1 provides an in-depth stakeholder analysis for the building of the SHAPES ecosystem.

During the second half of the SHAPES project, we will further deepen this analysis and design a plan for how to engage with all the stakeholders to inform, discuss, and shape the project with them towards sustainable outcomes. To facilitate planning, we will use a systematic guide to engagement, with an early draft shown in (Table 4).

Table 4: Stakeholder Engagement Guide

Activities	Communication Channels	Timeline & Schedule	Key Performance Indicators
Research	Network of SHAPES consortium / chosen partners	Develop the calendar of activities by stakeholder, date and location	Increased awareness of digital integrated care
Focus Groups	Social Media (e.g., Twitter, LinkedIn, Instagram)	Identify complementary events and programmes for cross-promotion	Increased public eHealth dialogue
Consultation	Website(s)		Event Attendance
Design Charette[2]	Podcasts		Diversity of Attendees
Open House	Blog(s)		Number of Likes, Shares, Comments on social media

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[2] A **design charrette** is a short, collaborative meeting during which members of a team quickly collaborate and sketch designs to explore and share a broad diversity of design ideas.

Workshop	YouTube (Recordings, Vlogs, etc.)	Media Engagement
Demonstrations	Print/Broadcast Media	Survey Responses
Summit/Congress	Newsletters	Evaluation Responses
Competitions	Outreach Materials (Flyers)	Diversity of Inputs
Poster Calls	Personal Emails/Calls	
Open Calls	Surveys	
Peer Networking	Signage	
Surveying	Presentations	
Presentations	Fairs/Festivals	
Webinars	Hangtags	
Cross Promotion with other projects	Meeting Minutes	
Fair/Festival Presence	Networks/Mailing Lists	
Tool/Resource Development	SHAPES homepage (including videos, stories, and personas)	
Publications		
Suggestions		
Knowledge Exchange		

2.7 Networking and Liaising Activities

This sub-section of the report outlines the networking and liaison activities performed by SHAPES in its first two years of activity and identifies ways in which it seeks to improve its contacts in the two coming years. All these activities are helping to build and enlarge the SHAPES ecosystem.

During its first year of existence, the SHAPES consortium liaised fruitfully with the AAL Joint Programme, thanks to which SHAPES was included in an online workshop in the European Week of Active and Healthy Ageing. (The original plan foresaw a face-to-face workshop in Trieste in 2020, then moved to a virtual one in October 2021.) The workshop has been organised by SHAPES and PHARAON and will provide highlights

from the GATEKEEPER and SMARTBEAR projects as well. The workshop's title is "Large-Scale Pilots (LSPs) driving innovation ecosystems for ageing well", and is due to take place on October 20th, 2021 (https://shapes2020.eu/2021/10/07/the-european-week-of-active-and-healthy-ageing-workshop-20th-october-2021/).

Equally fruitful was the cooperation with the IDIH Horizon2020 project (https://idih-global.eu/), fostering international cooperation among research projects for ageing well with digital solutions. SHAPES representatives spoke at the public IDIH Forum 2021 and presented at various Expert Panels organised by IDIH in 2020 as closed workshops. The opportunity to have SHAPES presented at a regional event for Asia, to be held in China, is currently under discussion.

During the second year, efforts were made to maintain the contacts established in year 1, and new networks have also been explored. SHAPES was successfully presented at the WHO DATA webinar (a private online webinar addressed to WHO DATA officers), thanks to its work in the Health and Care Cluster – WG1 on dissemination, that SHAPES led in 2020. Thanks to this connection, the SHAPES 4th dialogue workshop was disseminated internationally among the WHO DATA and GATE communities.

Exchanges were nurtured with the Platform-Update project (https://project.platformuptake.eu/), financed by Horizon2020, to display SHAPES within its network of peer projects and share information on the digital solutions implemented at pilot site level.

Besides European research projects, SHAPES networking efforts were directed to public and private entities suitable for disseminating the project's Open Call. Among those, the following were approached: Business Europe (https://www.businesseurope.eu/), the EIP on AHA and its reference sites (https://ec.europa.eu/eip/ageing/home_en.html), the Digital Health Europe and WE4AHA consortia (https://www.age-platform.eu/project/we4aha), SME Europe (https://www.smeeurope.eu), DIGITAL SME (https://www.digitalsme.eu), SME United (https://www.smeunited.eu/), ESPON (https://www.espon.eu/), Small and Medium-Sized Enterprises in European Regions and Cities, and the BDVA coordinators (https://www.bdva.eu/).

Last, SHAPES approached policy-makers, and was therefore visible at the Third eHealth Stakeholder Group held by the European Commission, while working to submit its contributions to the Green Paper on Ageing and the European Health Data Space. These latter two initiatives were, however, not duly followed up, resulting in poor contributions from partners, and therefore, adequate mutual submissions were not achieved. SHAPES will, however, monitor the progress made during the European Digital Decade to inform it about its lessons learned and good practices.

2.8 SHAPES Ecosystem building through participation in major events

SHAPES aims to disseminate the results of the project to all relevant stakeholders in order to create awareness, obtain feedback, and gather insights that complement and sharpen the outputs of the project. The following section highlights the events, activities, and publications within the SHAPES consortium which are aimed both at contributing to the ecosystem building as well as dissemination of the project results.

2.8.1 ISO Leaders Forum

The focus of the Agile Ageing Alliance (AAA) on cultivating age-friendly multigenerational environments provides the bedrock for sustainable developments in this area. The International Organization for Standardization (ISO) sets the standards for effective, safe and appropriate use of technologies and products. AAA and ISO have joined forces in a united effort to flesh out a new ISO Ageing Societies standard. The standard aims to accelerate the construction of a new breed of age-friendly housing in smart socially supportive multigenerational neighbourhoods, by employing innovative technologies, business and service models, to improve health and wellbeing and reduce the financial burden on citizens and states.

AAA and ISO aim to evolve the proposition for the new standard through consultation of industry, government, labour, academic and research bodies; non-governmental organisations; and older adults in particular. To do so, the AAA ISO Ageing Societies Leaders Forum was created. It invites various stakeholders to present and discuss their work in the domain of multigenerational neighbourhoods.

In particular, AAA anticipates for the new ISO Healthy Ageing standard to be actively informed on the development of the SHAPES project. Thus, SHAPES representatives from three consortium members participated in the 2021 AAA ISO Ageing Societies Leaders Forum. NUIM provided an overview on SHAPES, FhG presented the SHAPES pilots and associated solutions, and AIAS presented the results of the assessment of technology adaption process in integrated care (see D3.2 Scaling-up Improved Integrated Care Delivery).

At further future events in 2022, AAA will provide a platform for SHAPES to delve deeper into the domains of governance and business modelling in order to gain external insights that will facilitate the sustainability of SHAPES.

2.8.2 X Iberian Seminar on Psychogerontology and III Iberian Seminar on Social and Community Gerontology

UAVR was invited to present the SHAPES project, at the X Iberian Seminar on Psychogerontology and III Iberian Seminar on Social and Community Gerontology, which took place on November 12th and 13th, 2020. During this 45-minute

communication, the SHAPES project was presented to health and social care stakeholders as an example of a gerontotechnology project that has real implications for older persons' lives. This presentation focussed especially on one of the SHAPES pilots utilising the DanceMove dance game for older people. The stakeholders' feedback was positive, and several care professionals showed an interest in applying this technology at their institutions. As a consequence of this presentation, UAVR was contacted by a further stakeholder from a municipal council interested in testing this technology.

2.8.3 KES International Conference Invited Session ¨Innovative Supportive Systems for the Smart, Healthy and Active Ageing at Home and in Local Community Environments (SSHLC)¨

Vicomtech and the University of Castilla-La Mancha co-chaired the KES International Conference Invited Session "Innovative Supportive Systems for the Smart, Healthy and Active Ageing at Home and in Local Community Environments (SSHLC)" on September 8th, 2021, in Szczecin, Poland. As a result, the session organisers received several important papers on a wide variety of topics. Some of the publications were directly related to the research performed in the SHAPES project and addressed topics such as:

- ¨Behavioural anomaly detection system for the wellbeing assessment and lifestyle support of older people at home¨ (VICOM)
- ¨Cybersecurity in Active and Healthy Ageing Era¨ (UCLM)
- ¨A low-cost and unobtrusive system for fall detection¨ (UCLM)
- ¨An open and private-by-design Active and Healthy Ageing smart home platform¨ (UCLM)
- ¨Optimal deployment of face recognition solutions in a heterogenous IoT platform for secure older people's care applications¨ (VICOM)

2.8.4 The ICCHP-AAATE conference 2022

This conference, which will take place in July 2022 in Lecco (IT) (https://icchp-aaate.org/), will provide an opportunity to connect with the community of Assistive Technology and Ambient Assisted Living researchers and practitioners. The SHAPES consortium will organise a special session inviting other consortiums and organisations working at European and international level in advancing the use of technology in integrated care. The aim of the session will be to discuss progress beyond the state of the art in person-centred design of solutions for independent living of older citizens. We will look at co-design challenges, accessibility issues, human-device interaction, factors for adoption and abandonment of digital health devices and services. A call for contributions will be launched in the beginning of November 2021. In case there is a good response we will organise a public panel discussion during the conference.

2.8.5 DIPEx International Meeting

The lifeworlds of older adults and caregivers, mainly represented in the work of SHAPES' Work Package 2, were presented during an annual DIPEx International Meeting. DIPEx International is a unique global collaboration of academics, doctors, experts from different fields, and patients focussed on bringing a better understanding of people's experiences of health, healthcare, and illness to share these new insights with the wide public and range of stakeholders.

The nature of qualitative analysis of patients from different countries and various backgrounds was discussed during a short presentation focussed on SHAPES and its insights gathered throughout the first 12 months of the project. The meeting was held on-line in October 2020.

2.8.6 The EURECO Forum 2021

During the forum a staff member of AIAS Bologna Onlus delivered a keynote in which a biopsycho-social-tech model of human functioning was introduced, determined by different factors and areas of needs or empowerment. Ecosystems of support services and integrated care seek to optimise this human functioning in order to empower individuals and settings, foster independence, wellbeing, quality of life, or integration, and prevent non-calculated risks and undesirable events. In doing so, these ecosystems encounter various challenges, which include ensuring:

• Integrated care: maximising wellbeing and self-determination

• Quality of care: and thereby quality of life

• Sustainability: both financially and socially

• Security: including data protection

• Resilience: being adaptable and coping with change

There exist key factors which can help ecosystems of support services and integrated care overcome these challenges, such as being person-centred (with the user driving the process through unique relationships), efficiently coordinating among various actors, maintaining individual responsibility (but for the entire system), and prioritising open and efficient communication. While the ongoing digital transformation experienced by these sectors is pervasive and irreversible, it also presents key opportunities for services. These are opportunities to further support empowerment at the individual level, while effectiveness and efficiency at the organisation level and improved data gathering at the system level in order to tailored-made and innovative services to an active user. In the perspective of exploiting these opportunities, service providers should be mindful of the following points:

• Developing a shared vision and favorable climate

• Managing ethical aspects (such as dehumanisation, privacy, internet safety, etc.)

• Finding the right balance between empowering the existing and introducing the innovation

• Constantly monitoring the impact of innovation

In all these aspects, it will be essential to support the acquisition of new skills and competences by both staff and users.

Work of SHAPES D3.2 was presented and discussed with the audience.

2.8.7 Publications

Aside from participating in major events in order to build the SHAPES ecosystem, several publications by SHAPES consortium members focus on methodological and practical questions regarding ecosystem building in general as well as with particular focus on the SHAPES project. Details can be found in the references section of this deliverable.

2.8.8 SHAPES Stories

Fourteen SHAPES Stories have been published on the SHAPES webpage at the beginning of 2021 to bring awareness to the key experiences of older adults from different countries in Europe. The stories are written as short case studies. Their aim is to probe into the real-life experiences of older adults, to show the real nature of life. Each story represents one of the key themes of SHAPES (such as health, accessibility, and technology). These stories are available for the wide public, possible to use for teaching purposes, raise awareness and bring valuable input also for the SHAPES Ecosystem.

2.9 Involvement of relevant stakeholders

SHAPES aims to involve relevant stakeholders in discussions to facilitate and contribute to the SHAPES co-design and co-development of analysis, approaches, use cases and solutions. The following section highlights the activities of eight SHAPES partners to facilitate discussions with and involve relevant stakeholders.

HMU, as task leaders in WP4, and active participants in almost all SHAPES WPs has participated and collaborated in all discussions concerning use-case definition, system design, and overall architecture. The outcome of those discussions has led to the design, development, and implementation of SHAPES' stable architecture and component placement. Moreover, as providers of SHAPES' Single Sign On (SSO) mechanism, the ASAPA component, HMU's contribution has been crucial in ensuring the robust design of the project's use cases' definition. Furthermore, by facilitating coalitions with other EU-funded projects related to the Smart and Healthy Living, HMU has co-authored an open-access article titled "*Reference Architectures, Platforms, and Pilots for European Smart and Healthy Living—Analysis and Comparison*". In it, based on an extensive survey, HMU proposes a standard Reference Architecture Model (RAM) for future projects tackling the Ambient Assisted Living (AAL) domain.

WFDB, as a representative organisation of persons with deafblindness, and therefore, persons with disabilities, helps ensure that the platform, solutions, and information is accessible to all stakeholders. In SHAPES' co-design and co-development, it should be a priority that all developed solutions and services should be user-friendly, accessible, and effective. WFDB has engaged in many discussions, in the format of reports (including project deliverables), articles, workshops and events concerning all work packages to highlight the importance of:

- Representing the perspective of older persons with disabilities, comprised, amongst others, of underrepresented groups such as persons with deafblindness
- Actively ensuring the meaningful contribution, participation and feedback on all relevant processes within the project of persons with disabilities
- Respecting the principle of universal design and accessibility
- Consulting and involving persons with disabilities, their representative organisations and essential service providers, in line with the principle of "nothing about us without us"
- Making use of inclusive language and avoiding stereotyping and prejudices sometimes associated with older persons with disabilities.

The main outcome of WFDB's contribution has been an increased awareness on disability, inclusion and accessibility inside the SHAPES project.

SciFY is a technological partner with a wide network of shareholders related to older people and people with disabilities. As such, it will ensure that the technical specifications will match actual and implicit user requirements, and that the outputs will be open and sustainable over time through open-source practices. Moreover, being an active communicator of digital solutions that have a societal impact, will help ensure that the project and its results will be communicated effectively at the right time and place. By cooperating with the informed community, SciFY will systematically and consistently inform any potential users of relevant news. This will be done via articles

and posts on social media, and presenting the SHAPES projects and its solutions to the "SciFY Academy", which is a series of initiatives. Thus, it enthusiastically undertakes to spread knowledge and cooperation, which include presentations, conferences, hands-on sessions, and workshops. SciFY consulted with NCSR "Demokritos", the biggest research facility in Greece, to better shape the specifications and KPIs of various of its digital solutions that contribute to the SHAPES project. This process allowed for external feedback that provided a fresh look on what should be done, and how it should be done. This feedback is reflected in the specification and analysis documents in various use cases of the SHAPES large scale pilots.

The University of Aveiro (UAVR) has been successful in building a solid relationship with its region's stakeholders, enhancing knowledge transfer, and contributing to regional development. The strong interaction with the business community, regional and local government authorities, and the third sector, and on helping to address the needs of society, creates an interesting and important platform to formally and informally discuss and involve potential local and regional stakeholders and disseminate SHAPES outputs throughout the academia arena.

Palacký University (UP), as a leader of WP2 and coordinator of the first SHAPES Dialogue Workshop, has been in touch with various stakeholders, mainly older adults, academics, and students. The key goal has been to disseminate SHAPES though direct contact with older adults via presenting how SHAPES solutions can meet their needs. Moreover, UP's connection to SHAPES has been "two-way" (so the unknown needs of older adults were also brought back to the SHAPES Ecosystem as well as UP fulfilling an external communication/dissemination role). The aim has been to bring valuable insights from the target group. This has been an ongoing process. Lastly, UP has collaborated with other consortium partners on producing academic papers and publishing SHAPES Personas.

EUD, as a representative organisation of deaf people, contributes to ensuring accessibility, for example through sign language. EUD has contributed to SHAPES on accessibility in the form of making recommendations, often in collaboration with WFDB in various work packages.

Future Intelligence Ltd (FINT) is one of the core technical partners of the SHAPES project. It has led several tasks in the most technology intensive work packages, like WP4 and WP5, while participating in almost all the other work packages. Through these tasks, FINT has been engaged in many discussions by providing input in the form of reports, questionnaires, events, and presentations with the pilot leaders who disseminate this information directly to older people and pilot participants. The results of these discussions have benefited both end-users/pilot participants and technical partners. Through the joint discussions, end-users/pilot participants gained more insight into the core SHAPES technologies and underlying assumptions including the possibilities and interactions that are available. Additionally, technical partners had the ability to understand better the needs of older people and how they want to interact

with the community, what their limitations are, and what are good practices. The analysis of good practices has helped to establish a strong connection between the user requirements and the actual technical specifications (which now have translated into the core SHAPES architecture that will be enable the various SHAPES use cases).

AIAS Bologna, which has led on Task 3.2. and participated in Task 9.1, is well connected at European and global level. The organisation will announce the SHAPES outcomes to the ICCHP-AAATE conference that will be held in 2022 and actively seek a dialogue with other organisations working in this field. At regional level, AIAS Bologna is part of the eHealth cluster of the region of Emilia Romagna, a sector cluster of academia and companies in the field of technology and health and wellbeing. The cluster's aim is to support the digital transition of services in the region and beyond. AIAS will connect SHAPES and its pilots to the cluster strategic objectives.

3 Co-Creation Think Tank Meetings on European Integrated Care

T9.1 constitutes the Co-Creation Think Tank for European Integrated Care, by definition tasked with elaborating deeply on any questions regarding integrated care and its meaning and importance for SHAPES. The think tank comprises 20 SHAPES members (NUIM, AIAS, CH, EDGE, EUD, FNOL, FINT, GNO, LAUREA, UP, SAL, AAA, SciFy, HMU, TREE, UCLM, UAVR, UCC, VICOM, WFDB). The goal and primary work of the think tank is to assess core questions that regard both European integrated care and platforms that aim for care integration such as SHAPES. Overall, the results from think tank activities will support the production of the SHAPES Recommendations, helping to design and develop new access policies to improved health and care services for older individuals across Europe.

Until M24, the think tank relied on the internal members of SHAPES and invited externals. In the second half of SHAPES, T9.1 will aim for external members that regularly participate in the think tank meetings.

As defined in the DoA, T9.1 holds a think tank workshop every 6 months. These meetings serve as dissemination activities to communicate to audiences about the vision, activities, and preliminary results of SHAPES, as well as to generate interactions and discussions with both internal and external stakeholders of the project. To broaden outreach even further, CCS aims to embed the think tank meetings into other events to be held during the last quarter of 2021 and in 2022-23 (such as the SHAPES Dialogue Workshops, external workshops, and third-party conferences).

This section of the deliverable describes the design, execution and main findings of the think tank meetings that have been carried out within SHAPES so far.

3.1 1st SHAPES Dialogue Workshop

In M6, SHAPES held its first online dialogue workshop, which included the first co-creation think tank meeting. This think tank meeting was led by CCS and was one of four parallel sessions during this workshop. This think tank meeting focussed on the activities in SHAPES pilot 1 as described in the DoA and comprised interactive sessions with experts from the digital health and care ecosystem. The participants at the workshop were representatives from health care and government, academia, industry, and civil society. In a joint discussion, we looked for insights into the needs of older people so as to be able to identify solutions that enable people to lead a sustainable and independent life.
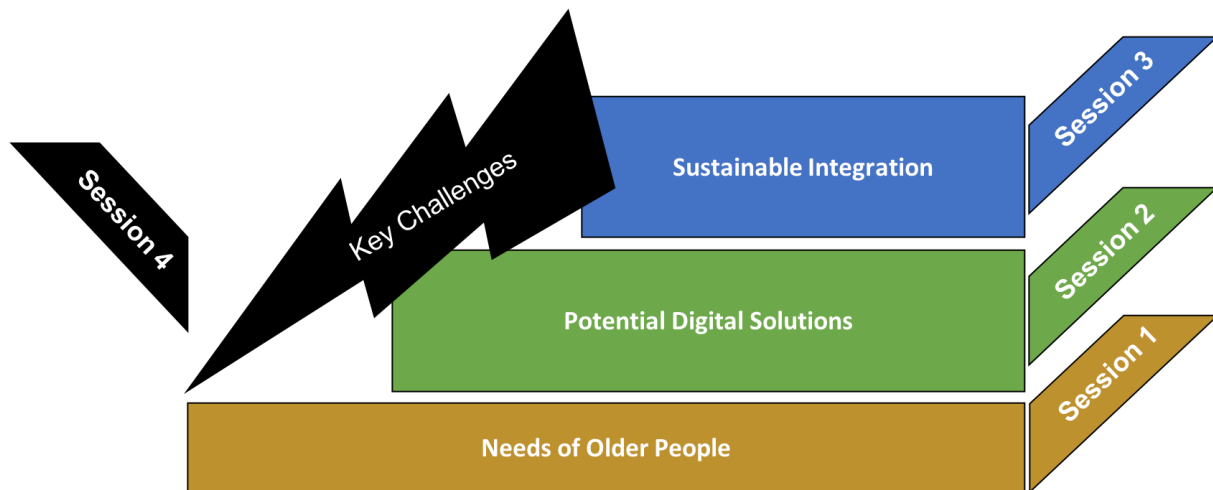
Figure 2: Workshop design depicting the 4 sequential sessions.

Session 1 aimed to define the needs of older people based on the view of present stakeholders. Session 2 used the identified needs to find matching digital solutions to meet those needs. Session 3 focussed on how to sustainably integrate such digital solutions. Session 4 deepened the discussion by identifying key challenges to the integration of digital solution that promote active and healthy ageing.

To achieve this goal, CCS held four separate virtual sessions that built on one another and focussed on the following topics: (1) needs of older people, (2) potential digital solutions to meet these needs, (3) how to sustainably implement the solutions mentioned, and (4) key challenges for a successful implementation. Each session lasted 45 minutes and included an introduction to the topics, brainstorming, discussion, and an evaluation of results. On average, there were 17 participants in each session.

3.1.1 Session 1 results

In session 1, the workshop participants identified 25 needs of older people. CCS asked each participant in session 4 to weight the identified needs according to their level of importance (by assigning a total of 3 weighting points to any of the needs on the list). The four most important needs of older people identified by the experts were loneliness / social integration, integrated care / solutions and education on solutions, access to services and user-centred / user-friendly solutions which scored 5 or higher. Unfortunately, older people did not participate in the meeting directly.

The experts specified that there was no importance for needs such as to find appropriate doctors, the need for mobility / public transportation, support for caring responsibilities, and the need for assistance (Table 5).

Table 5: Summary of identified needs of older people in workshop session 1 and weighting by session 4 participants.

Needs (25 total) of older people	Weighting points
Loneliness / social integration	11
Integrated care / solutions and education on solutions	8
Access to services	5
User-centred / user-friendly designed solutions	5
Independence	4
Include culture knowledge to answers of the needs question	4
Personalised care	3
Respect as member of society and as an individual	2
Pandemic-related issues – support system needed	2
Mental / psychological health	2
Solutions tailored to mental and physical health	2
Minimal technological burden	2
Solutions working without internet access	2
Sign language for the deaf	1
Struggle with and access to technology (e-literacy)	1
Access to medication / e-prescriptions	1
Access to desired communities	1
Being heard / involvement in decision-making	1
Support on choosing appropriate solutions	1

Six needs scored zero points each, which are Finding appropriate doctors; Mobility / public transportation; Caring responsibilities; Assistance; Life without constraints and barriers and finally Language barriers.

In session 2, CCS converged these needs to 12 categories of needs and asked the participants to identify solutions for these 12 chosen needs. The solutions mentioned comprised smartphone apps, digital assistants, and in-person training programs to enhance e-literacy and education on digital solutions (Table 6).

Table 6: Summary of potential digital solutions for 12 converged needs of older people.

Needs of older people	Potential solutions
Being heard / involvement in decision-making	Smartphone apps that allow older people to take part in decision-making via polls or interviews
Finding appropriate health and care professionals	Solutions from the private sector with connection to hospitals
Solutions tailored to mental and physical health	Software for individualised learning that older people can interact with via a digital speech assistant (comparable to Amazon Alexa)
Pandemic-related issues	Credible information in real time, tele consultation, smart home safeguarding, physical exercise apps, chatrooms, video chat for community groups, online banking, technology coordinating volunteers
Purpose for the individual	Multiplayer gamification e.g., quizzes on individualised topics with chat / video, interactive, increasing complexity
Language barriers	Cartoons to convey information in an easy-to-understand format
Info push and visibility	Haptic feedback on wearables, e.g., fall prevention; text-to-audio translation
Minimal technological burden	Simple-to-use apps, intuitive UX, co-design
Up-to-date solutions without internet access	SMS / MMS service
e-literacy	Platform for information exchange, e- and physical training
Access to the community older people want	Online marketplace, online community care
Caring responsibilities	Apps to manage care both for older people and their carers

In sessions 3 and 4, CCS asked the participants to identify barriers and challenges for the integration of digital solutions for older people. The barriers and challenges mentioned fell into two categories, those arising for users and healthcare professionals and those arising for data management and solutions (Table 7 and Table 8).

Table 7: Barriers and challenges for users and healthcare professionals.

Barriers and challenges for users and healthcare professionals
Lack of co- and re-design together with users / joint use and integration to create meaningful solutions
Lack of e-literacy, digital skills, education and co-design of users and caregivers
Lack of information on older people's lives e.g., complexity, behaviour
Resistance of end-users to use innovations / intuitive, ideally invisible solutions required
Accessibility and affordability of digital solutions
Health and social care systems are inert, resistant to innovation and change
Procurement framework / long tender timelines
Lack of consideration of problems that come with digital solutions

Further elaboration in the upcoming month will need to answer several questions arising out of these results. For instance, some of the barriers are more at systems level (systems; procurement); others are more at an individual level. Some barriers relate to data; others to the lack of availability of appropriate training and education; others to e.g., societal challenges relating to economics.

Table 8: Barriers and challenges for data management and solutions

Barriers and challenges for data and solutions
Transparency for data protection / commercial and academic use of personalised data
Credibility of commercial players as data users
Lack of interoperability and standards (not only technical but also considering work environment and workflow)
Legacy technology

3.1.2 Validation of Workshop Results with Older People

In the first think tank meeting, experts from the health, government, academia, industry, and civil society sectors identified the needs of older people and their importance. Because older people did not participate directly, CCS aimed to validate the results of the think tank meeting by having older people participate in pilot theme 1 (pilot site in Saxony, Germany) to define the importance weighting on the information gathered on the needs of older people. To do so, the older people were asked to rate the importance of the needs based on a Likert scale from 1 (not important at all) to 5

(very important)[3]. The results show that the older people did not agree with the importance weightings provided by the experts in the workshop (Table 9). The second column shows the average Likert score of importance for each need in descending order.

Table 9: Validation of needs of older people identified by experts from the first think tank.

Needs of older people	Average importance for older people	Weighting points given by experts
Mental / psychological health	4.9	2
Respect as a member of society and as individuals	4.7	2
Being heard / involvement in decision-making	4.7	1
Life without constraints and barriers	4.6	0
Solutions working without internet access	4.5	2
Integrated care / solutions and education on solutions	4.3	8
Pandemic-related issues – support system needed	4.3	2
Minimal technological burden	4.3	2
Support on choosing appropriate solutions	4.3	1
Personalised care	4.2	3
Solutions tailored to mental and physical health	4.2	2
Sign language for the deaf	3.9	1
User-centred / user-friendly designed solutions	3.7	5
Language barriers	3.4	0
Struggle with and access to technology (e-literacy)	3.3	1
Access to services	3.1	5
Access to desired communities	3.1	1
Finding appropriate doctors	2.7	0
Caring responsibilities	2.3	0
Mobility / public transportation	2.1	0
Access to medication / e-prescriptions	1.7	1

[3] The older people were asked to weigh by a Likert scale in order to reduce complexity.

Loneliness / social integration	1.6	11
Independence	1.3	4

Eleven needs featured above Likert scale 4 for the older adults. Five featured as 4.5 and above, and one of these was "solutions working without internet access". In contrast to the insights provided by the experts, the top four needs that are the most important for older people are needs for which the experts assigned 0–2 weighting points. These needs are mental / psychological health, respect as a member of society and as individuals, being heard / involvement in decision-making, and life without constraints and barriers. Loneliness / social integration, which was weighted by the experts as the most important need of older people, received an importance score of 1.6 (not very important) by the older people. These results show the differing views of the expert stakeholders and the older people themselves on the needs of older people. This underlines the importance of the co-creation approach in SHAPES that aims to involve older people from the very beginning in the design and development of assisting digital solutions and services.

In addition to validating the importance of the needs of older people, CCS asked the pilot participants to mention additional needs that were lacking in the list from the think tank workshop (Table 10). The categories were assigned by CCS.

Table 10: Additional needs of older people.

Additional needs of older people mentioned by pilot 1 participants	Category
Finding appointments with specialist doctors	Access to services
To receive all needed health services to be fully cared for, complaints are taken seriously, and not put off because of my age	Access to services
Free choice of medicines without interference from insurers and pharmacies	Access to services
Online search for appropriate service providers and trades people	Access to services
Video consultation with health care service providers	Access to services
Assistance in taking care of spouse at home that has reduced capabilities	Assistance
Automatic scanning and paying in the supermarket	Assistance
Online payment for public transport, cabs, etc., **from ordering to payment via cell phone**	Assistance
Use of skills and experience of older people by the society	Decision making, Purpose
Information on helpful hardware and software (apps) for older people	E-Literacy

Support and help for using hardware and software	E-Literacy
To stay fit through the active use of digital media	E-Literacy
To keep health, healthy and physical capacity for as long as possible	Maintaining health
To cope with the usual daily demands (e.g., driving a car)	Maintaining health
To stop the progress of my disease (e.g., Parkinson)	Maintaining health
To remain active, to stay healthy, and to be able to do sports	Maintaining health
To eat a balanced diet	Maintaining health
Monitoring and reduction of body weight	Maintaining health
Monitoring of my vital functions such as cardio-circulation and oxygen content of the blood (sleep apnoea)	Maintaining health
Preservation and training of my cognitive abilities	Maintaining health
User-friendly recording of health data and transmission, e.g., to the family doctor, without time-consuming doctors' visits	Maintaining health
To maintain mobility	Independence
Easy tools to find, book and pay for travel connections, tickets and possibly hotels	Independence
To stay in my living environment for as long as possible, to live independently	Independence
To be able to enjoy cultural events and trips	Independence
To always be able to live independently in my apartment	Independence
More use of understandable language in everyday life	Language
To pursue a meaningful secondary occupation for as long as possible, creates social recognition and contributes to financial independence	Purpose, independence, social integration

The needs mentioned fell into the categories of access to services (n = 5), assistance (n = 3), decision-making (n = 1), purpose (n = 2), maintaining health (n = 9), independence (n = 6), language (n = 1) and social integration (n = 1).

The survey results show that both the experts, and the older people themselves, mentioned similar needs of older people. However, the older people also mentioned additional needs to be considered by providers of assistive digital technologies and societal solutions, such as SHAPES.

The gathered results synergise with the work carried out in WP2 "Understanding the Lifeworld of Older Individuals and Improving Smart and Healthy Living". They form a

basis for the continued work towards effective and efficient SHAPES services and solutions, and the SHAPES recommendations for active and healthy ageing.

3.1.3 Summary

As a conclusion of the first think tank meeting and the validation of its results with older people from pilot theme 1, there were four major learnings:

- The needs of older people were easier to identify than assistive solutions.

- The barriers to the integration of assistive solutions were easier to identify than solutions.

- Experts identified different important needs for older people than the ones that older people identified for themselves.

- There is an opportunity for SHAPES to use these insights to provide helpful solutions.

3.2 2nd SHAPES Dialogue Workshop

On October 29th, 2020, CCS hosted the 2nd SHAPES Dialogue Workshop. The workshop focussed on integrated care, the needs of the recipient of care, the coordination between diagnosis and treatment, and the links between primary and secondary care. The workshop was intended to

(d) gather representatives from the industry, academia, health and care sectors and civil societies as well as older people; and
(ii) unveil the project's preliminary findings.

The morning part was pre-recorded and aired on the SHAPES YouTube® channel. The video included moderator sequences, four talks and a virtual, staged interview. The afternoon part comprised four different online workshops that were run in parallel with circulating groups of participants. There were 60 attendees participating in the interactive workshop sessions, of which 36 attendees were from inside and 24 attendees from outside the SHAPES consortium.

The detailed methods, activities and results of the afternoon parallel workshops were summarised in a document entitled "2nd Dialogue Workshop on Integrated Care – Interactive Sessions Summary" (https://shapes2020.eu/workshops/workshop-2/).

The following section highlights the major outcomes of the first of these four parallel workshops which considers the ecosystem development of SHAPES and focussed on four core topics.

3.2.1 Good Practice Examples of Integrated Care, Lessons Learned and Future Concepts

The goal was to find good practice examples of integrated care, identify success factors, and discuss potential future concepts. To achieve this goal, this first of the four parallel afternoon workshops was divided into four interactive sessions and moderated by CCS. The individual sessions built on the results of the previous ones. The first session topic focussed on good practice examples of integrated care, lessons learned, and future concepts.

Sessions 1 and 2 were identical. These sessions were opened with a presentation of "Gesundes Kinzigtal" as a good practice example of integrated care in Germany. After that, the workshop participants were invited to answer two questions:

1. Do you have additional examples of good practices, and why?
2. What do you think are the success factors / key factors for integrated care?

In session 3, the participants were asked to evaluate and complement the results previously identified in sessions 1 and 2. In order to weight the success factors found, each participant assigned a total of 3 points to the listed success factors. For this, the stamp function in Zoom was used.

Session 4 focussed on the summary of the sessions 1 to 3, followed by a question and discussion about potential future concepts of integrated care.

Results

The workshop participants identified several examples of good practices in integrated care, such as:

- Continual care network (Portugal),
- Medical centre with a focus on deaf people (Finland),
- Integrated care prototype (Northern Ireland),
- Short patient medical file to be shared between GP and hospitals (Greece),
- TOMY – paediatric / social workers / nurses / health (Greece), and
- Janecare (Czech Republic).

From these examples, the participants identified and weighted the importance of success factors for good practices in integrated care. The importance was weighted by each participant through assigning a total of 3 weighting points to any of the success factors on the list (Table 11).

Table 11: Success factors for good practices in integrated care.

Success Factor for integrated care	Weighting points

Patient Empowerment	3
Standardisation	3
Supportability / Accessibility	2
Pricing and Costs	2
ICT centredness	0
Access to Health Data	0
Stratification	0
Legislation Base	0
Quality Measuring	0
Financial Resources	0
Governance	0
Capacity Building	0
Soft Skills / Communication	0
Data Security / Data Protection	0
Service Availability	0
Personal Resources	0

According to the workshop participants, the most important success factors for integrated care are patient empowerment, standardisation, supportability, and pricing / costs. Being particularly highlighted, these are important factors to consider for the integrated care approach of SHAPES and its task T3.2 Scaling-up Improved Integrated Care Service Delivery.

Furthermore, the participants in session 4 mentioned potential future concepts of integrated care (Table 12).

Table 12: Future concepts for integrated care.

Future concept for integrated care	Mentioned by experts from:
Integrated budget, focusing on needs	Health & Government
Global standardisation in medical care / treatment and technology with a **personalised focus**	Health & Government
Partnership instead of procurements	Health & Government

Role of data issue	Academia
Integrated care	Academia
Value-**based care**	Academia
Case manager based on **AI**	Academia
AI as a new player	Academia
Integration of the **private sector**	Academia
Global standardisation in protocols in medical care	Industry
Connection to community and society	Civil Society

The experts highlighted a required focus on the right needs of older people to efficiently allocate budgets for integrated care. Essentially, experts stated that the focus might shift to partnerships instead of procurements. Additionally, issues on data collection, storage and exchange were deemed central, considering the shift taking place towards value-based integrated care.

Following the concept of integrated care, it will also become increasingly important to offer value-oriented care, which poses its own challenges of documentation and evaluation. AI will generally play an increasingly important role in health care systems to achieve this goal while accompanied by changes in personnel and processes.

In addition to AI, the participants mentioned that the private sector must be involved in the design, development, and improvement of integrated care (which has so far only been done marginally). A means to do so is to foster global standardisation of protocols and data exchange in medical environments to increase efficiency and to reduce possible sources of errors.

Next to these more fundamental changes, it is of high importance to train and develop soft skills required to develop and implement future concepts of integrated care. The connection of patient and community / society is a major aspect that requires special attention in the future.

3.2.2 User Perspectives on Integrated Care

Overview

The second of the afternoon workshops focussed on user perspectives on integrated care and was moderated by AGE and NUIM. This workshop aimed primarily to facilitate a discussion about, and obtain perspectives on, the governance of health care and social care from the standpoint of the individual as a care recipient in these systems. Secondarily, we sought to obtain similar perspectives from the standpoint of

informal care providers. Hence, four sessions were held in total. The outcomes formed part of SHAPES T3.4 Governance Model and Guidelines, within WP3.

AGE / NUIM facilitated a total of nine individual group discussion sessions across the four interactive sessions. The discussions explored seven broad themes:

- Actors and Inclusion in the Care Process and Decision Making
- Dis/Connection and Non/Communication Between Health and Social Care Systems and Components
- Funding Mechanisms and Equity of Access
- Non-Integration Engendering Worse Outcomes and Institutionalisation
- Informal Caregivers as Care Coordinators, Mediators, and Persons with Needs Divergent from Recipients
- Agents of Change: The Pandemic and Technology
- Risks and Ethical and Legal Implications

Results and Implications

The results of this workshop are detailed in the summary of the 2nd SHAPES Dialogue workshop. They fed directly into the work of T3.4 Governance Model and Guidelines as a means to understand the opportunities for the SHAPES platform to support person-centred, integrated care. T3.4 leads into the development of the SHAPES governance model and guidelines (deliverables 3.5 and 3.6). In turn, the development of the SHAPES governance model and guidelines is a central building block for the work of T9.1 in the second phase of the SHAPES project.

3.2.3 Scaling up solutions for integrated care

Overview

The third workshop topic focussed on scaling up solutions for integrated care and was moderated by AIAS. The questions that the workshop addressed were the following:

- What are the key factors to consider when adopting a digital solution in a specific care context?
- Can these key concerns be adapted to specific phases of the technology adoption process? (The following phases were distinguished: Needs identification – Definitions of functions – Choice of technology – Procurement – Implementation – Evaluation and outcome measurement.)
- How can these factors be "translated" into requirements for developers and providers that seek to respond to market demand?

Results and Implications

The results of this workshop are detailed in the summary of the 2nd SHAPES Dialogue workshop[4]. The following table highlights the most important factors and requirements identified in the workshop and contextualised in the Four-Wheel model presented in D3.2 (Table 13):

Table 13: Key factors and requirements to consider when adopting a digital solution in a specific care context.

Phases	Key factors to consider	Requirements
Needs Identification	The importance of a good understanding of the care contexts, the multidisciplinary values expressed in that care context, the needs expressed by the different stakeholders (identify them and ask!), and how these are interrelated so as to reach overall higher outcomes. Assessment of the technology adoption readiness of the context.	Adaptability to a variety of needs of different stakeholders Reflection of a holistic approach to care.
Definition of functions	Clear need of the objectives and goals. Correct definition of requested functions and functionalities of the solution, taking into account the complexity of the needs and their evolution over time. Definition in functions based on nature of the organisation (e.g., public statutory or private/for profit or not-for-profit). Need of data and data analytics and the response time of the system to data needs. Clear awareness of how the way of working will change; definition of responsibilities.	Scalability and modularity of functions allowing for incremental development and deployment. Interconnection of functions. Different levels of data output and analysis as well as response time are foreseen.
Choice of technologies	The importance of choosing technologies that are interoperable among themselves, scalable, mature, robust, stable, and supported over time by (local) providers. Connectivity issues are taken into account. Providers of the solution and its components are traceable.	Interoperability of technologies included in the solution. Solution can cope with different levels of connectivity (e.g., alternative solutions are available).
Procurement	The need to have tailored, suitable solutions.	Compliance with industrial and

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	Legislative compliancy, including privacy and data protection.	commercial standards and legislation.
	Compliance with local regulations and practices in terms of data storage and data exchange protocols.	Compliance with data protection legislation.
	Appropriate language version available.	Different language versions are available.
	Reliability of the company.	
	Costs of procurement and support/maintenance over time.	
	Trial period (or pilots) should be foreseen.	
	Clear responsibilities.	
Implementation	The solution should be understood and trusted by end-users, accessible (tech-wise, cost-wise), adaptable to different cases, fed by updates in new format/products and services as the context evolves (laws, needs of the users, etc.).	Universal design principles are respected.
	Learnability of the correct use of the functions provided by the solution.	Manuals and tutorials are available.
	The need for training of staff and end-users.	Training and support are provided on an as-needed basis and in the local language.
	The ease of use.	
Evaluation and outcome assessment	Assessment of the impact the technology can make on the outcomes of care.	
	The definition of appropriate assessment and evaluation protocols and tools: Standard outcome measurement parameters and tools/scales can be used, or specific ones need to be defined.	Solutions provide data allowing for monitoring, outcome measurement and evaluation.
	Monitoring should be possible, as well as intervention adjustment.	
	Awareness that results might only come in the medium- to long-term.	
	Evaluation should include not only usability but also impact on the lives of the people and the quality of care.	

This part of the workshop identified important factors to consider when adopting a digital solution in a specific care context as well as general requirements for

developers and providers to successfully integrate digital solutions. Six categories of phases and their key factors/requirements were identified. They included: needs identification; definition of functions; choice of technologies; procurement; implementation; and evaluation and outcome assessment. These results fed directly into the work of T3.2 "Scaling-up Improved Integrated Care Service Delivery" and D3.2.

3.2.4 Disrupting Disintegration: Constructing a new mindset for caring

Overview

The fourth workshop topic was on constructing a new mindset for caring, and the workshop itself was moderated by NUIM. This workshop topic was based on the idea that systems are designed to disintegrate, and that this disintegration has to be disrupted/interrupted. (A lack of integration in health and social care services for older people is not only a consequence of poorly thought-through inter-linkages and systems; sometimes a lack of integration is actually designed into systems. That is, some systems are designed to disintegrate. One of the ways in which this may happen is when groups of people working together are placed in hierarchical relationships that result in some form of domination or privilege, which may undermine effective integration. If it is possible to identify and disrupt such relationships, societies may be able to produce more integrated care.)

Among the four interactive workshop sessions, a range of different themes were identified as being related to dominance in service provision.

Results

As result of the workshop session, five overarching themes were identified and discussed in detail (Table 14).

Table 14: Themes and key factors to consider as leading to dominance in the service provision landscape.

Theme	Key factors to consider
	Three forms of financial dominance were identified: they were those exercised by payers/reimbursement mechanisms; ranges of provision of pharmaceuticals; and socio-geographic distribution. Payers might dominate in terms of their decision-making power about which treatments to reimburse, even though payers are socially funded and operate through government-mediated mechanisms. Pharmaceutical companies may seek to influence the sorts of medications local pharmacies (and other providers) provide, thus influencing access to a fuller range of medicines including less expensive generic forms of drugs.
Finances	

	Other forms of dominance may result in inequities in the distribution of finances from centralised services to more local or regional services.
Governance	In many countries, a centralised system determines the key protocols adopted in the service provision for older people. Thus, local or regional service providers may feel they have little latitude to influence intervention decisions. In federated systems, there may be a greater delegation of these responsibilities at the sub-state level. The role of politics in healthcare can also be a dominating interest. Local and constituency concerns can override concerns for effective services.
Clinical Professions	The status of different professions may be associated with differing degrees of privilege and dominance. This may affect the efficient working of multidisciplinary teams, where some professional perspectives are given more credence than others. The result is that interventions reflect dominant views rather than necessarily the best practices. For many professions a narrowing of expertise is seen as being related to status (higher status = more specialisation), thus encouraging compartmentalisation of work and making integration more complex.
Gender Relations	In many health and care systems, resources may be classified by gender differences. For instance, jobs or roles (often unpaid) that are characterised as "caring relationships" often have more women in them than men, while technical jobs often have more men in them than women. Part of the integration agenda may therefore require addressing gender disparities, including recognising that gendered role-differences are associated with gendered pay differences. However, if we consider gender simply as a binary – male or female – then we are also reinforcing a form of dominance which does not recognise, for example, intersexed, non-binary or gender fluid people, as being equally legitimate in the roles/tasks they undertake.
Representation / Dominance	One way in which dominance may influence healthcare integration is through some types of experience or knowledge being valued more than other types. This dominance could occur in relation to either service user or service provider experiences being disproportionately valued. In both situations, there may also be difficulties when people question the authenticity or authority of another person's experience. Networks (e.g., "knowing each other") also may perpetuate dominance in certain sectors. Patient/service user advocates may not always be able to contribute effectively to discussions; they may require support, time, and resources to make the contributions of which they are capable.

This session assessed different sources of dominance through finance, governance, professions, gender relations, and representation that can pose barriers for the successful integration of change and new solutions. Based on these themes related

to dominance, the discussions led to key factors to consider for promoting integrated health and social care for older people living in their communities.

This workshop was purely exploratory in terms of assessing the aspect of dominance in integrated care. Thus, to assist with SHAPES ecosystem building, it would be beneficial to deepen this exploration in WP3 in the second half of the project.

3.3 CCS Partner Dialogue

On March 3rd, 2021, CCS hosted its annual networking event, the CCS Partner Dialogue. This event gathers Germany-wide health and care partners to present and discuss progress in the area of digital health. This 12th Partner Dialogue focussed on "Active and healthy ageing in Saxony and Europe" and comprised 97 participants.

The presentation and discussion of SHAPES was a major component of the event's program, as the event was used as the project's 3rd co-creation think tank meeting.

Alongside the live presentations of the pilot themes, Prof. Mac MacLachlan provided a general SHAPES overview via a pre-recorded video. Additionally, the program of the event included a presentation and discussion of the Interreg Central project HoCare2.0, by focusing on the co-creation process established and used in the project. (This process involves a variety of stakeholders such as older people as users; digital health SMEs and a local business (industry), and a technical university (academia).)

Based on the SHAPES and HoCare2.0 talks, a panel discussion was held on the challenging question of whether digital health platforms emerging from initiatives such as SHAPES are isolated projects or are viable pan-European solutions to promote active and healthy ageing. The experts within the panel were composed of the director of the German insurance firm, AOK PLUS, Rainer Striebel (payer); the managing director of the Dresden International University, Prof. Joachim Niemeier (academia); managing director of the Medipolis Group, Dr. Christian Wegner (industry); and Dr. Alexia Zurkuhlen, head of the gewi-institute for healthcare studies (digital management and networking organisation).

3.3.1 Key Take-Aways

Each of the four panellists had their own take-aways from the discussion. The key items of the discussion are later summarised.

Payers (insurers in Germany)

The insurance scheme, AOK PLUS, which is one of Germany's 103 statutory health insurances, aims to act as a guide for its older35s to provide them with help, orientation, and support. AOK PLUS aims at creating a network to connect all required

stakeholders to establish and promote user-oriented digital health services and to promote its attractiveness for customers. To provide sustainability and successful integration, platforms such as SHAPES should collaborate with insurers / payers to ensure reimbursement and, based on the take-away from the discussion, outreach to older people. So far, the SHAPES consortium does not include insurers and, up until M24 of the project, interacts with insurance schemes and payers mainly through the SHAPES dissemination activities.

Industry

Managing director of the Medipolis Group, Dr. Christian Wegner, promoted a closer collaboration between service providers and patients to address patient needs appropriately and to foster acceptance of new assistive services. However, to establish and integrate these services into the health and care system, there needs to be a focus on usability and the use of appropriate standards.

Digital Management and Networking Organisation

Digital Management and networking organisations in distinct health regions in Germany (like GEWI and CCS) foster the exchange and dialogue between academia, industry and real-life settings. Thus, these networking activities build the necessary bridge(s) to establish new services and to connect stakeholders as a means of achieving integration of these services and their sustainability.

Academia, transfer of innovation

To meet the challenges that users face in adapting to and using new services and to improve acceptance of these services, an open ecosystem should be established that reaches the users and involves them in all processes, from development to implementation, in an interactive, two-way manner together with academia and industry.

The attendees of the workshop joined in the discussion on the question: "How are users supposed to know about digital health services and how should they know which ones are trustworthy, efficient, and effective?"

The key points of the discussion were:

- Users need to be provided with reliable information about and advantages of digital health services
- Data protection and usability are major concerns for older people in Germany and these need to be addressed appropriately
- Both professionals and end-users need to be involved in the design and development processes of new health services to ensure uptake

- Competence centres / online platforms for older people focusing and informing them about digital health services could be established.

3.3.2 Summary

This think tank meeting comprised a panel discussion with representatives from a larger German insurance company (payer), industry, academia, and digital management / networking organisations. The discussion showed that, in order to ensure that digital health platforms – such as SHAPES – become viable pan-European promoters of active and healthy ageing, a close interaction among all relevant ecosystem stakeholders is necessary. The focus on informing, training, and involving older people and their carers about assistive technologies and services seems to be the most important aspect in this ecosystem.

The experts in the panel also mentioned various needs and requirements that are in line with the intention of SHAPES. Although the needs for interaction of stakeholders were described, the actors, and responsibilities to address these needs, were not assessed. Thus, there is high potential for SHAPES to become a viable actor in the ecosystem it is building by providing networking and connectivity among the different stakeholders and by sharing information that is essential for change. SHAPES can proactively establish managed and validated processes from design to development, testing and integration of new solutions that considers all relevant stakeholders on a European scale.

3.4 Conclusions from 2020/2021 Think-Tank meetings

For ecosystem building, SHAPES aims to interact with all relevant stakeholders, to assess their views and opinions, to create added value by stakeholder dialogue, and obtain indications for the sustainability of SHAPES' operations after the project end.

One format of interaction is the think-tank workshops that CCS undertakes every six months in T9.1. So far, the think-tank workshops have involved experts from academia, industry, health and care, civil society, and older people. For future think-tank workshops, additional stakeholders will be invited to attend and contribute so as to broaden outreach and input from the SHAPES ecosystem.

In think-tank meeting 1, the goal was to identify the needs of older people, solutions to meet those needs, and barriers to the integration of new solutions. CCS aimed to validate the workshop results with its participants in pilot theme 1, a sample of older German citizens. However, the results show that there are differing views between the expert stakeholders and the older people themselves, especially on the question which are the most important needs of older people. For that reason, older people have to be the first stakeholder type to be involved in the design and development process of assistive digital solutions so as to address appropriately the actual needs.

According to the older people interviewed, SHAPES will need to address a myriad of needs from among the following categories: access to services, assistance, support in decision-making, goal identification, health maintenance, independence, language, and social integration. Most importantly, older people seeking for mental health and psychological wellbeing respect, both as members of society and as individuals; to be heard and involved in decision-making; and to live without constraints and barriers. Taken together, the results of think-tank meeting 1 made clear that the needs of older people are easier to identify than are the assistive solutions that meet those needs, and the barriers to integration of assistive solutions in the lives of older persons are easier to identify than the solutions themselves. **This underlines the opportunity for the SHAPES consortium and its combined expertise to facilitate the design, development, and integration of useful solutions in a co-creation approach with older people** as protagonists, as is done within the SHAPES large scale pilots.

In think-tank meeting 2, we aimed to identify good practices of integrated care and to define the general success factors drawn from the integrated care scenarios discussed. As a result, SHAPES will aim to facilitate good practice by ensuring the empowerment and involvement of older people (governance), the standardisation of all involved processes and solutions (standardisation), the supportability of / accessibility of appropriate platforms, frameworks and solutions (access to resources) and, development of business models that lead to viable pricing and costs of the services and solutions provided (business modelling). **These four success factors are essential for scaling up integrated care and providing sustainability**.

Importantly, think-tank meeting 2 led to important requirements for scaling up of integrated care, which, together with field research outcomes, are at the basis of the Four-Wheel model presented in D3.2 "Scaling-up Improved Integrated Care Service Delivery". Think-tank 2 also assessed the user perspectives on integrated care and led to essential insights for the development of the SHAPES governance model in WP3. The **last topic of think-tank meeting 2, dominance of different domains when promoting integrated care, provided some preliminary findings that need further exploration to be considered in the operation of SHAPES**.

Think-tank meeting 3 comprised a small panel discussion with a sample of German expert stakeholders. The discussion highlighted gaps in integrated care, such as the lack of proactive roles of stakeholders in interconnecting and informing other stakeholders within the ecosystem. **These gaps/lacks result in a high potential for SHAPES to become a leading partner to facilitate integrated care by providing international networking, working platforms, and processes that are validated as a result of the design, testing and integration of solutions together with all relevant stakeholders**. (However, in order for SHAPES to act effectively, the specificities of the differing health and social care systems in Europe need to be considered as well as differing relationships of the stakeholders within these systems.)

To sum up, the first three think-tank meetings served as a basis for ecosystem building in T9.1 by assessing the opinions of expert stakeholders and older individuals and by identifying success factors and requirements for integrated care. As a supporting task, T9.1 and its think-tank provided a basis for WP2, WP3, WP6 and WP10 to perform their tasks and gain internal and external inputs for their deliverables. T9.1 will continue its supportive role by planning and executing future think-tank meetings in cooperation with the other work packages.

3.5 Late 2021 and 2022-2023 Think-Tank meetings

Together with T3.2, CCS developed a plan for the remaining think-tank meetings to be held in the second half of SHAPES. This plan is based on the Four-Wheel model for implementation and scaling-up of integrated care in D3.2. The plan focusses on four chosen aspects derived from the Four-Wheel model depicted in (Figure 3): technology, governance, impact / assessment, and solution design / co-creation.

Figure 3: Four-Wheel Model for adoption and upscaling of integrated care. Extracted from SHAPES D3.2.

(d) Technology for integrated care

In order to focus dissemination and a potential think-tank onto technology for integrated care, we aim to represent SHAPES at an ICCHP-AAATE conference in July 2022. Because AIAS has a close connection with the AAATE, this dissemination and think-tank activity will be co-organised with T3.2.

(b) Governance of integrated care

One think-tank meeting oriented towards the ideal governance of integrated care will be held in January 2022. Two or three focus groups will illuminate issues relating to the different domains of governance that were identified in D3.5 entitled Initial SHAPES Collaborative Governance Model:

- Data Governance
- Enterprise Governance of IT
- Business and Corporate Governance

Potentially, this think-tank meeting will be co-organised with the ISO Leaders Forum, represented by AAA. We aim to introduce the think-tank meeting with talks on ethics, governance, and scaling-up. Those think-tank workshops will focus on (working titles):

- Governance of eHealth Ecosystems to ensure participation of all stakeholders.
- Successful Business Modelling to ensure scaling up of integrated care.

© Assessment of long-term impact of integrated care project outputs

Together with T3.2, we plan on organising an event that will focus on evidence-based policy development in digital health. This event could be a joint approach held with either AAATE, EIP on AHA or the WHO (based on the WHO Global Strategy on digital health 2020-2025).

(d) Identification of digital solutions with users / Co-Creation

This event will be part of a technical workshop on the identification of digital solutions with users / co-creation, that will potentially be organised in co-operation with WFDB. It is likely to be held around April 2023 in Geneva, together with WFDB's members and their networks (consisting of other end-users with deafblindness).

4 Identification and impact of new digital solutions

This chapter explores four topics that focus on SHAPES' digital solutions; innovation watch; cross-fertilisation; and foresight exercises, in order to facilitate the identification and evaluate the impact of new digital solutions.

4.1 Digital Solutions and SHAPES

Society is now embracing the use of digital solutions to assist and enhance daily living. Technology can enable older people to manage complex health conditions and to live with dignity at home longer, while staying connected to others. Shaping the market to create open and accessible platforms that integrate not just technologies but, most importantly, human systems, ecologies, neighbourhoods and values is thus a key future challenge[5]], with a systems-thinking approach to technology and ageing now being recognised as crucial[6].

SHAPES addresses the challenge of ageing populations by developing a socio-technical ecosystem. The ecosystem comprises a variety of technologies integrated through a core platform to enable and facilitate active, independent, and healthy ageing at home. Quick access to health information and medical data can improve the knowledge basis in the health sector while making the delivery of care more effective. At the same time, health information and electronic access to medical data can also empower individuals. Well informed patients can use their medical data to preserve their health, self-manage health conditions, adopt healthy behaviours, and participate actively in clinical decision-making and medical treatment.

The current internal list of SHAPES digital solutions covers tools for monitoring users' daily routines, detecting falls using both computer vision and wearables, encouraging the practice of physical exercise and the take up of healthy diets and delivering stimulation to patients of neuro-degenerative diseases. It provides caregivers and care professionals with insights on the evolution of users' vitals and wellbeing, on the early detection of COVID-19 symptoms and on the patients' likelihood to develop specific diseases or to experience decompensation episodes. From accessible smartphones and tablets to telecare systems, wearables and sensors, memory aids, virtual

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[5] C. Khasnabis, C. Holloway, and M. MacLachlan, "The Digital and Assistive Technologies for Ageing Initiative: learning from the GATE initiative", Healthy Longevity, The Lancet, Volume 1 Issue 3, E-94-E95, December 01 2020, doi: https://doi.org/10.1016/S2666-7568(20)30049-0.

[6] MacLachlan, M. & Scherer, M. J., 'Systems thinking for assistive technology: a commentary on the GREAT summit', Disability and Rehabilitation: Assistive Technology, 13:5, 492-496, doi: 10.1080/17483107.2018.1472306].

assistants, visual and communication aids and service and companion robots, SHAPES digital solutions have the potential to empower older people to optimise their health, mental and physical wellbeing and participate in civic life, while maintaining a degree of independence as they age. As a result, older people may continue to enjoy healthy, productive, independent and dignified lives at home and delay or prevent the need for long-term institutionalised care.

This wide range of digital solutions is to be deployed and validated across Europe in a large-scale piloting campaign.

Overall, SHAPES is conducting seven independent pilots. The pilots span 25 different use cases that touch on the multiple facets of older people's lifeworlds. They are to deliver high-quality health and care and embrace a significant number of personas and caregivers representing different typologies of users. The SHAPES digital solutions included in the piloting campaign have undergone a careful and thorough design and adaptation process that have taken into consideration the end-users' needs, requirements, and expectations, in aspects such as functionality and usability.

The diversity in the number and nature of the SHAPES digital tools, pilots, use cases, and personas provides an unprecedented "field laboratory" to demonstrate and validate what works and what does not for older people, while generating a large amount of relevant feedback to test new approaches to tailor the overall user experience to the end-users. Indeed, the experience collected from the SHAPES' pilot phase provides invaluable first-hand information on how digital solutions should be designed and which features should be included to ensure their support for active, independent and healthy ageing at home.

4.1.1 Short-term: Initial recommendations and insights relating to SHAPES' digital solutions

Regardless of the particular nature of the digital tools and use cases, some general recommendations may be derived from the experience already accumulated in SHAPES by its 24th month of activity with regard to the benefits a digital solution is expected to provide. They relate to the coherence, simplicity, and added value/specificity of digital solutions:

- **Coherence**: digital solutions may work in a stand-alone manner but are also expected to integrate smoothly into a bigger ecosystem or to provide the means to achieve that integration in the future. The whole portfolio of SHAPES digital solutions hints at a paradigm shift in how independent tools can lead to growth in an ecosystem-level solution to delivering integrated care while adopting a holistic approach to security and privacy issues. The coherence required to contribute to the entire digital solutions' ecosystem, without introducing

inconsistencies or doubling-up on solutions, is a major recommendation derived from the SHAPES pilots in the first half of the project.

- **Simplicity**: users may not be familiar with technology or with IT-related terminology. For example, they may be older people with inherent difficulties to operate devices with touch functionality. Alternatively, they may be caregivers who expect to see a clear, at-a-glance view of a patient's evolution. Therefore, digital solutions must add an extra layer of simplicity to focus the user on the information needed (and avoid distraction on not-often-needed aspects) and offer a polished and carefully designed user experience.
- **Added value/specificity**: digital solutions must target a specific need and address it. Solving a specific need is key to achieving long-term adoption of the digital solution by users. (This recommendation also relates to the previous point about simplicity, in the sense that users' capabilities to adopt new digital solutions may be limited.) A clear added value has to be perceived by users in a straightforward way, from the early stages of their use of any device/equipment.

SHAPES, however, understands that technology is not a 'silver bullet' for addressing complex problems. It is paramount to understand how best to realise the gains of technology to improve everyday life for older people. An important step towards this improvement in people's lives means **envisioning** not only **what the SHAPES digital solutions and ecosystem will look like** and how they will function, but more importantly, **what kinds of lifestyles SHAPES wishes to promote** and **what role technologies will play** in that. Such lifestyles must be centred around the core needs and preferences of the participants in this ecosystem, which involves understanding the current reality of peoples' lives as well as their aspirations for their future lives.

Many digital solutions and technologies have not been very successful in achieving sustainable innovations in health and social care practices. This situation is directly linked to those technologies' general disregard of the interdependencies between technology, human characteristics, and the socio-economic environment, that has resulted in technologies that have a low positive or constructive impact on health and social care practices. Today, there are several barriers and challenges hampering the wider uptake of digital solutions in Europe. They include a lack of confidence in eHealth among patients and healthcare professionals, the limited interoperability between digital solutions for health and care, insufficient evidence of the cost-effectiveness of digital tools and services for health and care. Furthermore, a lack of legal clarity and transparency regarding the use of data collected by such applications, the absence of reimbursement schemes for digital health services and EU national and regional differences in accessing information and communication technology services.

SHAPES promotes **a holistic approach to the development of digital solutions and technologies** that takes into account the complexity of health and social care and

the rituals and habits of interested individuals and other stakeholders. It is thus essential to guarantee a new agenda for active and healthy ageing using digital solutions, technologies, and innovations, while, minimising potentially adverse effects on the rights, capabilities, and resilience of older persons.

Importantly, the SHAPES piloting activities have **two main foci**. They facilitate the required focus on the effectiveness of digital solutions and the development of rigorous assessment criteria, relating the technology to different stages of the ageing process. They also analyse age and gender differences in digital solutions' access and use, quality of social and health care, economic factors, and quality-of-life issues.

To summarise, in the short-term, **SHAPES intends its digital solutions, processes, and integrated care delivery mechanisms to increase the quantity, value and quality of services provided to older persons (at either equal or lower costs)**, especially in terms of services to be used in health and social care, by informal carers, and on personal assistance.

4.1.2 Longer-term: Possible directions for SHAPES' digital solutions

For the long-term, SHAPES envisions that:

- **Digital solutions**: facilitate the easy use of digital solutions and services for older people, removing barriers and encouraging older people to enhance their independence with a good quality of life; participate longer in working life; and be active and socially included in society.
- **Delivery**: increase the efficiency and quality of social and health care delivery to a growing ageing society, by contributing to the financial sustainability of those systems and services in the future.
- **Work with European industry**: provide the European eHealth industry with a clear understanding of existing and future market(s) while acknowledging that the ageing population will soon become a mainstream market; reinforcing European leadership in this domain; and building a substantial base for exporting to global markets.

4.2 Innovation Watch, Cross-fertilisation and Foresight Exercises

Deliverable D1.3 "SHAPES Innovation and Knowledge" describes in detail the background to Innovation and Knowledge Management in SHAPES. The discussion that follows highlights the most important aspects that put T9.2 into the context of the ecosystem building activities.

4.2.1 Innovation Watch and the SHAPES Innovation Management Strategy

The innovation process in SHAPES comprises the following six steps:

- Identification of user requirements
- Definition of the context environment (lifeworld of aging individuals; organisational, structural, and sociotechnical factors)
- Development and/or adaption of digital solutions and creation of the SHAPES platform
- Evaluation of the SHAPES platform in real life use cases
- Development of business models and the broader SHAPES ecosystem
- Dissemination and exploitation of SHAPES solutions.

Additionally, SHAPES follows the **innovation model of the 3rd generation** and seeks to locate a balance between technology push and market pull factors (Figure 4). This general innovation model of the 3rd generation was adapted to include three critical activities which are necessary for the success of the SHAPES project:

- Inclusion of the interaction with end-users and the market environment
- Inclusion of external input (e.g., society, competitors, universities)
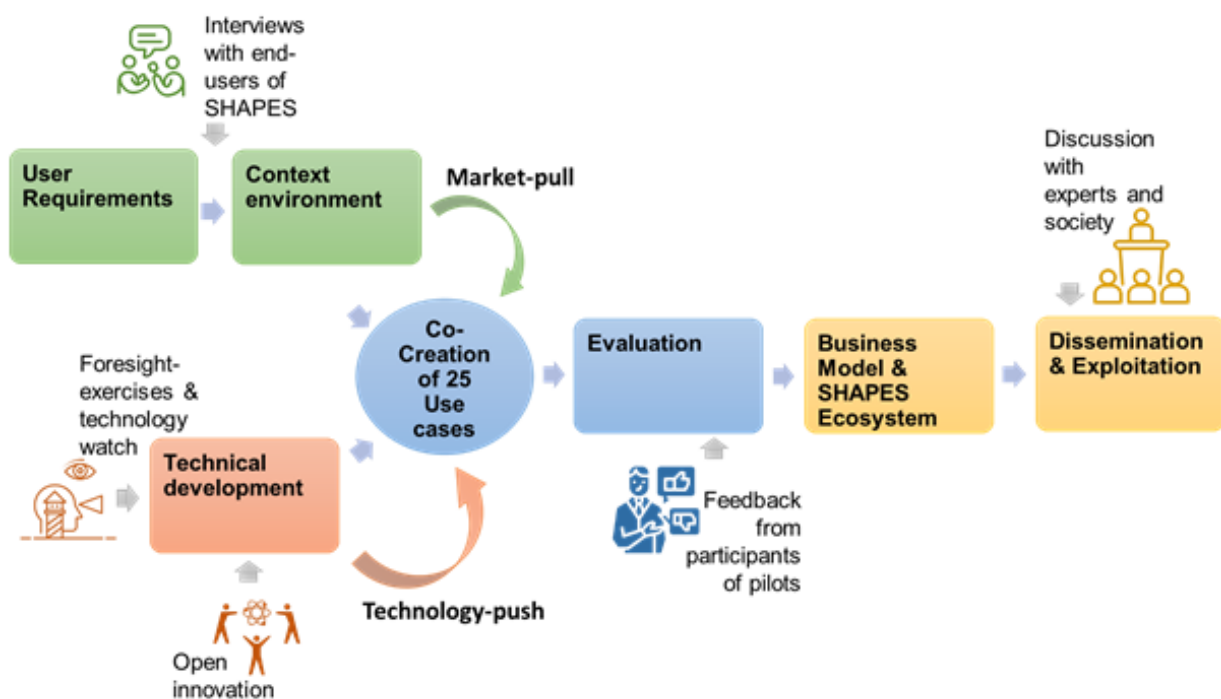- Inclusion of external ideas (open innovation).

Figure 4: SHAPES Innovation Model

The following seven methods and tools are in use in the SHAPES innovation process:

- In-depth interviews
- Different participatory workshop formats
- Co-creation elements (co-development of use cases)
- Feedback-loops with end-users (mock-up tests, prototype testing)
- (Online) conferences with participatory elements
- Dissemination via several channels/media to invite feedback

- Risk assessment.

4.2.2 The SHAPES knowledge management strategy

To facilitate innovation, SHAPES follows a dedicated knowledge management strategy. This strategy interconnects the outputs of six SHAPES' deliverables (WP2, WP3, WP4, WP5, WP6 and WP9) to provide joint input for SHAPES innovation (Figure 5).

All SHAPES technological and non-technological innovations are made available to the consortium via the publication of deliverables 1.3 and 1.4.
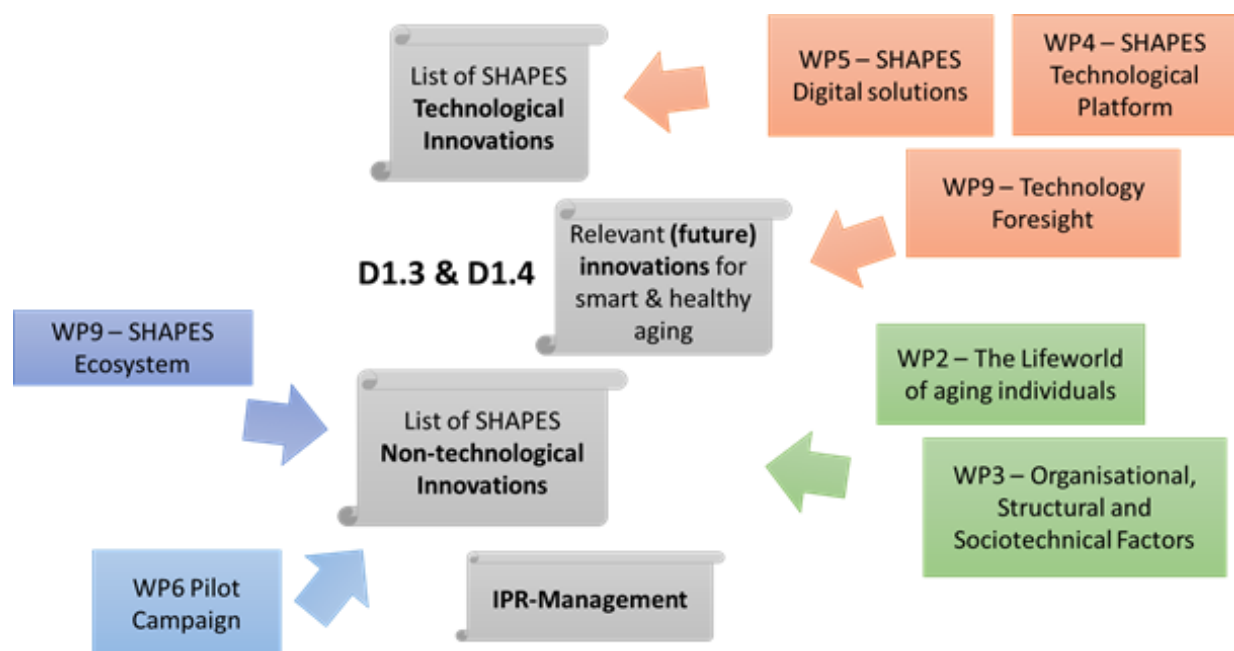

Figure 5: SHAPES Knowledge Management

Relevant innovations that take place outside of SHAPES are published on technology cards on a regular basis in WP9 and are also available in annex 2 of this deliverable.

4.2.3 Foresight Exercises

In the course of the SHAPES project, Fraunhofer INT (FhG) is set to carry out eight Foresight Exercises under task 9.2. Until M24, FhG has completed three Foresight Exercises, while the fourth is currently ongoing.

4.2.3.1 Introduction to the Foresight Exercises

Foresight comprises the exploration of possible futures using specific scientific methodological approaches, e. g. scenarios, roadmaps.

Foresight can be used to:

- identify emerging technologies, future impacts as well as new societal demands and challenges,
- anticipate future developments, disruptive events, risks and opportunities,
- evaluate the impact of (upcoming) decisions (in combination with other developments),
- help to evaluate priorities and potential new directions in decision making.

SHAPES foresight starts by gathering information about future technologies and anticipating influencing factors. This information is gathered by and through:

- evaluation of current research and foresight studies. (This search for early signs of important changes in society, science and technology is also called horizon scanning.)
- exchange with participants in foresight exercises, e.g., in workshops.

An important factor for the foresight exercises is how far into the future we will look. For the SHAPES project, we decided to aim for the year 2030.

Future-Influencing Factors and Technologies can be gathered from numerous sources:

- Study of foresight and current research studies (mostly, but not only related to smart and healthy aging),
- Exchanges with scientists and researchers in the fields,
- Discussions with all affected persons (older adults, caregivers, etc.).

To make sure that all the gathered information is consumable and useful for the project, FhG developed two templates. These templates are called "Influencing Factor Cards" and "Technology Cards", and they aim to provide starting points for interested actors for more in-depth analysis into specific topics.
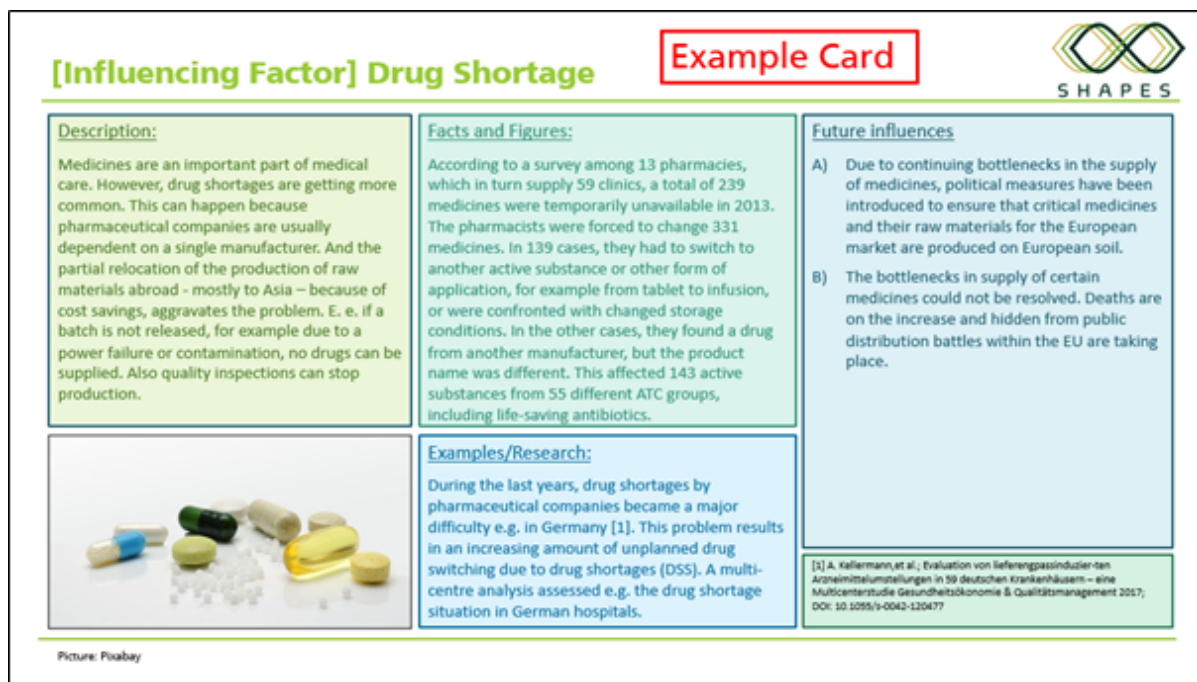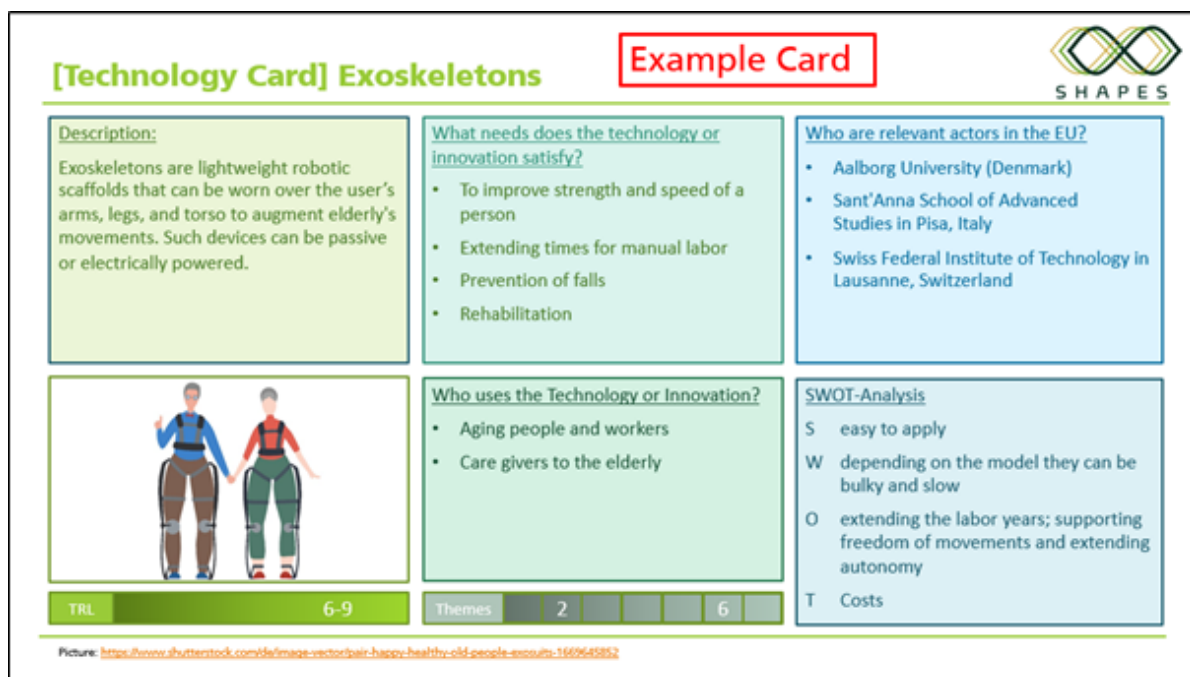
Figure 6: Example of an Influencing Factor Card

Figure 7: Example of a Technology Card

These Information Cards can and should be used at various points during the project:

- as input for other work packages, e. g. technical work packages,
- as inspiration for work in pilot themes and highlight solutions for SHAPES personas,

- as information sources for people which are not directly involved in SHAPES but are interested in future technologies concerning smart and healthy ageing.

The foresight exercises undertaken are a starting point, and one can extract unaddressed needs of all concerned parties. The gathered ideas of technologies or hints for technologies, can help in the process to satisfy such needs. Starting from current needs, for example, it is possible to investigate new technological developments which have not yet been developed or which are used in other areas, such as the aerospace industry. However, with some more development, such technologies could also be used to satisfy needs e.g., in the care of older adults.

During the SHAPES awareness campaign in work package 10, Fraunhofer INT provided some first studies, which are published by research institutes, governmental bodies, industry, and so on. Such foresight studies can provide hints for relevant trends and innovations, as well as of changing environments for current and future SHAPES solutions.

The seven pilot themes and personas in SHAPES were used as guidelines for the analysis. The seven pilot themes together are the basis to providing a clear understanding of the reality of European health and care systems. They enable the validation of innovations capable of supporting effective healthy and independent living of older individuals within and outside the home.

4.2.3.2 1st Foresight Exercise

Fraunhofer INT contributed to the first Dialogue Workshop in SHAPES and the awareness campaign week, to introduce the foresight process and the planned foresight exercises into SHAPES. The aim was to lay a foundation for discussions during the upcoming SHAPES workshop.

Additionally, a video was produced for the introduction of Fraunhofer INT and the foresight activities in the context of SHAPES. The next one-day virtual SHAPES workshop was mentioned as well as the fact that the foresight workshops would be carried out in its framework.

For each day of the awareness campaign week, one specific topic was highlighted by providing some slides with information. The following five topics were presented:

- On Monday, some general information about the foresight activities in SHAPES were presented and the following questions answered:
    1. What is foresight?
    2. Why should it be conducted?
    3. How is it done?
    4. How far into the future do we look?
    5. How can the workshop participants support the process?

- On Tuesday, the influencing factors and technology/innovation cards were introduced. (These types of cards will be the main output from task 9.2 of the SHAPES project.).
- From Wednesday onwards, some ideas highlighted in already published foresight studies were introduced and analysed regarding their importance for SHAPES. On this day, three topics were selected. They concerned the pilot themes 1 (Smart Living Environment for Healthy Ageing at Home), 2 (Improving In-Home and Community-based Care) and 6 (Physical Rehabilitation at Home).
- On Thursday, ideas of foresight studies concerning the two pilot themes were presented. They involved pilot themes 3 (Medicine Control and Optimisation) and 4 (Psycho-social and Cognitive Stimulation Promoting Wellbeing).
- On Friday, foresight ideas concerning the two remaining pilot theme topics were highlighted. They covered pilot theme 5 (Caring for Older Individuals with Neurodegenerative Diseases) and 7 (Cross-border Health Data Exchange Supporting Mobility and Accessibility for Older Individuals).

4.2.3.3   2nd and 3rd Foresight Exercise

The 2nd and 3rd Foresight Exercises were conducted as paperwork exercises by all contributing partners of Task 9.2. Each partner carried out an evaluation of current research and foresight studies by using the following four questions:

- **Gaps**: What are current needs of older people that are not yet properly addressed?
- **Influences**: What are critical current and possible future influences concerning older people?
- Possible **direct solutions**: Are there any future technologies which could help older people in smart and healthy aging and in the satisfaction of needs or the mitigation of negative influences?
- Possible **transferred solutions**: Are there any technologies in other areas (e.g., from industries such as the automotive, space, or production sectors) which could be adapted to be used in the future for older people?

4.2.3.4   Results

The following five figures provide an overview of the results of the first three Foresight Exercises (see Figure 8 through to Figure 12). The results of the 1st foresight workshop identified a set of gaps relevant to either people or technologies; showed the potential influences on the field(s); listed some seven different types of technologies; and

named at least one technology that could be transferred from another sector and transformed into a service to support active and healthy ageing.

Figure 8: Results of the 1st Foresight Exercise

The total (27) results of the two following foresight exercises (the 2nd and the 3rd) are included in annex 2. The following four figures (9-11) show just some examples.

The graphics explain the innovation watch concept; identify the 15 types of technologies that could helpfully support active and healthy ageing; describe video consultation technology (and analyse the needs satisfied, relevant actors, users, and conduct a SWOT analysis; and outline the influencing factors around insecure devices.

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51

SHAPES – TASK 9.2

Innovation Watch, Cross-Fertilization and Foresight Exercises

Technology and Innovation Cards resulting of Foresight Exercise 2

Figure 9: Example individual results from the 2nd and 3rd Foresight Exercise 1 – innovation watch

Results

! Smart Living Environment for Healthy Ageing at Home

- ➤ Sensors for water use on appliances and water taps
- ➤ Air quality measurement device: air-Q"
- ➤ eCare – Personalized Care Intelligence Platform
- ➤ Smart Textiles
- ➤ Authentication, Security and Privacy Assurance
- ➤ Security assessment as a Service
- ➤ Multitude of un-secure devices
- ➤ Environmental Sensing IoTs for Health
- ➤ "ELLI.Q" the connected companion for older adults
- ➤ Video consultation
- ➤ SMART Insulin Pens
- ➤ Anomaly Detection and Behavioral Analysis
- ➤ Support on using modern technologies
- ➤ eHealthPass – Chronic Disease self-management solution
- ➤ "ARI" healthcare assistant and companion

Figure 10: Example individual results from the 2nd and 3rd Foresight Exercise 2 – overall results

Figure 11: Example individual results from the 2nd and 3rd Foresight Exercise 3 – technologies relating to video consultations
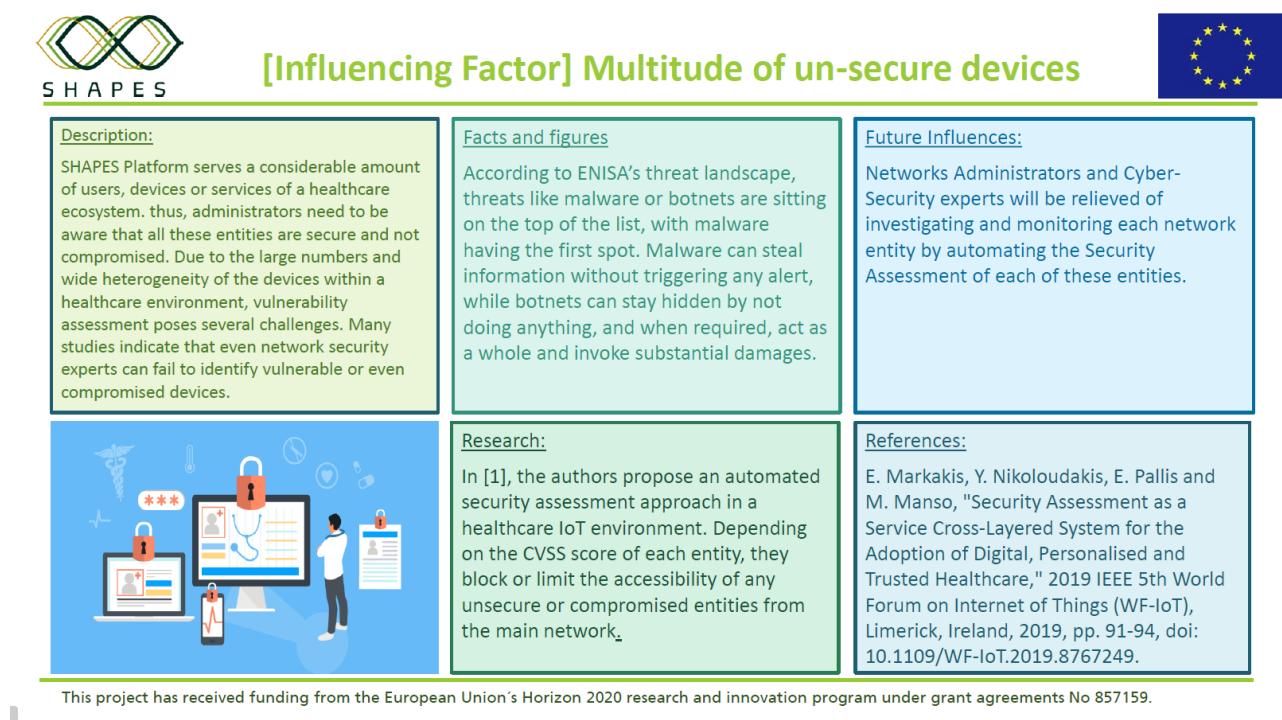
Figure 12: Example results of the 2nd and 3rd Foresight Exercise 4 – influencing factors relating to insecure devices

4.2.3.5 Conclusion of the Foresight Exercises

The following section will briefly summarise uptake, limitations and outlook on the Foresight Exercises within SHAPES.

Uptake of Foresight Exercise Outputs

The findings gathered from the three Foresight Exercises flow into the SHAPES knowledge and innovation strategy, as described above. This strategy interconnects the outputs of six of the SHAPES work packages (WP2, WP3, WP4, WP5, WP6, and WP9). The Foresight Exercises ensure input for future technological innovations to both broaden the portfolio of SHAPES solutions and service and address the needs of older people appropriately.

Limitations and Outlook

All Foresight Exercises were originally planned as workshops to be attended physically. Hence, the workshops of all Foresight Exercises would have been carried out using a World Café approach. The workshops would have operated in this way:

- Groups of people discuss the respective topics at several tables, with individuals switching tables periodically and being introduced to the previous discussion at their new table by a "table host"
- Input of the participants collected at each table
- The different rounds of discussions build on each other.

Due to the local and international lockdowns resulting from Covid-19 in 2020-2021, only virtual workshops were held. In the virtual workshop(s), all participants work in one group and contribute both via a chat box or video talk.

Unfortunately, the input received was less than expected. As a result, the following Foresight Exercises were conducted as paperwork exercises. This provided the advantage that all the contributing SHAPES' partners had more time for doing a literature review, and hence gave more detailed input. However, the biggest disadvantage was that not all relevant stakeholders of the SHAPES ecosystem could be included in the Foresight Exercises. In particular, there has been a lack of input from older people and external stakeholders of SHAPES in the Foresight Exercises performed.

Fortunately, by November 2021, there are many new technology tools available that allow for positive and constructive virtual workshops and digital exchange than in 2020. Thus, FhG aims for many relevant users and key stakeholders of the SHAPES ecosystem as possible to participate in the upcoming Foresight Exercise to be held as (virtual) workshops.

5 Conclusions and Outlook

This chapter draws together a number of conclusions from the work of the deliverable, and highlights what the outlook is for the second half of SHAPES on ecosystem building.

5.1 Conclusions

This report constitutes the first of two iterations of the overall task implementation of T9.1 "Co-creation Think-tank for European Integrated Care", T9.2 "Innovation Watch, Cross-fertilisation and Foresight Exercises" and T9.3 "Building Strong Networks and Liaisons". The content of this report is drawn from the think-tank workshops, the various events supporting an open discussion forum for both internal and external stakeholders, the foresight exercises, and the project's networking and liaising activities.

This report aims to provide a clear understanding of the mission and vision of SHAPES and an in-depth stakeholder analysis of the players in the SHAPES ecosystem. We also included external stakeholders in the discussion to assess and improve the actions of SHAPES and outlined the implications of the co-creation think-tank workshops. As a result, this deliverable summarises factors to be considered for successful integrated care and suggests further actions for the ecosystem building to be considered in other work packages besides WP9. Furthermore, we have presented the results of identifying, and the impact of testing, new digital solutions that aim to facilitate active and healthy ageing.

The summarised findings aim to support the actions carried out in six other work packages (WP3, WP5, WP6, WP7, WP8, and WP10). In the long-term, the results and the presented actions also aim to support the production of the SHAPES Recommendations, i.e., they will help to design and develop new access policies to improved health and care services for older individuals across Europe.

5.2 Outlook

In the second half of SHAPES, we aim to complement this stakeholder analysis with additional details. Included in these details will be the most relevant relationships among the identified stakeholders, and the regional and systemic differences between those stakeholders among Europe. This comparison will facilitate the collaboration, support, and establishment of the SHAPES governance model (T3.4) and business modelling (WP7) as means to achieve sustainability of the operations of SHAPES.

We also aim to improve systematically the outreach and involvement of relevant external stakeholders for ecosystem building using a stakeholder engagement plan.

This includes addressing and involving stakeholders that have not been included yet, such as payers / insurers, policy-makers, authorities and regulatory bodies, and the media.

The success factors for integrated care that we identified in the think-tank workshops already held will be reviewed and complemented by further think-tank meetings.

Additionally, the Foresight Exercises show a potential expansion of the portfolio of influencing factors, digital solutions, and services that facilitate active and healthy ageing. In the short-term, the result of the Foresight Exercises may benefit other technically enabled systems that support healthy ageing and assisted living in the home. In the long-term, we aim to partner with, develop, and implement technologies and solutions identified in the SHAPES platform.

6 Ethical Requirements Check

Ethical issue (corresponding number of D8.4 subsection in parenthesis)	How we have taken this into account in this deliverable (if relevant)
Fundamental Rights (3.1)	**Research and co-creation actions considered factors and / or fulfilled the set requirements in D8.4.**
Biomedical Ethics and Ethics of Care (3.2)	**N/A**
CRPD and supported decision-making (3.3)	**N/A**
Capabilities approach (3.4)	**N/A**
Sustainable Development and CSR (4.1)	**Research, co-creation and networking actions considered factors and / or fulfilled the set requirements in D8.4.**
Customer logic approach (4.2)	**Research, co-creation and networking actions fulfilled the set requirements in D8.4.**
Artificial intelligence (4.3)	**N/A**
Digital transformation (4.4)	**Research, co-creation and foresight actions considered factors and / or fulfilled the set requirements in D8.4.**
Privacy and data protection (5)	**Research, co-creation and networking actions considered factors and / or fulfilled the set requirements in D8.4.**
Cyber security and resilience (6)	**N/A**
Digital inclusion (7.1)	**N/A**
The moral division of labour (7.2)	**N/A**
Caregivers and welfare technology (7.3)	**N/A**
Movement of caregivers across Europe (7.4)	**N/A**

Comments: _____

References

C. Khasnabis, C. Holloway, and M. MacLachlan, "The Digital and Assistive Technologies for Ageing Initiative: learning from the GATE initiative", Healthy Longevity, The Lancet, Volume 1 Issue 3, E-94-E95, December 01 2020, doi: https://doi.org/10.1016/S2666-7568(20)30049-0.

MacLachlan, M. & Scherer, M. J., 'Systems thinking for assistive technology: a commentary on the GREAT summit', Disability and Rehabilitation: Assistive Technology, 13:5, 492-496, doi: 10.1080/17483107.2018.1472306.

The UAVR team published a paper titled "Procedures of User-centred Usability Assessment for Digital Solutions: a Scoping Review of Reviews reporting on digital solutions relevant for older adults" in the JMIR Human Factors (DOI: 10.2196/22774)[7]. The paper synthesises the procedures used or reported for the different steps of the process of conducting a user-centred usability assessment of digital solutions relevant for older adults and identifies principles guiding this assessment.

Another publication authored by the UAVR team and titled "Experts' Evaluation of Usability for Digital Solutions Directed at Older Adults: a Scoping Review of Reviews" published at the 9th International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion (DSAI 2020) that took place in December 2-4th, 2020[8].

As of October 2021, UAVR is in the process of publishing a paper reporting a Delphi study about consensus on the terms and procedures for usability evaluation. It intends to publish it in Jamia Open (https://academic.oup.com/jamiaopen/pages/About). The draft paper presents a conceptual framework on usability evaluation through the generation of consensus on the terms and procedures that should be considered when planning and reporting a study on usability evaluation both by users and experts.

5th DYPE, in collaboration with UP, based on personas and their methodology created in T2.5, have submitted an article titled "Enhanced Dialog between Formal and Informal Caregivers: Following a user-centred Design for Personas Development". This draft paper explores the roles of both formal and informal caregivers (as they are very often crucial for the well-being of older adults, yet their needs are undermined and often misunderstood)[9].

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[7] https://preprints.jmir.org/preprint/22774.

[8] **https://doi.org/10.1145/3439231.3439238**

[9] http://dx.doi.org/10.21203/rs.3.rs-860699/v1.

UP is currently working on publishing a handbook on the SHAPES Personas covering older adults, as well as formal and informal caregivers. The handbook should be published via Palacký University Press.

An AIAS staff member led the writing of the policy report titled "Technology in Social Care and Support Services. A policy paper from the Person-centred Technology Membership Forum of the EASPD" (European Association of Service Providers to Persons with Disabilities). The report was presented at the EASPD conference "The future is now. Persons-centred technology to empower people and disability services." Brussels*:* October 13-14th, 2021*.* Work done under T3.2. is reported in the report[10].

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[10] https://www.easpd.eu/fileadmin/user_upload/Publications/easpd-privacy__003_.pdf.

Annex 1: Stakeholder types

6.1.1 Older people

Older people are at the centre of the SHAPES ecosystem and are therefore the most important stakeholder type when building the ecosystem. Older people are the users and / or most direct beneficiaries of the SHAPES digital solutions and services and will be, in some cases, the future customers for these solutions.

D8.4 SHAPES Ethical Framework First Version comprehensively summarised important aspects to be considered within SHAPES when addressing and including older people (e.g., Chapter 7 D8.4). First and foremost, older adults form a heterogeneous group of people with different backgrounds, skills, interests and capabilities. To address the various needs of older people, T2.5 created different SHAPES personas representing the needs of older adults across Europe. These personas facilitate further work that is taking place across the whole of the SHAPES ecosystem. More details will be published in November 2021 in a write-up of T2.1, in which interviews have been conducted in countries all over Europe with over 80 participants. All of these participants have been informed of the content of the project and provided their valuable input regarding the solutions.

6.1.2 Formal and informal caregivers of older people

Alongside older people, SHAPES aims to consider the view of informal caregivers of older people, such as their family members and friends. This spread of interest means that SHAPES digital solutions and services also aim to assist informal caregivers (by allowing them to gain better and more detailed insights into the health and mental status of their loved ones, and eventually understand them better). Apart from the relatives of older people, SHAPES also considers as informal caregivers assistants and volunteers, and other whether they receive a benefit or payment or not. Neighbours, young people and friends, among others, may volunteer to do simple tasks for older people (like walking the dog, taking out the garbage, shopping, or mowing the lawn). Through the digital solutions and services offered by SHAPES, the interaction with and support of older individuals by the community can become more organised and safer. On the one hand, this communication allows older people not to feel alone. On the other hand, many people provide assistance to older people that may have a tremendous impact on their daily lives. Additionally, SHAPES aims to provide guiding information, beneficial activities, and knowledge for informal caregivers. To do so, SHAPES must understand the needs and requirements of these carers. This process of understanding has been presented via the SHAPES Personas that are aimed at addressing formal and informal caregivers' needs.

6.1.3 Civil society

Civil society plays an essential role in expressing the needs and opinions of different groups of older people representing. At the same time, civil society is an invaluable channel to reaching, representing, informing older people, as well as facilitating the uptake and use of digital solutions. Thus, SHAPES aims to address the networks representing older people, organisations of persons with disabilities, health and care professionals' associations, voluntary organisations interested in the effectiveness of Active and Healthy Ageing policies and measures for the benefit of society.

Because SHAPES is interested in the views of older people, the consortium is also interested in the perspective of various representative organisations. These organisations include those that represent persons with disabilities, since they contribute to understand how SHAPES can ensure the full accessibility of the SHAPES solutions proposed and take into consideration specific needs and requirements to achieve the inclusion and participation of all.

6.1.4 Health and care service providers

The digital solutions and services tested during the SHAPES pilots will empower users via improved self-management. The solutions and services provide valuable insights into the health status (both mental and physical) of older people to assist health and care service providers with their work. Additionally, the increasing number of SHAPES services will broaden the portfolio of health and care providers and enlarge their capabilities to overcome the gap between preventing and treating diseases of older people. This approach enables better management and delays the onset of illness by monitoring and analysing vital signs and mental data, daily routine, and medication in a holistic real-time manner. Ultimately, data analysis will lead to improved preventive or intervening measures. Thus, health and care providers are key stakeholder types for SHAPES to involve in the project's actions and activities throughout the entire project's lifetime.

Importantly, SHAPES assesses both primary and secondary care aspects in the research in WP3, and the pilots and service testing and integration in WP6. These aspects will form an integral part for the ecosystem building.

6.1.5 Academia

Academia is substantially represented within the SHAPES consortium. The project's research results will provide the basis to understand the lifeworlds of older people, exploring and establishing the framework for ethics, legal aspects and governance

while assisting in the definition of requirements and recommendations for future digital solutions that foster active and healthy ageing.

As an open platform, SHAPES intends to provide anonymised data to academic institutions, thereby contributing to the implementation of secondary research even after the project's lifetime. Particularly, SHAPES considers the health research community (universities and RTOs) working on a wide range of scientific disciplines and innovative projects as relevant partners. The SHAPES partners are interested in building interdisciplinary networks to generate significant synergies and exponential benefits from the project.

SHAPES invites academic institutions and researchers to join the project's ecosystem of stakeholders and form liaisons that support the uptake and sustainability of its pilot and research outputs. Additionally, SHAPES enables and prompts its participating partners to join forces in producing academic content (such as scientific papers and articles), presenting the research results, and making use of the data produced by SHAPES. Namely, they address the relevance and impact of digital solutions to support and extend a life of quality to the ageing population. Furthermore, SHAPES will seek to inform health and care education and training organisations of its project conclusions on how to improve teaching and training of future health and care experts and workforce ensuring the right skillsets (technological skills, soft skills, and eHealth literacy) that are needed to use eHealth digital solutions and benefit the most from the efficiency and reduced workload such solutions can bring.

SHAPES publishes regularly the project's public deliverables which summarise the results and conclusions of the work performed, so that not only academia, but also civil society and governmental organisations may benefit from the project's knowledge, insights, and accumulated data.

6.1.6 Industry

Digital technology companies refer to developers and sellers of the digital solutions and services that SHAPES uses to facilitate active and healthy ageing. With the exception of not-for-profit organisations, these types of companies are interested in selling products and services that either provide high margins or products and services with which the companies can reach the highest possible market share. The ideal case for commercial companies is to achieve both ambitions.

On the one hand, digital technology companies are interested in efficient channels to gain insights about customer needs to develop customer- and solution-oriented products and services. Thus, SHAPES intends to share its expertise in the development of co-design techniques that, by connecting developers and users, are likely to generate products and services aligned with existing and future market needs.

On the other hand, companies are interested in efficient channels to reach customers to sell their products and services to. SHAPES aims to provide a channel to address these interests with a focus on both the needs of commercially acting and NGO-like companies as well as the needs of older individuals.

Through the use of Open Calls and the SHAPES Marketplace, the consortium aims to grow dynamically by inviting digital technology companies to join the SHAPES approach. To achieve a high-quality standard of digital solutions and services, digital technology companies must be attracted to SHAPES by compelling business models and/or platform-consortium-advantages.

In the second half of SHAPES, through WP7 activities and with the support of WP9, the consortium will address business modelling, cost-efficiency and sustainability schemes to achieve this goal.

6.1.7 Housing associations / house builders

As SHAPES aims to provide solutions and services to maintain the independent, active and healthy life in the homes of older people, we aim to connect with and inform housing associations and house builders about SHAPES' results and insights in the long-term. The goal is to facilitate the integration of SHAPES solutions and services in future housing for older people.

6.1.8 Digital Health Management / Networking organisations

Digital health management and networking organisations are at the centre of this process to engage with all stakeholders, as they represent and interconnect health regions, health clusters, and / or networks of both commercial and civil actors. Digital health management and networking organisations are important for gathering, condensing and spreading knowledge; initiating and managing projects; and bringing together the right parties to test and implement digital health innovations.

6.1.9 Insurance companies / Payers

Payers for healthcare services resemble the refinancing stakeholders of SHAPES and are at the centre of any business modelling activity. The analysis of healthcare systems of chosen EU countries in Task 3.1 shows that older people themselves, insurance companies, or governmental institutions can play the role of payers for digital health and care solutions. Thus, the business modelling that seek sustainability for SHAPES' commercial operations need to consider all the specificities of the different health and care systems in Europe or attempt to identify and address similarities. The willingness and ability to pay for desired services can vary according to differing systems and circumstances. (This lack of generalisability can make it

difficult to address the topic of reimbursement of digital tools/services, as it is not possible to do so in a general overarching way.).

6.1.10 Policy-makers

Policy-makers are responsible for formulating or amending policy to be carried out by executive institutions. Currently, policy-makers around the world, at EU level, Ministries and local levels[11] are struggling to address both the demographic change and ageing challenge while protecting the sustainability of health and social care systems. This endeavour highlights the positive potential of digital solutions and technologies to implement scalable and effective health interventions across the care continuum, ranging from health promotion and disease prevention policies to long-term care and end-of-life care. In this context, policy-makers are also responsible for setting the legal, economic, financial and commercial frameworks for nurturing digital health innovations.

SHAPES is aware of the role policy-makers play in the development of health and social care policies and programmes and how instrumental they are in the support of the SHAPES project and its vision, well-beyond the project's lifetime[12]. Purely as an example, the World Health Organisation has been a driving force, having developed an eHealth strategy toolkit intended to guide and support countries to develop national eHealth strategies.

Involving policy-makers as key stakeholders in SHAPES is likely bound to ensure that the SHAPES approach is aligned with current and future digital health regulatory frameworks and will co-evolve to fully exploit the potential of digital health services. At the same time, SHAPES may provide policy-makers with expert assistance on how to re-design regulatory frameworks with sufficient flexibility to enable (digital) development and innovation while protecting users.

Throughout the project i.e., in the short-term, the SHAPES consortium aims to approach policy-makers to form liaisons that support paving the way to the uptake and sustainability of the SHAPES digital solutions and services, as well as of the SHAPES research outputs regarding the lifeworld of older people (WP2), eHealth ethics (WP8), and governance and upscaling of integrated care (WP3). For the short to medium-term, SHAPES aspires to support the development of relevant policies in Europe to ensure adequate response from health and social care systems to support healthy ageing, build adequate long-term care systems, and enhance economic and social integration.

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[11] At the EU levels, these include the main policy Directorate-Generals in the European Commission, at the Member States' level the various Ministries, and at the local level municipalities.

[12] The relevant policy-making bodies for SHAPES are described in detail in D3.1.

6.1.11 Public authorities

Public authorities have the responsibility for defining governance and executing policies on the delivery of health and social care, while at the same time being capable to embed a multi-dimensional approach to the healthy and active ageing policies to be implemented. Indeed, adequately meeting the challenge of demographic change and ageing societies will require public authorities to bridge a number of important policy sectors, including healthcare, social care, employment, housing, transportation, and urban development.

First, SHAPES involves public authorities as key stakeholders in the discussion, definition and rolling-out of digital solutions for ageing-in-place and possess advanced knowledge on healthy ageing for the construction of economically and socially resilient communities. Second, SHAPES', in turn, provides knowledge and assists public authorities to consider structural reforms while reorienting social protection systems. (The structural reforms might promote economic growth, macroeconomic integrity, and a resilient labour market. The reorientation of social protection systems might emphasise poverty alleviation, adequate social security for all, and fiscal sustainability.) Third, SHAPES intends to provide guidance or recommendations on how public authorities may leverage digital solutions and technologies to support effective responses to the (negative) impacts of ageing societies.

6.1.12 European and governmental regulatory bodies

SHAPES intends to work collaboratively with European and national regulatory bodies to ensure that the SHAPES vision and results are duly compliant with laws, regulations and established rules, and may influence the implementation of new regulatory pathways to improve the delivery of sustainable health and social care. (Regulation is the main mechanism available to governments to influence the quality of care in a market economy. It sits at the crossroads of the state, provider organisations, and the experience of care itself.)

SHAPES aims to generate a novel ecological concept of activities to improve care and to support active and healthy ageing in-place. Hence, the role of regulators becomes crucial to understanding the environment in which older people, carers, and care service providers live and work in. SHAPES research aims to include the regulators' expertise to grasp a better understanding of regulation and both its prohibitive and facilitative effects, as well as map the current state of play in regulatory frameworks across Europe. This coverage will assist regulatory organisations to be aware of applicable regulations and become knowledgeable of the system changes needed to foster improved care delivery.

6.1.13 Standardisation Bodies

Standardisation bodies play an important role for SHAPES as they develop, define, and provide standards for digital health as tools for the seamless exchange of information, guidance for compatibility and ultimately, scalability and sustainability. These promoters of standards also enable the development of digital health systems by providing specifications and services that help to promote interoperability.

On one hand, the SHAPES platform and digital solutions adhere to standards such as FHIR to achieve interoperability of solutions and IoT (see D4.1). On the other hand, SHAPES aims to provide insights and recommendations (see T3.7) to be considered by standardisation bodies in the formation of future standards and frameworks to foster active and healthy ageing.

There are several promoters of standards for health information exchange. Important examples are Integrating the Healthcare Enterprise (IHE), the International Organization for Standardization (ISO) and Health Level 7 International (HL7).

SHAPES is also a driving force for a new global **ISO standard for smart multigenerational neighbourhoods**. Led by SHAPES partner AAA (The Agile Ageing Alliance), the objective is to reimagine homes and neighbourhoods that are more accessible and enabling, adapting to different stages of life and ever-changing human requirements. Over the past 18 months, AAA has invited leading practitioners, researchers, policy-makers, and thought leaders to engage in the SHAPE ecosystem, by sharing their practical advice and details of inspirational work in progress. Working in a spirit of open innovation, it is anticipated that partners will be willing to pool resources and share data and know-how beyond the constraints of the SHAPES funding agreement.

6.1.14 Healthcare-related European initiatives and infrastructures

eHealth Digital Service infrastructure (eHDSI) is implemented under the Connected Europe Facility (CEF) programme and aims to implement services and infrastructure using ICTs to enable cross-border healthcare services. It brings together a large and interdisciplinary community of experts from various Member States. The community aims to advance the semantic interoperability and bridge the semantic differences between the national healthcare terminologies of the various Member States. Further, it wishes to implement the services and network to facilitate the exchange of healthcare documents such as the patient summary and prescriptions. To this end, SHAPES will monitor the evolution of the standards and practices used in the eHDSI and in the future support the ones considered beneficial for the SHAPES ecosystem.

6.1.15 The media

The notion of media traditionally encompasses newspapers, magazines, radio and television, and currently involves the new internet-enabled social media platforms. It plays an important role in society, drastically influencing or shaping public opinion and raising public pressure. Often referred to as the fourth power, the media are co-responsible for the (in)formation process of the public concerning subjects of social relevance, thus also influencing the agenda for the policy-makers. The media have the power to highlight as newsworthy issues that concern the ageing society, the reality of health and social care economics, and the quality of health and social care delivery.

Whether mainstream or specialised, the media are instrumental for the SHAPES consortium in order to be fully aware of the different perspectives on the ageing phenomena and the impact of digital solutions in supporting healthy and active ageing in-place. In fact, media interventions can convey health-related information, including SHAPES research evidence, to the public, policy-makers, and health professionals, and can generate large communication campaigns that influence individual health behaviour. Current experiences in SHAPES (e.g., in recruitment for pilots) show that many older people still rely on print media to become informed. Thus, in the long-term, SHAPES needs to assess the best channels to reach and inform older people about the possibilities and benefits that SHAPES can offer. In terms of print media, this includes but is not limited to newspapers, brochures, flyers, and posters, as well as the appropriate distribution of media sources such as local newspapers and placement of brochures, flyers and posters at pharmacies, doctors' offices, libraries, public institutions etc.

At the same time, the media are a relevant vehicle to broadcast the SHAPES vision and results, reinforcing the European investment in innovation efforts to improve the ageing population's quality of life. By privileging cost-effective online media, the SHAPES Consortium aims to raise public awareness about several aspects of the ageing phenomena: the positive impact of digital solutions and technologies in active and healthy ageing, and stimulation of policy-makers and governments to take action on the building of sustainable health and care systems.

Annex 2: Stakeholder-oriented elevator pitches

Older People

Older people

> Where can I learn more about SHAPES?

Please have a look at shapes2020.eu or contact us directly here.

> How can I participate in SHAPES?

We invite you to join our Dialogue Workshops that we run every six months (shapes2020.eu/workshops). In those workshops, we present and discuss important topics with everyone interested to ensure the success of SHAPES.

Informal Caregivers

Informal Care Givers

> What is SHAPES?

SHAPES is a large research project that is running across 14 European countries. The SHAPES consortium consists of researchers, technology companies, civil society and public organizations that aim at helping older people to continue living healthy and active lives both at home and within their communities.

> How will SHAPES help older people and carers?

SHAPES researchers interview older people and care givers across several EU countries to get a broad understanding about their daily lives. At the same time, SHAPES aims to provide guiding information, beneficial activities, and knowledge for informal care givers. To do so, SHAPES needs to understand the needs and requirements of those carers.

> How will we be able to use these digital solutions?

We will create a central SHAPES platform to make our solutions available and to ensure that all solutions work together in a user-friendly way.

Civil Society

Health and Care Providers

Health and Care Providers

What kind of solutions does SHAPES offer?

SHAPES will establish services that range from illness prevention and social interaction up to managing diseases and rehabilitation. The digital services tested during the SHAPES pilots empower users through improved self-management. At the same time, our services provide insight into the health status of older people to assist the work of health and care service providers. This approach enables better management and delaying the onset of illness by monitoring and analysing vital and mental data, daily routine and medication in a holistic real-time manner. Ultimately, data analysis and resulting preventive or intervening measures will improve the use of resources in health and care, while contributing to better quality of life of older people using the technologies

How can health and care providers help SHAPES?

The increasing number of SHAPES services will broaden the portfolio of health and care providers and enlarge their capabilities to overcome the gap between preventing and treating diseases of older people. To do this efficiently, SHAPES consults health and care providers throughout the project to guarantee service uptake and long-term sustainability in the future. Help us create these solutions and services, together.
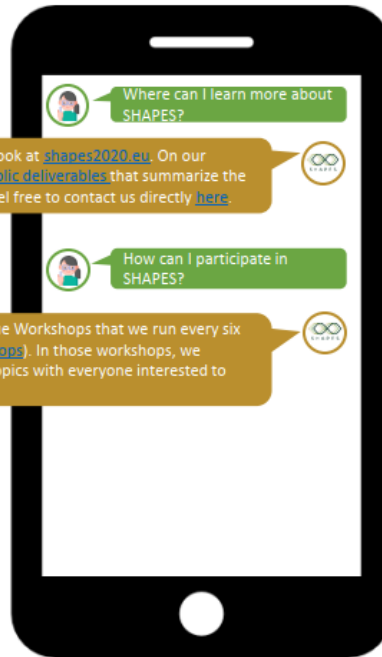
Health and Care Providers

Where can I learn more about SHAPES?

For more details, please have a look at shapes2020.eu. On our website, we also provide our public deliverables that summarize the results of SHAPES. Please also feel free to contact us directly here.

How can I participate in SHAPES?

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Academia

Industry

Industry

> **How will the eHealth industry be able to interact with SHAPES?**

The SHAPES project will provide an open and standardized one-stop-shop platform as a central gateway for older people to access digital solutions and services that facilitate healthy ageing. eHealth companies will be able to use this open platform to develop, test, and promote their digital health innovations. Through the academic-industry channels of the SHAPES consortium, companies will gain easy access to reach customers and users.

> **Can companies already work together with SHAPES?**

Yes, SHAPES broadens its expertise by inviting organisations in several funded open calls to co-develop and integrate innovative solutions to meet the challenges of the project. As a result, the SHAPES open calls provide opportunities for not only industry but also other organisations to integrate their solutions into a large ecosystem at European level.

Industry

> **Where can I learn more about SHAPES?**

For a more details, please have a look at shapes2020.eu. On our website, we also provide our public deliverables that summarize the results of SHAPES. Please also feel free to contact us directly here.

> **Are there any SHAPES events that I can attend?**

Yes, we invite you to join our Dialogue Workshops that we run every six months (shapes2020.eu/workshops). In those workshops, we present and discuss important topics with everyone interested to ensure the success of SHAPES.

Insurers / Payers

Insurances / Payers

What is SHAPES?

SHAPES is a large research project that is running across 14 European countries. The SHAPES consortium consists of 36 partners from academia, industry and civil societies that aim at helping older people to continue living healthy and active lives at home and within their communities.
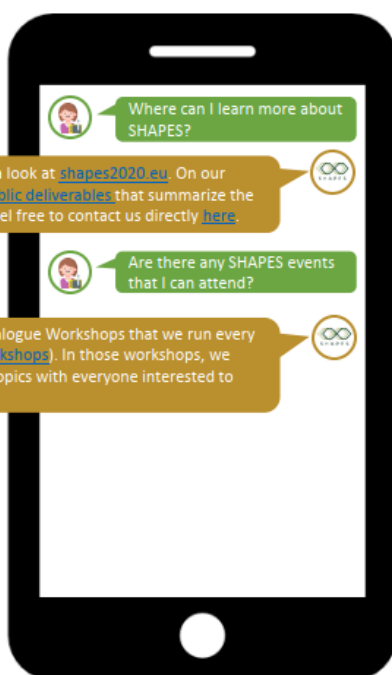
How will SHAPES help older people?

To provide helping services, our researchers interview older people across the EU to get a broad understanding of how their daily lives work. We involve older people in the development of digital health services to ensure a sustainable use of these solutions and to allow managing and preventing health conditions that may be more prevalent among older people. Thus, SHAPES fosters the co-development of new digital services and digital devices in a joint approach of technology companies, technology and service advisors as well as its users and beneficiaries. At the same time, our researchers are investigating how different European health and care systems operate. This research helps us to create a SHAPES platform that provides user-oriented services and to ensure that all these digital services work together in a user-friendly way.

Insurances / Payers

What kind of solutions does SHAPES offer?

SHAPES will establish services that range from illness prevention and social interaction up to managing diseases and rehabilitation. The digital services tested during the SHAPES pilots empower users via improved self-management. At the same time, the services provide insight into the health status of older people to assist the work of health and care service providers. This approach enables better management or delaying the onset of illness, by monitoring and analysing vital and mental data, as well as daily routine and medication, in a holistic real-time manner. This data forms the foundation for vast areas of research about the life world of older people and about the medical support needed for their healthy ageing. Data analysis and resulting effective preventive or intervening measures are supposed to improve the use of resources in health and care, while contributing to better quality of life of older people using the technologies.

Digital Health Management / Networking Organisations

Digital Health Management / Networking Organisations

What benefits does SHAPES aim to provide?
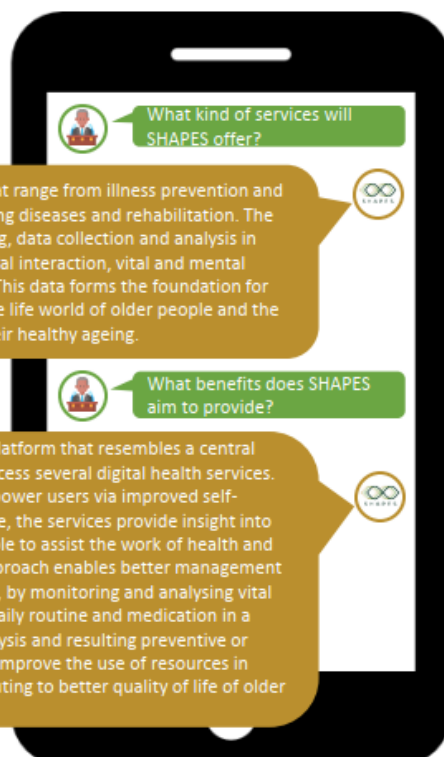
The SHAPES project will provide an open and standardized one-stop-shop platform that resembles a central gateway for older people, to access digital solutions and services to facilitate healthy ageing. These services range from illness prevention and social interaction up to managing diseases and improve rehabilitation. The underlying digital solutions allow monitoring, data collection and analysis in areas such as daily routine, social interactions, vital and mental status and medication intake. This approach creates a link between the self-management and information collection about the health status of older people and the work of health and care service providers. New capabilities for preventive or intervening measures will improve the use of resources in health and care, while contributing to better quality of life of older people using the technologies.

How will organizations interact with SHAPES?

Organizations will be able to use the SHAPES open platform to develop, test, and promote their digital health innovations in cooperation with the consortium and easily reach customers and users. This approach leads to a steadily growing portfolio of SHAPES services that help to overcome the gap between preventing and treating diseases of older people and facilitate active and healthy ageing.

Digital Health Management / Networking Organisations

Can organizations already take part in SHAPES?

Yes, SHAPES broadens its expertise by inviting organisations in several funded open calls to co-develop and integrate innovative solutions to meet the challenges of the project. As a result, the SHAPES open calls provide opportunities for organisations to integrate their solutions in a large ecosystem at European level.

What emphasis does SHAPES lay on networking activities?

The SHAPES consortium networks with all relevant stakeholders in the digital health and care ecosystem throughout the project to guarantee service uptake and long-term sustainability. Digital health management and networking organisations are in the centre of this process to engage with all stakeholders. Help us create the SHAPES solutions and services, together.

Policy-Makers

Policy Makers

> What kind of services will SHAPES offer?

SHAPES establishes services that range from illness prevention and social interaction up to managing diseases and rehabilitation. The digital services allow monitoring, data collection and analysis in areas such as daily routine, social interaction, vital and mental status, and medication intake. This data forms the foundation for vast areas of research about the life world of older people and the medical support needed for their healthy ageing.

> What benefits does SHAPES aim to provide?

SHAPES will provide an open platform that resembles a central gateway for older people to access several digital health services. The digital services aim to empower users via improved self-management. At the same time, the services provide insight into the health status of older people to assist the work of health and care service providers. This approach enables better management or delaying the onset of illness, by monitoring and analysing vital and mental status, as well as daily routine and medication in a holistic real-time manner. Analysis and resulting preventive or intervening measures will will improve the use of resources in health and care, while contributing to better quality of life of older people using the technologies.

Policy Makers

> How does the SHAPES approach involve policy makers?

SHAPES involves all relevant stakeholders in the development of digital health services to ensure sustainable use of these services and to allow managing and preventing health conditions that may be more prevalent among older people. Thus, SHAPES co-develops new digital solutions and digital devices in a joint approach with technology companies, technology and service advisors as well as its users and beneficiaries. It is essential that the SHAPES approach and the framework of regulations for digital health co-evolve to fully exploit the potential of digital health services. Throughout the project, the SHAPES consortium approaches policy makers to form liaisons that support the uptake and sustainability of its pilot and research outputs.

> Where can I learn more about SHAPES?

For a more details, please have a look at shapes2020.eu. On our website we also provide our public deliverables that summarize the results of SHAPES. Please also feel free to contact us directly here.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 857159

82

Annex 3: Results of Foresight Exercises 2 and 3

Results of Foresight Exercise 2

Results

‼ Smart Living Environment for Healthy Ageing at Home

- Sensors for water use on appliances and water taps
- Air quality measurement device: air-Q"
- eCare – Personalized Care Intelligence Platform
- Smart Textiles
- Authentication, Security and Privacy Assurance
- Security assessment as a Service
- Multitude of un-secure devices
- Environmental Sensing IoTs for Health
- "ELLI.Q" the connected companion for older adults
- Video consultation
- SMART Insulin Pens
- Anomaly Detection and Behavioral Analysis
- Support on using modern technologies
- eHealthPass – Chronic Disease self-management solution
- "ARI" healthcare assistant and companion

This project has received funding from the European Union´s Horizon 2020 research and innovation program under grant agreements No 857159.

[Technology] Sensors for water use on appliances and water taps

Description:

Water sensors on water using appliances and tap to measure and alert when water is running too long.

The sensors should be linked to an app or similar so that the alert can be sent to the older people and its care giver.

What needs does the technology or innovation satisfy?

These sensors could satisfy the need for even more security. These sensors would be another building block to create a smart home. Older people in particular gain a certain independence, as they can better control their environment and intervene if necessary, for example by turning off the tap if they have forgotten to do so. On the other hand, older people can be sure that if they are not able to intervene themselves, a trusted person (care giver) will receive an alert and will be able to take the appropriate steps.

Who are relevant actors in the EU?

- Household appliance manufacturers
- Providers of smart home products
- Building technology/services manufactures / providers

Example:

Sensor for measuring water use on a shower tap. The sensor is installed between the tap and the shower head.

Who uses the Technology or Innovation?

- Everybody how wants to have a smart home.
- Mainly older people
- Trusted person / care giver from the elderly

SWOT-Analysis

S   create smart home, increase security

W   new product, costs of market launch and roll out, different providers – different interfaces

O   increase the independence from older people
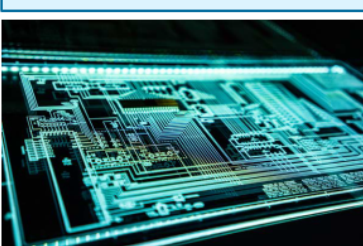
T   Costs

TRL

Themes   1

Picture Source: This project has received funding from the European Union´s Horizon 2020 research and innovation program under grant agreements No 857159.

[Technology] Air quality measurement device: air-Q

Description:

The air-Q is a powerful and intelligent indoor air quality measuring device that can measure, differentiate, monitor and analyze the components of the air, the indoor climate and environmental influences in real time. If unfavorable situations are detected, the associated smartphone app provides information on possible solutions. In addition, air-Q functions as an important data transmitter and modern smart home device.

What needs does the technology or innovation satisfy?

The air-Q evaluates the air in terms of health and physical as well as mental performance. The air-Q can also derive complex situations in care from the measurement data of different gas sensors. This can be used to support the nursing staff. In addition dangerous situations (cases of smoke/carbon monoxide, fire, low oxygen content) can be detected.

Accordingly, it supports the needs to guarantee safety, it helps in everyday life and supports nursing staff.

Who are relevant actors in the EU?

- Corant GmbH
- www.air-q.com
- Air standard providers

Who uses the Technology or Innovation?

- Everybody how wants to have a smart home.
- Mainly older people
- Care facilities / nursing homes

SWOT-Analysis

S create smart home, increase security

W new product, costs of market launch and roll out, different providers – different interfaces; able to handle an app

O increase the independence from older people, support nursing staff

T Costs

| TRL | |
| Themes | 1 |

Picture Source

[Technology] eCare – Personalized Care Intelligence Platform

Description:

eCare is a personalized care intelligence platform that, collecting and integrating health, well-being, quality of life and environmental data, empowers individuals to create smart living environments that promote healthy lifestyles and improve independent living conditions.
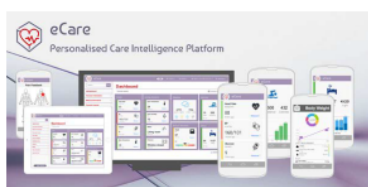
What needs does the technology or innovation satisfy?

- To allow individuals to manage their self-care and health condition
- To support care professionals in the remote monitoring of individuals' health and wellbeing parameters
- To build smart living environments

Who are relevant actors in the EU?

- Alcove (UK)
- Current Health (UK)
- Withings (FR)
- Philips Healthcare (NL)
- Medtronic (IE)
- Eurecat (SP)

Who uses the Technology or Innovation?

- (Older) Individuals attentive to own health, wellbeing and quality of life
- Patients requiring remote monitoring of their health and wellbeing condition
- Informal caregivers and care professionals

SWOT Analysis

S Combination of health, wellbeing and environmental data in a single platform; Full control of user data

W Dependence to third-party devices

O Constrained health budgets; eHealth; Ageing population; IoMT

T Large market players and partnerships

| TRL | 6-9 |
| Themes | 1 | 2 | 3 | 4 |

[Technology] Smart Textiles

Description:

Healthy ageing is much more than just physical wellbeing, important though that is. The motivation for adding electronic functions into textiles is in order to assist healthy ageing.

E-textiles can include a wide range of functions such as sensing, signal processing, lighting, wireless data transmission and actuation.

What needs does the technology or innovation satisfy?

- Wearable and comfortable EEG devices
- Wide range of different sensors (Inertial sensors, fabric electrodes, textile pulse oximetry, strain gauges, temperature sensors, moisture sensors, textile pressure sensors…)
- Strong batteries for long-term applications
- E-textile processing must be compatible with mass manufacture
- Data processing, storage and privacy issues

Who are relevant actors in the EU?

- Paul Hartmann AG, Germany
- Porcher Industries, France
- Getzner Textil, Austria
- Lenzi Egisto by FF, Italy

Picture: https://pixabay.com/de/illustrationen/transformation-netz-gehirn-netzwerk-4990455/

Who uses the Technology or Innovation?

- Fashion & Entertainment
- Medical
- Protection & Military
- Sports & Fitness
- Transportation

SWOT-Analysis

S   Avoid disease & disability, reduce risk factors, increase functional ability

W   Fake websites assuring service guarantees for products, limited sources for Advertising

O   Establishing Brands, Global Expansion, ..

T   Competitors, Web Spoofing, privacy, …

TRL

Themes   1

[Technology] Authentication, Security and Privacy Assurance

Description:

Numerous complete digital solutions require authentication for their users, devices or services that request connectivity. The Authentication, Security and Privacy Assurance Component (ASAPA) consolidates this in one simple solution for authenticating each of the afore-mentioned entities with respect to the latest protocols and guidelines.

Key Points:

- Secure Stateless tokens
- IoT Friendly
- End-to-end encryption
- Single Sign On Interface
- Modular Architecture

Who are relevant actors in the EU?

Any SHAPES user, digital solution or device that requires authentication.

Example:

When a user or a device requests to use a Digital Solution inside the SHAPES platform, it will require authentication. This will be achieved through this component utilizing a secure connection to minimize compromises.

[Technology] Security assessment as a Service

Description:

Considering the enormous cohort of devices connected to the internet today, it is extremely challenging to verify each individual entity's security integrity, especially manually. Thus, we propose SAaaS to automatically assess any entity connected to the SHAPES network, to minimize compromises and ensure secure interaction between entities.

Key Points:

- CVSS scoring
- Multiple report formats
- Monitors the entire network
- Segregates entities based on their CVSS score

Who are relevant actors in the EU?

The SHAPES network administrator and all network-enabled entities connected to the SHAPES network.

Example:

An extensive number of individuals are not cyber-security aware, with no indication if their device is secure. SAaaS is responsible to assure network administrators and SHAPES users of a secure internal SHAPES network.

[Influencing Factor] Multitude of un-secure devices

Description:

SHAPES Platform serves a considerable amount of users, devices or services of a healthcare ecosystem. thus, administrators need to be aware that all these entities are secure and not compromised. Due to the large numbers and wide heterogeneity of the devices within a healthcare environment, vulnerability assessment poses several challenges. Many studies indicate that even network security experts can fail to identify vulnerable or even compromised devices.

Facts and figures

According to ENISA's threat landscape, threats like malware or botnets are sitting on the top of the list, with malware having the first spot. Malware can steal information without triggering any alert, while botnets can stay hidden by not doing anything, and when required, act as a whole and invoke substantial damages.

Future Influences:

Networks Administrators and Cyber-Security experts will be relieved of investigating and monitoring each network entity by automating the Security Assessment of each of these entities.

Research:

In [1], the authors propose an automated security assessment approach in a healthcare IoT environment. Depending on the CVSS score of each entity, they block or limit the accessibility of any unsecure or compromised entities from the main network.

References:

E. Markakis, Y. Nikoloudakis, E. Pallis and M. Manso, "Security Assessment as a Service Cross-Layered System for the Adoption of Digital, Personalised and Trusted Healthcare," 2019 IEEE 5th World Forum on Internet of Things (WF-IoT), Limerick, Ireland, 2019, pp. 91-94, doi: 10.1109/WF-IoT.2019.8767249.

[Technology] Environmental Sensing IoTs for Health

Description:

IoT technologies have sprung over few last decades , many of which focusing on monitoring environment in the context of possible negative effects on human wellbeing and health. Such platforms, some proprietary and other ones open and public (e.g. European Environmental Agency), offer gathering air and water pollution with various types of substances. Concentrations of such pollutants can be correlated with adverse effects on (especially) sensitive user groups and elderly.

What needs does the technology or innovation satisfy?

Primarily ability to detect conditions that might cause mild or even severe adverse health effects, such that sensitive user groups could avoid exposure during increased pollution times, such as asthma and pulmonary chronic diseases.

Who are relevant actors in the EU?

There are number of technology providers of both sensors/detectors and IoT platforms, including those controlled by public national (National Ministries of Health in EU Member States) and EU authorities (e.g. European Environmental Agency gathering hourly and yearly concentration data from national authorities).

Who uses the Technology or Innovation?

Such technologies have been used not only in e-Health, but nearly in every domain. Applicability to e-Health has been recognized since decades, while advanced in both sensing and IoT platforms combined with advances in health modelling in correlation with external factors made such technologies even more applicable.

SWOT-Analysis

S   already available from numerous providers, in many cases offering data for free

W   too many technologies with limited interoperability, hence room for technologies like SymbIoTe

O   clear needs rom e-Health

T   none really

TRL	6-9

Themes	1	2	3	4	5	6	7

[Technology] "ELLI.Q" the connected companion for older adults

Description:

ElliQ is specially designed for older adults, giving them everything they need to stay sharp, connected and engaged. ElliQ creates a magical relationship with each individual user, providing older adults with a device that they truly want to converse and interact with. ElliQ is equipped with several easy-to-use baseline features that have already been validated and accepted by older adults – some of the most popular include: Wellness, Health reminders, Cognitive games, Curated videos, …..

What needs does the technology or innovation satisfy?

- To allow individuals to manage their everyday life
- To help families with elderly people living alone
- To build smart living environments

Who are relevant actors in the EU?

Intuition Robotics

Who uses the Technology or Innovation?

(Older) Individuals attentive to own health, wellbeing and quality of life

SWOT-Analysis

S   pro-active AI initiated Interactions and easy to use

W   New product, need to be validated on a large scale

O   clear demand of such a product

T   none really

TRL	

| Themes	1	2		4		6	

[Technology] Video consultation/ Virtual visits

Description:

Video call solutions offer digital face-to-face communication between persons in general whereas video consulting platforms are intended to be used between Health Care professionals (HCP) and other HCPs or patients to support the care process.

Video consultations, however, generally meet stricter data protection requirements according to GDPR, compared to video calls.
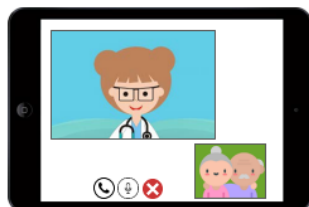
What needs does the technology or innovation satisfy?

- Maintain contact with Health Care Professionals and family when being immobile or living far away
- Reducing Loneliness and social isolation
- Reducing risks of COVID-19 through direct face-to-face contact

Who are relevant actors in the EU?

Video call:

- Skype, Zoom, MS Teams, Facetime, WhatsApp, etc.

Video consultation:

- Various (partly certified) providers for National Health Care systems (outpatient and inpatient)

Who uses the Technology or Innovation?

- Health Care Professionals (physicians, nurses, psychotherapists, etc.)
- People of all ages
- healthy and impaired people

SWOT-Analysis

S   technical requirements mostly existing

W   Handling may be difficult for older people; adequate instruction required

O   maintain face-to-face contact to HCPs and family in times of COVID-19

T   Areas with poor technical conditions could be excluded

TRL	9-10

Themes	1

This project has received funding from the European Union´s Horizon 2020 research and innovation program under grant agreements No 857159.

[Technology] SMART Insulin Pens

Description:

Devices such as smart insulin pens have the potential to record the amount and timing of each insulin dose. The pens are often linked to Bluetooth enabled mobile apps that can track insulin, make dosing recommendations, and be linked with HCPs and caregivers.

What needs does the technology or innovation satisfy?

- Can improve adherence
- Assist in monitoring insulin and blood sugar levels.
- Assist with correct dosing.

Who are relevant actors in the EU?

Medtoronic. (Partner in Gatekeeper project, which is in the Health and Care Cluster).

Who uses the Technology or Innovation?

- Older people
- Health care professionals
- Informal Caregivers

SWOT-Analysis

S   Easy to use. Assists with adherence

W   May have a high cost initially

O   Demand for products

T   N/A

TRL	

Themes	1	2	3	4	5	6	7

Picture Source
This project has received funding from the European Union´s Horizon 2020 research and innovation program under grant agreements No 857159.

[Technology] – Support on using modern technologies

Description:

Technology has come a long way over the last 20 years. Internet, for example, opened many doors, making it easier for everyone to work, learn, chat with their friends and families, shop, etc.

Young people easily adapted to use modern technologies, but older adults are generally less acceptant to use new technologies, because use technology is not natural for them. To overcome this situation, it is crucial that technology providers design user friendly solutions, engage with the end-user during the design phase and include videos/tutorials for older users.

What needs does the technology or innovation satisfy?

Easy to use technology with the support of tutorials, videos with examples on how to use the technology and the possibility to have support from the technical team, in case the user needs.

Who uses the Technology or Innovation?

Such technologies are useful for every domain, specifically in eHealth. Older adults can interact with their carers, monitor actively their health, perform rehabilitation exercises and memory games.

Who are relevant actors in the EU?

There are number of technology providers of eHealth in Europe, from SMEs to big players, but not all of them consider the opinion/needs of older users, who are not familiar to the technology.

SWOT Analysis

S   More acceptance and engagement from older users

W   More investment needed initially

O   Ageing population adherence/acceptance

T   N/A

TRL 6-9

Themes 1 2 3 4 5 6 7

This project has received funding from the European Union´s Horizon 2020 research and innovation program under grant agreements No 857159.

[Technology] eHealthPass – Chronic Disease self-management solution

Description:

eHealthPass is an eHealth solution that empowers the patients to self-manage their chronic disease and conditions (such as Diabetes and Chronic pain).

It provides self –management tools, collaboration between patient and doctor, connection with a range of IoT device and data privacy.

What needs does the technology or innovation satisfy?

- Allows chronic diseases patients to self-manage their condition
- Allows the Health Care Professionals (HCP) to remotely monitor the progress of their patients

Who uses the Technology or Innovation?

- Patients with chronic diseases (such as diabetes or chronic pain)
- Health Care Professionals
- Informal caregivers
- Patient Associations

Who are relevant actors in the EU?

- Hospitals and healthcare centers in Spain, Portugal, Italy, France, Sweden, Turkey that have already used the eHealthPass solution.
- Patient associations such as the LIRE - Spanish Rheumatological League and ELEANA - Greek association for patients with rheumatological conditions
- Research partners such as the Aristotle University of Thessaloniki

SWOT Analysis

S   Empowers patients to self-manage their condition, users are owners of their data, brings the stakeholders in the healthcare domain in one place

W   Healthcare regulatory policies in each country.

O   Digitalization of healthcare, 5g network

T   Competition

TRL 6-9

Themes 1 2 3 4 5 6 7

This project has received funding from the European Union´s Horizon 2020 research and innovation program under grant agreements No 857159.

[Technology] – "ARI" healthcare assistant and companion

Description:

As a social robot ARI can serve as a therapeutic assistant at hospitals, care-homes or user homes to foster social communication, reduce loneliness, stress, and increase overall user entertainment. In addition, it can carry out the tasks including hospital reception, patient registration. ARI can also be integrated with other devices -such as smart devices, biosensors, smartphones- for health monitorization and providing personalized feedback.

What needs does the technology or innovation satisfy?

- To reduce medical care cost by offering more in-home care
- To reduce loneliness and increase overall user enjoyment
- To free up employees so they may carry out higher-value activities
- Reduce caregiver workload
- Customer and employee engagement, enhancing their experience

Who uses the Technology or Innovation?

Older people with early-stage dementia or mild cognitive impairment, who live in sheltered apartments, and who can still live independently.

Hospitals, care-homes or user homes

Who are relevant actors in the EU?

- Softbank Robotics
- LuxAI
- Aisoy Robotics
- PAL Robotics
- KOMPAÏ

SWOT Analysis

S   pro-active AI initiated Interactions and easy to use

W   New product, need to be validated on a large scale

O   Less strain on employees

T   Costs, user acceptance

TRL	6-9

| Themes | 1 | 2 | | 4 | | 6 | |

Results of Foresight Exercise 3

Results

SHAPES

! Improving In-Home and Community-based Care

- Video Consultation
- Smart audio analysis
- Contactless Vitaldata Monitoring
- Anomaly Detection Systems
- AHA Business Clusters
- Inertial Measurement Units
- Smart Fitness Wearables
- eCare - Monitoring Physical Activity
- Smart Sleep Trackers
- eCare - Monitoring Sleep Quality
- SMART Canes
- 4G IoT Medical Devices
- A thermal, radar, and sound monitoring system for Senior Safety

[Technology] Video Consultation

Description:

Video consultation is a appropriate technical platform to consult and care for patients without contact. Therapy, counselling and aftercare consultations are just as possible as the normal regular visit or obtaining a second opinion.

Video-based, digital consultation for doctors and patients

What needs does the technology or innovation satisfy?

Convenient and barrier-free access to quality medical care, even in the case of geographical or mobility limitations, as well as in pandemic situations.

Who are relevant actors in the EU?

- CCS (Provider) and MedicalSyn (TecPartner, Development)
- Other provider from video consultation

Who uses the Technology or Innovation?

- Patients
- Doctors
- Care provider

SWOT-Analysis

S easy handling; resource-efficient; no data storage, certified; increase safety

W internet connection necessary; periodic certification necessary - costs

O can be used in the entire medical and care sector

T

TRL | Themes 2

Picture-Source:

[Technology] Smart audio analysis

Description:

An App on a wearable (smartwatch) for permanent acoustic monitoring and coupling to the smartphone of the care receiver for recommendations and to the smartphone of the caregiver for an alert if necessary.

What needs does the technology or innovation satisfy?
- Healthy and safe ageing
- Fall detection; sleep monitoring (Snoring, sleep apnea); doorbell recognition; appliances recognition e.g.

Who are relevant actors in the EU?
- TU Chemnitz and other developer and engineers

Who uses the Technology or Innovation?
- Older people
- Care receiver
- Caregiver

SWOT-Analysis

S   easy handling; automatic recognition, recommendations and alerts; increase safety

W   internet connection necessary

O   increase the independence from older people, support nursing staff

T   incorrect alerts

| TRL | |
| Themes | 2 |

Picture: Source

[Technology] Contactless Vitaldata Monitoring

Description:

Vitaldata monitoring via everyday objects for example the bathroom mirror.

What needs does the technology or innovation satisfy?
- Monitoring the vitaldata automatically and contactlessly;
- Increase the safety and the independence from older people

Who are relevant actors in the EU?
- Smart home provider

Who uses the Technology or Innovation?
- Especially elderly people
- But also everybody

SWOT-Analysis

S   create smart home ,increase security

W   new product, costs of market launch and roll out

O   increase the independence from older people, support nursing staff
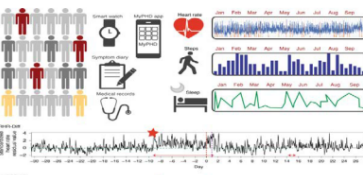
T   costs

| TRL | |
| Themes | 2 |

Picture: Source

[Technology] Anomaly Detection Systems

Description:

Anomaly Detection Systems are generated by applying AI techniques to biometric data in order to predict decompensations or overall changes in an older adult's health.

Source: https://www.nature.com/articles/s41551-020-00640-6

TRL	2-7

What needs does the technology or innovation satisfy?

Given that the majority of healthcare costs are incurred during the later years of a person's life, it is important to manage any chronic conditions and identify decompensations at an early stage in order to improve individual's healthcare outcomes and quality of life while simultaneously limiting costs.

SWOT-Analysis

- S   Real-time results, enables early intervention, non-invasive
- W   Dependency on technology, wearables require charging/ maintenance, correct use of wearables
- O   Improve older adults' QoL and healthcare outcomes, decrease healthcare costs
- T   Manages sensitive biometric data, requires additional security

Themes	2

Who are relevant actors in the EU and who uses the Technology or Innovation?

Source: https://www.pnqaaa.com/detail/1636202

This project has received funding from the European Union´s Horizon 2020 research and innovation program under grant agreements No 857159.

[Influencing Factor] AHA Business Clusters

Description:

Nowadays, the cooperation between business, research, and educational systems based on the open innovation principles in R&D&I processes represents strategic elements for sustainable and competitive development. Active and Healthy Ageing (AHA) is a societal challenge shared by all European countries, but it is also an opportunity to cluster industries (digital, medical, care…) around the AHA sector to be more innovative and therefore to obtain greater global competitiveness.

Facts and figures

According to the European Panorama of Clusters and Industrial Change 2020, there are 2.950 regional industrial clusters across Europe. Digital Industries and Medical Devices are catalogued as high-tech emerging cluster industries, which employs more than 15 million people in Europe. Both industries are complementary to reach further technological deployment to ensure high levels of AHA, through using efficiently the available European resources, both tangible (financial, infrastructure, human resources…) and intangible (knowledge, values…).

Research:

- Innovative Solutions for independent living (SIVI) (Spain).
- Healthy Ageing Innovation Cluster (HAIC) (Scotland).
- Healthy Ageing Network Northern Netherlands (HANNN) (The Netherlands)

Future Influences:

- European Innovation Partnership on Active and Healthy Ageing.
- The silver economy is expected to grow at around 5% a year from € 3.7 trillion in 2015 to € 5.7 trillion in 2025.
- Connection ties between the European agents involved in the AHA through the different EU financed projects and initiatives and strong Knowledge scientific base about AHA.
- Digital technologies bring the opportunity to share information and data without geographical barriers.

References:

https://ec.europa.eu/eip/ageing/about-the-partnership_en.html
https://unece.org/population/active-ageing-index
https://www.clustersivi.org/
https://www.dhi-scotland.com/
https://www.hannn.eu/over-hannn/europa

This project has received funding from the European Union´s Horizon 2020 research and innovation program under grant agreements No 857159.

[Technology] Inertial Measurement Units

Description:

Inertial Measurement Units (IMUs) are motion sensors that integrate accelerometers, gyroscopes and magnetometers to measure acceleration, impacts and orientation of the object or person where they are attached. They are nowadays integrated in many devices such as Smart phones, watches and wrist bands.

What needs does the technology or innovation satisfy?

- Level of activity monitoring
- Activity recognition
- Fall detection
- Gait analysis
- Detection of early signs of dementia
- Rehabilitation monitoring

Who are relevant actors in the EU?

- Bosch is one of the market leaders of IMU devices

Who uses the Technology or Innovation?

- Aging people
- Care giver of elderly
- Therapists
- Vehicles and aerospace industries
- Transportation and logistics (integrity of goods)

SWOT-Analysis

S   Easy to integrate as a wearable and low cost

W   Communication range and battery life

O   Non-obstrusive monitoring of people activity and potential accidents

T   Integration issues with technological platforms

TRL	6-9

| Themes | 1 | 2 | | 5 | 6 |

[Technology] Smart Fitness Wearables

Description:

Smart fitness wearables refer to the set of activity bands, watches and rings that keep track of the individuals' steps, heart rate and activity level. They provide several workout modes, register exercise sessions with steps counted, distance and calories burned, and also offer tools to monitor overall health and wellbeing.

What needs does the technology or innovation satisfy?

- Monitoring and tracking of physical activity parameters
- Monitoring of physical rehabilitation processes
- Execution of care plans involving a physical activity component

Who are relevant actors in the EU?

- Oura (FI)
- Polar (FI)
- Withings (FR)
- Most relevant actors in this sector come from outside of the EU: Fitbit (US), Apple (US), Garmin (US), Xiaomi (PRC), Huawei (PRC) and Samsung (SK)

Who uses the Technology or Innovation?

- (Older) Individuals aware of the importance to adopt an active lifestyle
- Informal caregivers
- Care professionals attentive to the importance of physical activity in individual health and wellbeing

SWOT-Analysis

S   Low cost; Easy-to-use; Unobtrusive

W   Short battery life; inaccurate data measurements

O   IoMT; Rising awareness of active lifestyle; Growing geriatric population;

T   Concerns on privacy; Rapid technology changes; Lack of skilled technicians

TRL	9

| Themes | 1 | 2 | 3 | 4 | | 6 |

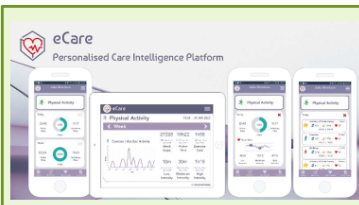## [Technology] eCare - Monitoring Physical Activity

Description:

eCare is a personalized care intelligence platform that combines health and wellbeing information, including physical activity data, to help individuals establish active and healthy lifestyles and improve their quality of life. Physical activity is key for good health outcomes and relevant for evidence-based interventions.

What needs does the technology or innovation satisfy?

- To allow individuals to monitor their physical activity and manage their self-care and health condition
- To support care professionals in the remote monitoring of individuals' physical activity parameters
- To build active and healthy lifestyles

Who are relevant actors in the EU?

- Oura (FI)
- Polar (FI)
- Withings (FR)
- Most relevant actors in this sector come from outside of the EU: Fitbit (US), Apple (US), Garmin (US), Xiaomi (PRC), Huawei (PRC) and Samsung (SK)

Who uses the Technology or Innovation?

- (Older) Individuals attentive to own health, wellbeing and quality of life
- Patients requiring remote monitoring of their physical activity and health and wellbeing condition
- Care professionals monitoring patients' physical activity

SWOT-Analysis

- S Combination of physical activity data with health, wellbeing and environmental data in a single platform; Full control of user data
- W Dependence to third-party devices
- O IoMT; Rising awareness of physical activity relevance; Ageing population;
- T Large market players and partnerships

TRL	6-9

| Themes | 1 | 2 | 3 | 4 | | | |

This project has received funding from the European Union´s Horizon 2020 research and innovation program under grant agreements No 857159.

[Technology] Smart Sleep Trackers

Description:

eCare is a personalized care intelligence platform that combines health and wellbeing information, including physical activity data, to help individuals establish active and healthy lifestyles and improve their quality of life. Physical activity is key for good health outcomes and relevant for evidence-based interventions.

What needs does the technology or innovation satisfy?

- Monitoring and tracking of sleep sleep-related health concerns (e.g., sleep apnea, insomnia, snoring)
- Supporting care professionals in the screening for sleep disorders, stress, anxiety, or other mental health concerns

Who are relevant actors in the EU?

- Oura (FI)
- Polar (FI)
- Withings (FR)
- Most relevant actors in this sector come from outside of the EU: Fitbit (US), Apple (US), Beautyrest (US), Garmin (US), Xiaomi (PRC)

Who uses the Technology or Innovation?

- (Older) Individuals attentive to own health, wellbeing and quality of life
- Care professionals screening for sleep disorders -related concerns, stress, anxiety, or other mental health concerns

SWOT-Analysis

- S Easy-to-use; Different brands and price ranges
- W Steep learning curve (complex data); Connection to home Wi-Fi
- O eHealth; IoMT;
- T New market sector: lack of awareness on sleeping conditions and available wearables for sleep tracking

TRL	6-9

| Themes | 1 | 2 | 3 | 4 | | | |

This project has received funding from the European Union´s Horizon 2020 research and innovation program under grant agreements No 857159.

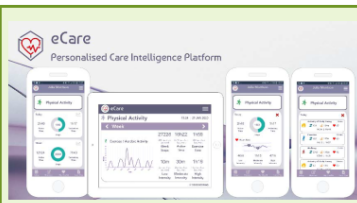## [Technology] eCare - Monitoring Sleep Quality

Description:

eCare is a personalized care intelligence platform that combines health and wellbeing information, including sleep data, to help individuals establish active and healthy lifestyles and improve their quality of life. Sleep quality is key for good health outcomes and relevant for evidence-based interventions.

What needs does the technology or innovation satisfy?

- To allow individuals to monitor their sleep and manage their self-care and health condition
- To support care professionals in the remote monitoring of individuals' sleep quality parameters
- To build active and healthy lifestyles

Who are relevant actors in the EU?

- Oura (FI)
- Polar (FI)
- Withings (FR)
- Most relevant actors in this sector come from outside of the EU: Fitbit (US), Apple (US), Beautyrest (US), Garmin (US), Xiaomi (PRC)

Who uses the Technology or Innovation?

- (Older) Individuals attentive to own health, wellbeing and quality of life
- Patients requiring remote monitoring of their sleep and health and wellbeing condition
- Care professionals monitoring patients' sleep

SWOT-Analysis

S   Combination of sleep data with health, wellbeing and environmental data in a single platform; Full control of user data

W   Dependence to third-party devices

O   IoMT; Rising awareness of physical activity relevance; Ageing population;

T   Large market players and partnerships

TRL		6-9

| Themes | 1 | 2 | 3 | 4 | | | |

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## [Technology] SMART Canes

Description:

A cane that uses smart technology aims to help visually-impaired people navigate their surroundings. The devices can be equipped with built-in speakers, smartphone integration, and sensors that send vibrations to warn users of obstacles up ahead.

What needs does the technology or innovation satisfy?

- Enhanced mobility

Who are relevant actors in the EU?

- Mainly in project stage at EU level
- WeWalk in USA
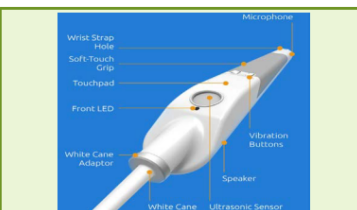
Who uses the Technology or Innovation?

- Visually impaired people

SWOT-Analysis

S   Easy to use. Assists with navigation

W   May have a high cost initially

O   Demand for products

T   Poor wifi connection in some areas

TRL		

| Themes | | | | | | | |

This project has received funding from the European Union´s Horizon 2020 research and innovation program under grant agreements No 857159.

[Technology] 4G IoT Medical Devices

Description:

IoT Medical Devices allows for seamless measurement and transfer of the vitals of patients to the Health Care Professionals, thereby enabling continuous and remote monitoring of the patients' condition. 4G alleviates the need for Bluetooth or smartphone integration rendering the use of such devices simpler for older individuals.

What needs does the technology or innovation satisfy?

- 4G IoT medical devices simplifies drastically their use from older individuals who are not very competent with technology.
- Allows the Health Care Professionals (HCP) to remotely monitor the progress of their patients

Who are relevant actors in the EU?

- IoT Medical device manufacturers
- Telecom providers
- Digital health products manufacturers
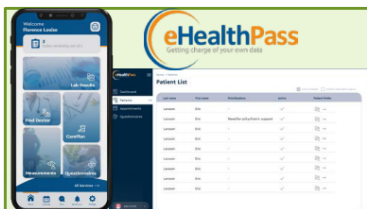
Who uses the Technology or Innovation?

- Patients with chronic diseases (such as diabetes or chronic pain)
- Health Care Professionals
- Informal caregivers

SWOT-Analysis

S Empowers elderly people and patients not competent with technology to use IoT medical devices.

W Requires cellular network coverage to operate

O Digitalization of healthcare, 5G network

T Poor cellular network coverage in remote areas

TRL		6-9

| Themes | | | | | | | |

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreements No 857159.

[Technology] A thermal, radar, and sound monitoring system for Senior Safety

Description:

It provides a robotic monitoring system for the large population of seniors and patients who live by themselves, providing an alert to request help whenever they might be in potentially dangerous situations. It doesn't require human intervention for monitoring, which encourages independence. The system allows the user to request help if needed through voice activation, and it uses artificial intelligence sensors, which provide human-like monitoring. The device provides: Body temperature analysis; Sleep analysis; Danger detection; Abnormal behavior detection.

What needs does the technology or innovation satisfy?

- Home safer for seniors

Who are relevant actors in the EU?

- Aeyesafe

Who uses the Technology or Innovation?

- (Older) Individuals at home,
- Caregivers, family

SWOT-Analysis

S Interaction using voice, AI intelligence and easy to use

W none really

O clear demand of such a product

T none really

TRL				

| Themes | | | | 1 | 2 | 5 |

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreements No 857159.