

Impact of EU-Funded Research and Innovation on ICT for Active and Health Ageing

The Top 25 Most Influential Projects



FINAL REPORT

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OUTSIGHT
Think out of the Box

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Abstract (EN)

Ageing poses one of the biggest economic and social challenges for this century. It is estimated that by 2025, more than 20% of Europeans will be 65 or over¹. To respond to the potential challenges that ageing presents for the future and to ensure that the necessary framework is in place to help Europe take advantage of the opportunities that the sector can provide, the European Commission (EC) has invested a great deal of resources into research and innovation (R&i) projects in this field.

The main aim of this tender is to identify and consolidate the key findings from the R&i projects addressing ICT for Active and Healthy Ageing (AHA) funded under FP7, the Competitiveness and Innovation Programme (CIP) and the Horizon 2020 Research and Innovation Programme. A selection of the top 25 most relevant projects has been identified in agreement with the EC to extract the key findings on results achieved. The study results will be used for the further development of priorities under the EU Horizon 2020 Societal Challenge 1 Health, demographic change and wellbeing¹ and as input for the further implementation of the policy initiative on a 21st century blueprint of digital solutions for AHA.

Abstract (FR)

Le vieillissement pose l'un des plus grands défis économiques et sociaux de ce siècle. On estime que d'ici 2025, plus de 20% des Européens auront 65 ans ou plus. Pour répondre aux défis potentiels que le vieillissement représente pour l'avenir et pour veiller à ce que le cadre nécessaire soit en place pour aider l'Europe à tirer parti des opportunités que le secteur peut offrir, la Commission européenne (CE) a investi beaucoup de ressources dans des projets de recherche et d'innovation (R & I) dans ce domaine.

L'objectif principal de cette étude est d'identifier et de consolider les principales conclusions des projets R & I traitant des TIC pour le vieillissement actif et en bonne santé (AHA) financés dans le cadre du septième programme-cadre (FP7), du Programme pour la compétitivité et l'innovation (CIP) et du programme de recherche et d'innovation Horizon 2020. Une sélection des 25 projets les plus pertinents a été identifiée en accord avec la CE pour extraire les principales conclusions sur les résultats obtenus. Les résultats de l'étude seront utilisés pour le développement des priorités dans le cadre du défi sociétal 1 Santé, changement démographique et bien-être du Programme Horizon 2020 et comme contribution à la poursuite de la mise en œuvre de l'initiative politique sur un plan du 21^e siècle sur les solutions numériques pour l'AHA.

¹ www.ec.europa.eu/health/ageing/policy/index_en.htm

ABBREVIATIONS

ARI – Acute Respiratory Infections

AHA – Active and Healthy Ageing

CIP – Competitiveness and Innovation Programme (2007–2013)

COPD - Chronic Obstructive Pulmonary Disease

EIP on AHA – European Innovation Partnership on Active and Healthy Ageing

FP7 – 7th Framework Programme (2007–2013)

HORIZON 2020 – EU Research and Innovation Programme (2014–2020)

ICT – Information and Communication Technologies

IPR – Intellectual Property Rights

MAFEIP - Monitoring and assessment Framework for the EIP on Active and Healthy Ageing

MAST – Model for the Assessment of Telemedicine

MCI - Mild Cognitive Impairment

PCP – Pre-Commercial Procurement

RAIL – Risks, Actions, Issues, Lessons learnt

RCT – Randomised Control Trial

R&I – Research and Innovation

RTD – Research and Technological Development

TRL – Technological Readiness Level

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INTRODUCTION

Ageing poses one of the biggest economic and social challenges for this century. It affects most EU countries and will have an impact on most policy areas. It is estimated that **by 2025, more than 20% of Europeans will be 65 or over, with a strong increase in numbers of over-80s²**. By 2060, one in three Europeans will be aged 65 or over. Furthermore, the ratio of working people to the “inactive” others will shift from 4 to 1 today, to 2 to 1 by 2060.

The different healthcare requirements of older people will require a shift in health systems so that they will be able to provide adequate care whilst remaining financially sustainable. If these changes are not made, we will not have the money or the people to guarantee a good and healthy life for all. However, it is not all doom



and gloom, active and healthy ageing also offers a great deal of opportunities for the future. At present,

DEM@CARE Tablet Application for Clinicians, DEM@CARE Project (FP7 Programme). Source: Photo courtesy of the Centre for Research and Technology - Information Technologies Institute, Thessaloniki

Europeans over the age of 65 have a spending capacity of over €3,000 billion³. Healthy ageing also offers several benefits for people such as the ability to travel, to work for longer, to learn new things and to prepare homes for independent living in the future.

Active and healthy ageing offers many opportunities for Europe that include the development of the appropriately named “silver economy” offering new highly skilled tech jobs and also opportunities for lower qualified people to re-train and gain new skills. The **development of new ICT products and services**, and a **market for the creation of a multitude of new SMEs and startups** are other opportunities that can be seen.

Europe has the capacity to benefit from these opportunities, but only if we are prepared to change our systems for health and social care and take advantage of digital innovation in the sector.

To respond to the potential challenges that ageing presents for the future and to ensure that the necessary framework is in place to help Europe take

² www.ec.europa.eu/health/ageing/policy/index_en.htm

³ Innovation for Active and Healthy Ageing. European Summit on Innovation for Active and Healthy Ageing, Brussels, 9-10 March 2015 Final Report, Pg14-16: www.ec.europa.eu/research/innovation-union/pdf/active-healthy-ageing/ageing_summit_report.pdf

advantage of the opportunities that the sector can provide, **the European Commission has invested a great deal of resources into research and innovation (R&i) projects in this field.** In fact, active and healthy ageing (AHA) has enjoyed an increasing presence over recent years in the key R&i European initiatives.

The aim of this Final Report is to present the results of the work carried out through the tender SMART 2016/ 0072 "**Communicating Key results achieved from EU funded research and innovation on ICT for Active and Healthy Ageing under Framework Programme 7, the Competitiveness and Innovation Programme and Horizon 2020**".

The main aim of this tender is to identify and consolidate the key findings from the research and innovation projects addressing ICT for Active and Healthy Ageing funded under FP7, the Competitiveness and Innovation Programme (CIP) and the Horizon 2020 Research and Innovation Programme. Whilst the total number of relevant projects from these 3 programmes accounts to more than 100, a selection of the top 25 most relevant has been identified in agreement with the European Commission to extract the key findings and lessons learnt on the achieved results, and to make recommendations for future research and innovation issues for policy makers.

A detailed selection methodology was used to analyse the different projects in terms of impact according to the key impact areas identified in the **European Commission's Triple Win Strategy: 1) Improved quality of Life, 2) Increased efficiency of health and long-term care and 3) Market growth and expansion of the EU industry.** The full methodology used in this study can be found in Annex IV, Final Inception Study Report, and included the following steps:

- **Establishing a knowledge base for the study**
 - Identification of project knowledge base/ selection of projects to be used for analysis. The 421 projects that were included in the initial project scoping were reduced to the initial knowledge base of 58 project (See Annex I).
- **Methodology for the preliminary analysis**
 - Analysis of 58 projects / Selection of the 40 most suitable projects for the In-depth analysis process (See Annex II). Definition of Preliminary Analysis criteria.
- **Methodology for the in-depth analysis**
 - Analysis of the 40 projects (selected in preliminary analysis phase) / selection of the 25 most relevant projects (See Annex III). Definition of the in-depth Analysis criteria.
- **Methodology for the lessons learnt analysis**
 - Methodology used to analyse the main lessons learnt in terms of state of the art and recommendations for further research and innovation issues for policy makers. The lessons learnt and the recommendations will be based on the analysis of the 58 projects

included in the initial knowledge base and are included at the end of this study.

In addition to the selection of the 25 most influential projects, the study team has included an overview of the analysis made of these 25 projects in each of the aforementioned key impact areas (see section 1.1 of this report). Furthermore, the key results and outputs for each of these projects have been identified and summarised (see section 1.2 of this report).

The results will be used for the further development of priorities under the EU Horizon 2020 Societal Challenge 1 Health, Demographic Change and Wellbeing¹ and as input for the further implementation of the policy initiative on a 21st century blueprint of digital solutions for active and healthy ageing.

The main specific objectives of this Study include:

1. Analysis of (at least) 50 EU funded projects with successful completion or close to a completion and the **identification of top 25 projects** which demonstrate the biggest advances in terms of the European Commission's Triple Win Strategy based on: 1. improved quality of life, 2. increased efficiency of health and long-term care, 3. market growth and expansion of EU industry.
2. **Production of a brochure showcasing the 25 most influential projects** including a description of the project idea and the key results.
3. Elaboration of a **report including the main lessons learnt** based on the final review reports in terms of state of the art and **recommendations for further research and innovation actions for policy makers**.

In order to carry out the study in a more effective manner and to better present the results, the selected projects have been categorised according to the following **6 thematic groups** as identified in the publication "Research and Innovation in the field of ICT for Health, Wellbeing and Ageing: An Overview"⁴:

1. Robotics for ageing well
2. Innovating elderly care
3. Better connected through integrated care
4. Frailty, early detection and intervention
5. Fall prevention
6. Knowledge sharing and standardisation related to ageing well

⁴ www.ec.europa.eu/digital-single-market/en/content/benefiting-personalised-care

An elderly couple is shown in a close-up, smiling and laughing as they look at a tablet computer. The man is holding the tablet, and the woman is pointing at the screen. They are both wearing striped shirts. The background is a textured, light-colored wall.

KEY FINDINGS FROM EU FUNDED
RESEARCH AND INNOVATION PROJECTS
ON ICT FOR AHA UNDER FP7, CIP AND
HORIZON 2020

1. KEY FINDINGS FROM EU FUNDED RESEARCH AND INNOVATION PROJECTS ON ICT FOR AHA UNDER FP7, CIP AND HORIZON 2020

1.1 Overview of the impact of key EU research and innovation projects

The objective of this section is to provide an overview of the impact from the Top 25 EU Research and Innovation (R&i) projects related to ICT for Active and Healthy Ageing (www.bit.ly/ImpactStudyICTforAHA) which demonstrate the biggest advances in terms of the European Commission's Triple Win Strategy which includes the following impact areas:

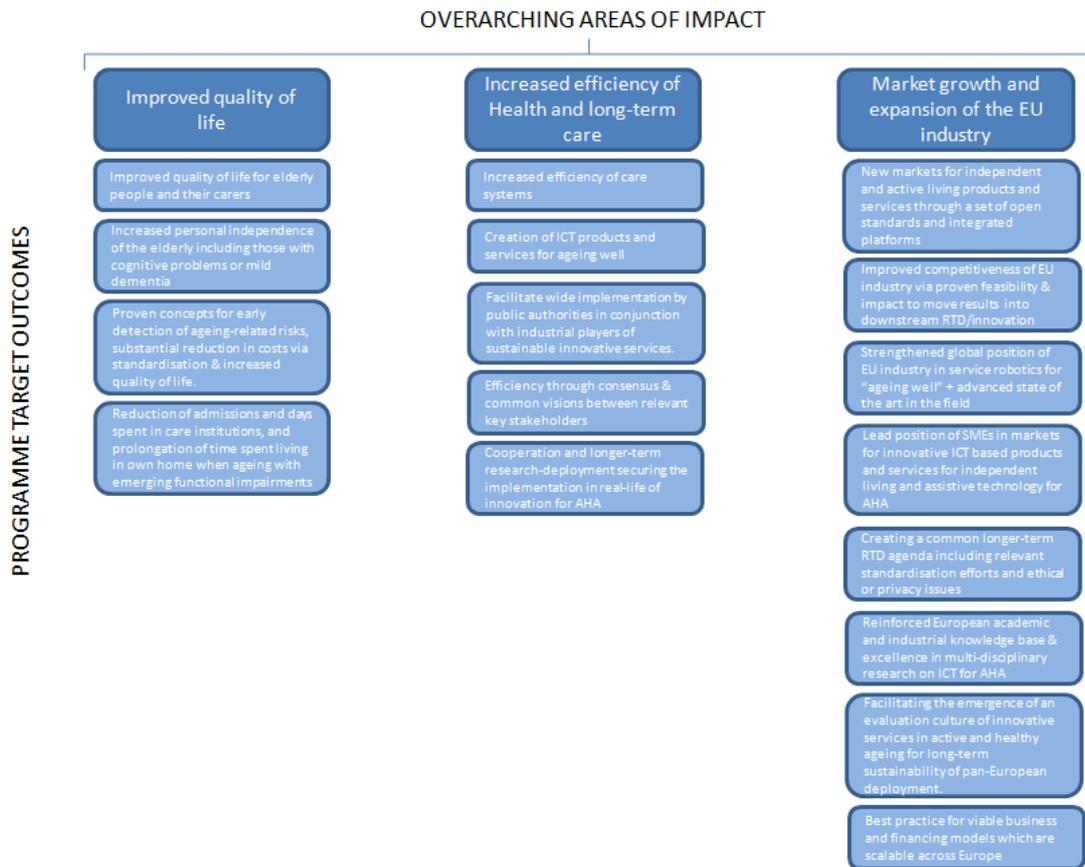


To further develop each of the three impact areas, the target outcomes from the different work programmes related to ICT for Active and Healthy Ageing from the 7th Framework Programmes, CIP Programme and the Horizon 2020 programme were used to help analyse the different projects within the overarching areas of impact. Figure 1 summarises the different target outcomes and the overarching areas of impact that will be used during this in-depth study.

Furthermore, two additional transversal impact areas have been taken into account due to their importance in the successful execution of EU-funded R&I projects related to ICT for AHA:



Figure 1 Basic Structure for In-Depth Analysis. Source: Own Elaboration based on the WPs from FP7, CIP and H2020 Programmes.



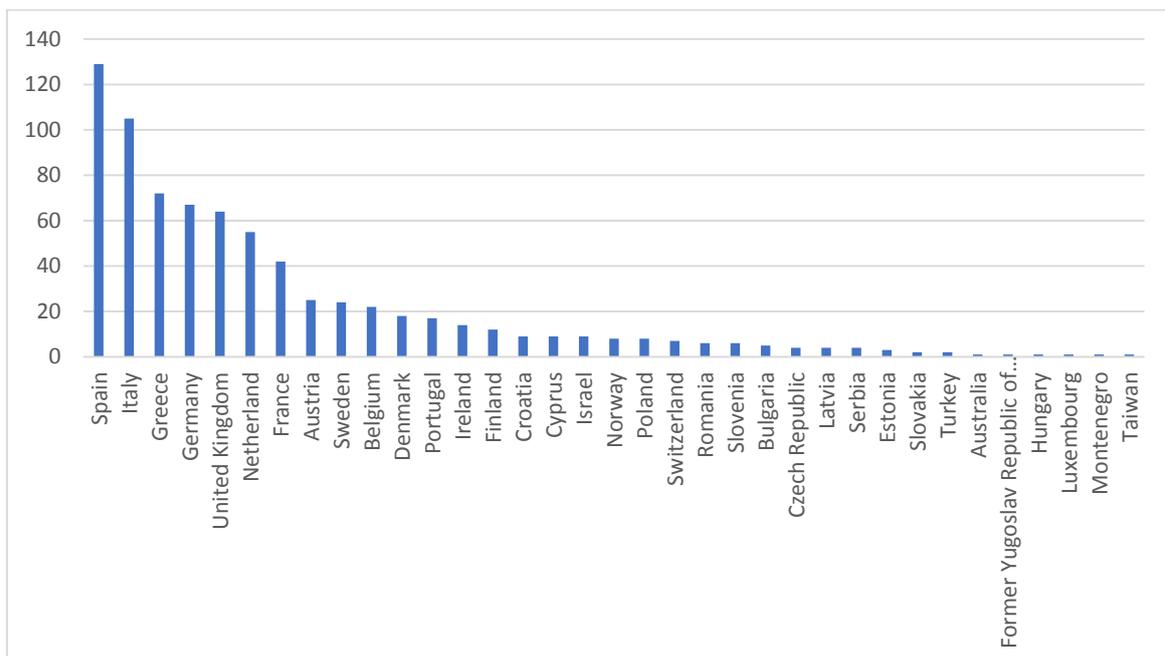
To begin the overview of the impact generated by these projects, the study team analysed the geographical coverage of the initial knowledge base of projects (See Annex I). This analysis is based on the outreach of activities performed in the project and the participation of project partners and project coordinators according to their country of origin covering the 7th Framework Programme, CIP Programme and the Horizon 2020 programme.

1.1.1 Impact on a geographical level

The initial knowledge base includes 58 projects involving 700 project partners and 58 Project coordinators. As can be seen in Figure 1, the **countries with most representation include Spain** (118 project partners, 11 Project Coordinators), **Italy** (93 project partners, 12 project coordinators) **Greece** (66 project partners, 6 project coordinators) and **Germany** (62 project partners, 5 project coordinators), closely followed by the **United Kingdom** (58 project partners, 6 project coordinators). With the exception of Sweden (23 project partners and 1 project coordinator) **the Nordic countries (Norway and Finland) had less representation in comparison to the more western and central European countries.** A **low representation of Eastern European countries can also be seen** with Poland (8 project partners) the most represented country, closely followed by Romania (6 project partners).

The presence of countries from outside of Europe such as Australia and Taiwan should also be highlighted, both within projects funded under the 7th Framework Programme (I STOPP FALLS and UNIVERSAAL, respectively).

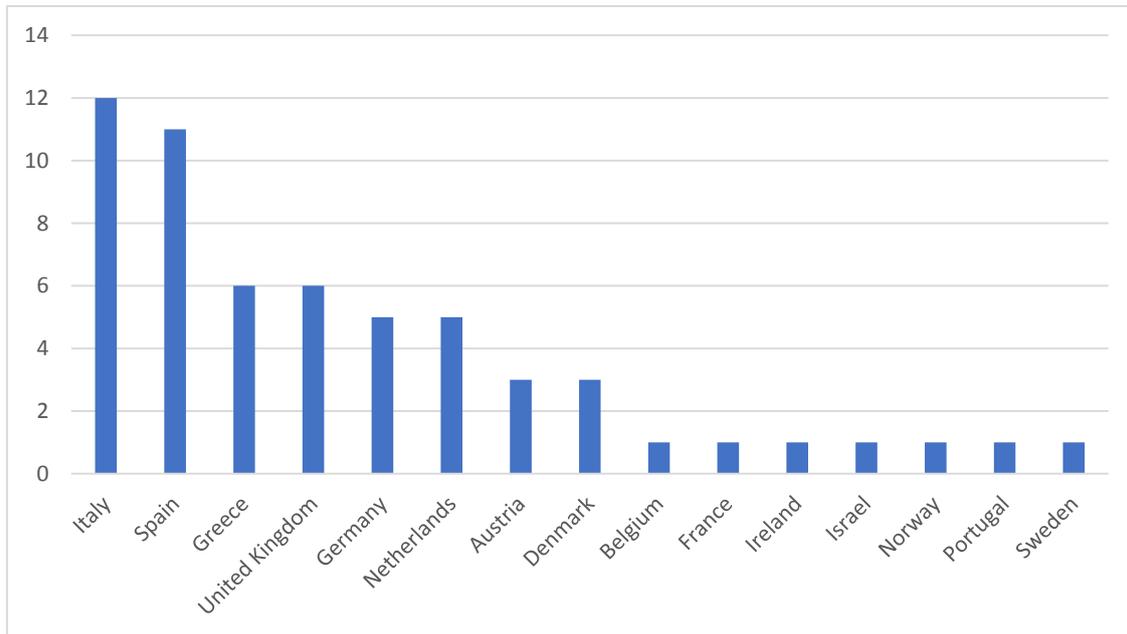
Figure 2 Country of origin of project partners and project coordinators from the initial knowledge base for the study (58 projects). Source: CORDIS Community Research and Development Information Service.



If a spotlight is focussed on the **statistics related to the country of origin of the project coordinators** in ICT Projects related to active and healthy ageing, the results are similar (see Figure 2). There is a **strong presence from Italy, Spain, Greece, the United Kingdom and Germany.**

Furthermore, the **Nordic countries are poorly represented with only two projects coordinated by these countries** (Norway and Sweden) and there is **no representation from the Eastern European countries.**

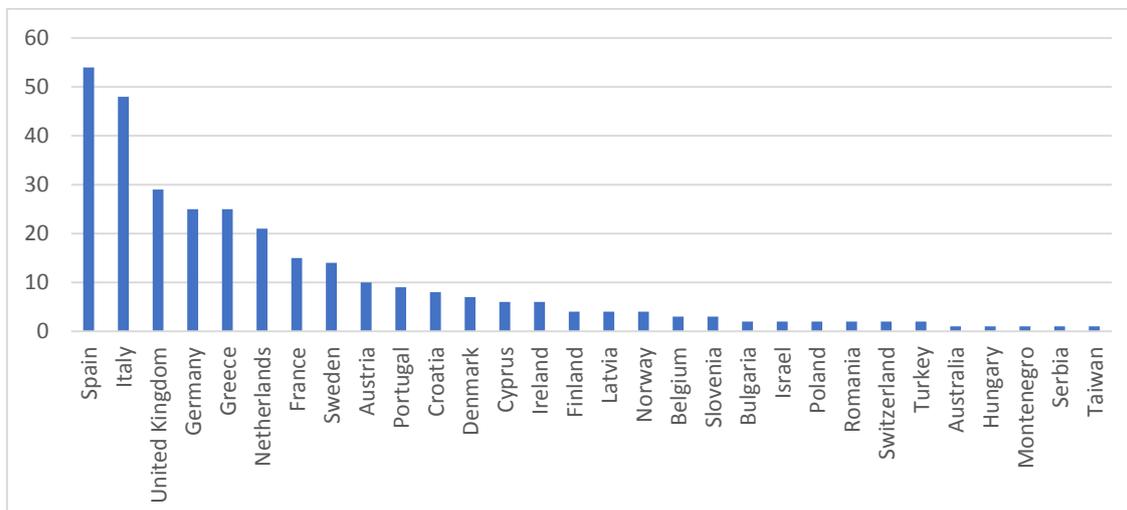
Figure 3 Country of origin of the project coordinators from the established knowledge base for the study (58 projects). Source: CORDIS Community Research and Development Information Service.



If we now centre our analysis on the top 25 most relevant EU funded research and innovation projects in terms of impact on ICT for active and healthy ageing, again there is very little change. Those **countries that are most represented in the top 25 projects include Spain** (49 project partners, 5 project coordinators), **Italy** (44 project partners, 4 project coordinators), the **United Kingdom** (26 project partners, 3 project coordinators) and **Germany** (24 project partners, 1 project coordinator).

With the exception of Sweden (13 project partners, 1 project coordinator), **other Nordic countries are not as well represented, this is the same for the Eastern European countries.**

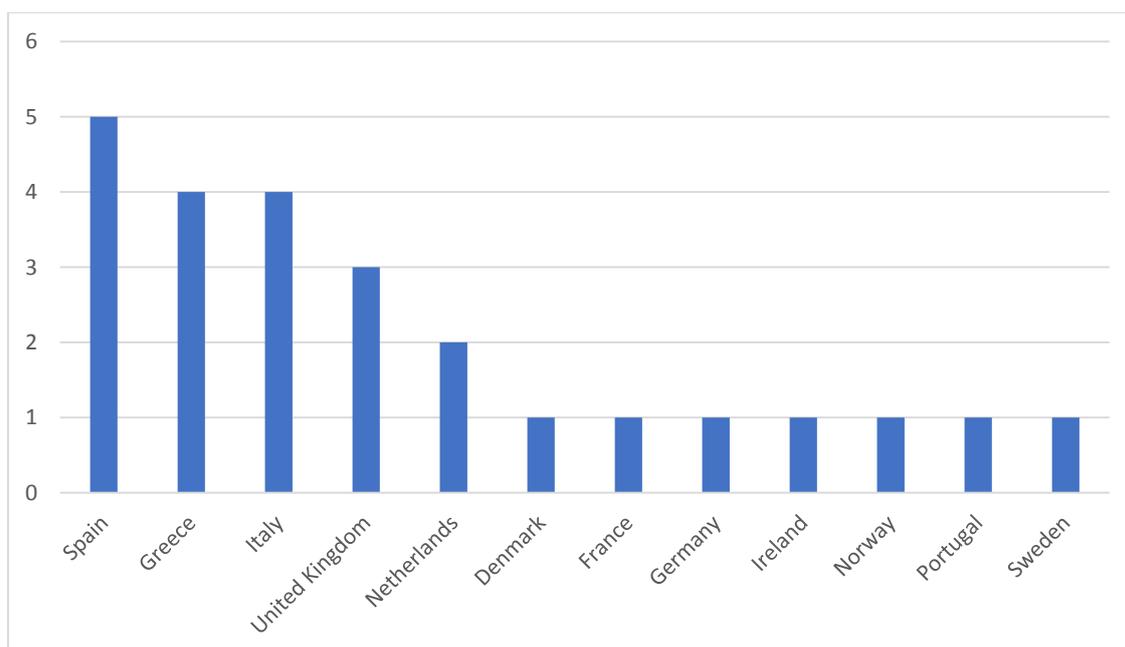
Figure 4 Country of origin of project partners and project coordinators from the top 25 selected projects. Source: CORDIS Community Research and Development Information Service.



Finally, when analysing the statistics on the project coordinators of the top 25 projects, a similar trend can be seen. The **projects were dominated by representative organisations from Spain, Greece, Italy and the United Kingdom.**

There were **only two project coordinators from the Nordic countries** (Sweden and Norway) and **no representation from the Eastern European Member States.**

Figure 5 Country of origin of the project coordinators from the top 25 selected projects. Source: CORDIS Community Research and development Information Service.



In conclusion, the **R&i projects related to ICT for active and healthy ageing** (included in the Initial Knowledge base for this study) **are dominated by five countries (Spain, Italy, Greece, Germany and the United Kingdom).** Whilst Sweden is moderately represented in this domain, although to a lesser extent than its western European counterparts, there is **a distinct lack of participation from both Norway and Finland. This is mirrored, in the Eastern European Member States with a notable lack of presence of representative organisations as project members and no representation as project coordinators.**



1.1.2 Impact Area – Improved quality of life

Increased quality of life for elderly people and their carers

In the area of robotics for ageing well, the ACCOMPANY project (www.rehabilitationrobotics.net/cms2/) has shown substantial progress in **improving the technology readiness level of Personal Care Robots**, and has helped to clarify a number of technological and social challenges that must be met in order to improve the quality of life of ageing EU citizens with personal care robots.

A further project that has had an impact in this area is MARIO (www.mario-project.eu/portal/). The social impact of this project is expected to become more visible following the results of the pilot trials⁵. However, Interviews carried out thus far confirm the effectiveness of the approach taken by the MARIO to engage and prompt people with dementia to reduce loneliness and help them to use service robots.

As the project reaches its midway point, the work carried out with end users has helped the project team to **equip MARIO with specific psychosocial applications designed to meet patient needs**, such as the Connect My Hobbies module which is made up of My Music, My News and My Games application. According to the project coordinator, although “These may seem like simple applications, **they promote autonomy and empower people with dementia**, who can select what they want to watch or listen to and decide when they want to do so, without having to wait for a busy nurse or caregiver.” The project coordinator goes on to say “As a result of engaging with MARIO we believe **the loneliness and isolation experienced by many people with dementia will be reduced, and their autonomy and their quality of life improved**. We also believe that, MARIO will reduce the burden of care on caregivers as they will have more time to spend on other meaningful tasks and interacting with people with dementia.”⁶

With regards to the field of integrated care, the INCA project (www.in3ca.eu/?lang=en) has had quite a strong impact in this area. This can be seen through the analysis of the cost-effectiveness of the software tool INCA/ADSUM+. This analysis shows that INCA can be seen as a **success case when considering aspects such as patient satisfaction or the patient quality of life (QoL)** with a good performance in the pilot sites in Spain, Cyprus and Latvia⁷. It was also demonstrated to be more effective and more economically viable than treatment used in the control group.

⁵ The MARIO Project finishes on the 31/01/2018.

⁶ European Commission (2017). MARIO – RESULTS IN BRIEF.

⁷ IDI EIKON (2016), INCA Project Final Report. Valencia, Spain. Pg 18

Amongst the projects focusing on Fall Prevention, the I STOPP FALLS project (www.istoppfalls.eu/cms/front_content.php) aimed to **reduce the overall fall of risk and improve the quality of life of elderly people, through the implementation of randomised control trials (RCTs)**. The project used relatively inexpensive computer-based gaming techniques to carefully control and monitor specific physical exercises. Although the impact on improved quality of life has not been scientifically demonstrated, **users did feel that the system had an impact on their quality of life**⁸.

Also in the realm of Fall Prevention, the I DON'T FALL project (www.idontfall.eu/) had an impact on improving the quality of life of the elderly. **The ICT solutions that were developed during the project have demonstrated clinical and social benefits for elderly patients.** In some test sites the solutions registered a two-point increase on the Quality of Life index⁹.



Participants using the LLM Care Platform, Long Lasting Memories Project (CIP Programme). Source: Photo courtesy of the Aristotle University of Thessaloniki

In the field of Innovating Elderly Care, the LONG LASTING MEMORIES

(www.longlastingmemories.eu/)

project has made an impact on the quality of life of the elderly. The statistical analysis of the results from the project showed **positive**

effects on the memory and on the cognitive abilities of elderly people of combined physical and cognitive training. The project even shows the **potential to reduce the negative effects of dementia.**

The impact on combined cognitive and physical training of primary an end-user's cognitive functions were evaluated using an active control group and psychometric and physical fitness tests. The **episodic memory performance improved significantly** (compared to controls) and this effect appears to be dose-dependent (increased slightly with the number of training sessions performed) and not dependent on the cognitive status before the training. When looking at the figures from the project, training with the LLM programme made **94% of the participants feel mostly positive.** Furthermore, **95% of participants believed that exercising through LLM was beneficial for them,** most felt LLM was amusing and they enjoyed their sessions with it and LLM met their expectations¹⁰. Finally, direct interviews with the **carers involved in the pilots also indicate**

⁸ Skiczuk, Peter (2015). Consolidated Review Report – ISTOPPFALLS. European Commission, FP7 Programme, Pg 11.

⁹ European Commission (2017). I DON'T FALL – RESULTS IN BRIEF.

¹⁰ AUTH/ GSI/ ALL PARTNERS (2012). Long Lasting Memories D1.4 Final Report. Pgs. 7, 12.

that they themselves experienced an improvement in their own quality of life, as they felt it was easier to manage the daily exercise and training of the elderly.

Increased personal independence of the elderly

The **projects related to fall prevention have had a particularly strong impact on an increased personal independence of the elderly**. For example, the FARSEEING project (www.farseeingresearch.eu/) has **helped to make independent living a realistic option even for those people who are at high risk** as it provides a **360° perspective on how to prevent, detect and manage falls in various environments**. The Fall Repository that was developed and tested in real life settings collected data using smartphones, and wearable and environmental sensors providing self-adaptive responses¹¹.

The I STOPP FALLS project also made a significant impact on increased personal independence for the elderly. The results showed that **those who took part in the I STOPP FALLS field trials experienced significantly less falls** than those participants in the control group. Furthermore, there was also a significant reduction in the overall physiological fall risk as compared to the control group. This **reduction in fall risk, coupled with the expected beneficial effects of greater motivation to exercise, leading to better health and independence**, are also successful outcomes of the project. One of the main original objectives of the project was to prove that a system such as I STOPP FALLS can be successfully integrated into the daily lives of older adults. The fact that this has been demonstrated reflects the success of the project¹².

The I DON'T FALL project has also shown impressive results in this area. The project trials that were carried out at selected sites showed a **significant reduction in falls with respect to the previous year (43%)**¹³ and an **increase of 4 points in the BARTHEL Index**¹⁴. Furthermore, the huge amount of data collected will feed into further studies and analysis.

There were also two projects focussed on robotics for ageing well that demonstrated a substantial impact on increasing the personal independence of the elderly. A first example can be seen with the ACCOMPANY project. The successful **achievement of the main project goals has constituted a key milestone towards a long-term vision of emphatic, socially acceptable, co-learning robotic home companions for elderly users**, supporting re-ablement and facilitating independent living.

¹¹ UNIBO (2015). FARSEEING – White Paper on Project Results (Second Release). Pg5.

¹² Skiczuk, Peter (2015). Consolidated Review Report – I STOP FALLS. European Commission, FP7 Programme, Pg 3.

¹³ European Commission (2017). I DON'T FALL – RESULTS IN BRIEF.

¹⁴ An index which measures performance in daily activities

The I-SUPPORT project (www.i-support-project.eu/) also promises to have a strong impact in this area. The main innovation activities of the project consist in the **specification and launch of the development of a modular ICT- supported service robotics system meant to support and enhance the motion and force abilities of frail older adults**. The solution developed within the project will also assist them in successfully, safely and independently completing the entire sequence of bathing tasks thus leading to an increased personal independence.¹⁵

Finally, with regards to projects oriented towards the development of Innovating Elderly Care, the LONG LASTING MEMORIES project showed significant impact potential. Through the use of a clinical intervention trial protocol and specific scientific metrics in the field trials, the project has been able to demonstrate **a significant improvement amongst elderly subjects with regards to their quality of life related to cognitive, motor and social function indices and autonomy**¹⁶.

The detection of ageing-related risks

With regards to fall prevention, the FARSEEING project made significant progress in key research areas for the detection of ageing related risks such as infrastructure building for real-life falls data collection, storage and analysis. Furthermore, the project managed to **establish the longitudinal risk factors for falls and methods for designing and implementing telemedical intervention models to monitor, prevent and predict falls, as well as methods to promote healthy active ageing**, emphasising its impact in this area. By the end of March 2015, a total of 405 real fall event recordings had been reported from different sources, including 518 reported falls, far exceeding the initial project goals of recording 200 real life falls¹⁷.

The I STOPP FALLS project also worked on this area. The secondary objectives for the RCTs were the development of proxy measures for falls, risk assessment and prediction of falls, health and morbidity, cognition and dual task. The project investigated falls in the elderly, looking at how the likelihood of falling could be predicted and investigating how the risks of falling can be reduced and the number of falls minimised. This project has achieved **great success in terms of providing evidence that a system like I STOPP FALLS can reduce the risk of falls**.

¹⁵ Razavi, Reza (2016). Consolidated Review Report – I-SUPPORT. European Commission, H2020 Programme, Pg 2.

¹⁶ AUTH/GSI/ALL PARTNERS (2012). Long Lasting Memories D1.4 Final Report.Pg. 8.

¹⁷All FARSEEING Project Partners (2015). Deliverable 8.6 – FARSEEING Achievements Conference. Pg. 12.



The DEM@CARE solution, DEM@CARE Project (FP7 Programme). Source: Photo courtesy of the Centre for Research and Technology - Information Technologies Institute, Thessaloniki

In the field of innovating elderly care, the DEM@CARE project (www.demcare.eu/) has also made an impact in the detection of ageing-related risks. The @Lab part of the project seems to have significant impact in the diagnosis and monitoring early stages of dementia, **helping to distinguish between healthy MCI¹⁸ and AD¹⁹ participants with relatively high accuracy rates (82%)²⁰.**

Out of those projects focused on robotics for ageing well, the MARIO project has also made an impact in this area. The team is equipping the MARIO robot with the capability of undertaking a Comprehensive Geriatric Assessment (CGA), something that would normally take a health care professional around 30 minutes per patient to complete. This function will **help to detect ageing-related risks and will have a knock-on effect on the efficiency of care systems.**²¹

Finally, in the field of integrated care, the main objective of the CAREWELL project (www.carewell-project.eu/home.html) was the provision of integrated care for frail older people with complex health and social care needs due to their complex multiple chronic conditions. However, this has only been achieved through the use of two ICT supported pathways: 1) integrated care coordination and 2) patient empowerment and home support²². Furthermore, CAREWELL also aimed to provide integrated care for frail elderly patients through ICT enabled healthcare services coordination, patient monitoring, patient self-management and the involvement of informal caregivers.

The reduction of admissions and days spent in care institutions

In terms of projects dealing with the topic of fall prevention, it can be highlighted that the FARSEEING project indirectly had an impact in reducing the admission and days spent in care institutions by **reducing fall risk and rates through a complex intervention programme**, as a method of delivering personalised and tailored at-home interventions to restore the complexity fluctuations of the activity states of the elderly²³.

¹⁸ MCI - Mild Cognitive Impairment

¹⁹ AD – Alzheimer’s Disease

²⁰ Hopper, Louise (2013). DEM@CARE D8.3 – Initial Pilots Evaluation (Second Interim Report). Pg. 17.

²¹ European Commission (2017). MARIO – RESULTS IN BRIEF.

²² CAREWELL Project Partners (2016). D7.2 Interim Process Evaluation report.Pg. 36.

²³ UNIBO (2015). FARSEEING–White Paper on Project Results. Pg 15.

The I STOPP FALLS project takes this one step further, providing numeric estimates regarding the potential economic impact of the implementation of the system. The project final report estimates that **if 3% of older adults at risk of falling used the system, the risk of falling could be reduced by 35%**. This could **save up to EUR 27.7 million²⁴ a year** in fall-related health care costs in Germany alone due to the reduction of admissions and days spent in care institutions.

Finally, regarding integrated care projects, the INCA project shows **an impressive reduction of re-hospitalisations after INCA deployment and operation** (even if not necessarily demonstrating that INCA is the only driver of change). The INCA project proposes a model that promotes higher coordination of socio-sanitary services while reducing costs, improving patient experience and achieving greater efficiency from health delivery systems. The inclusive approach of INCA can help to remove the technological barriers for the engagement of patients and to leverage integrated care programmes in Member States.²⁵

Table 1 Summary of the Impact Area - Improved quality of life

Improved Quality of Life		
Sub-category	Project category	Most influential projects
Increased quality of life for elderly people and their carers	Robotics for ageing well	ACCOMPANY/MARIO
	Integrated care	INCA
	Fall prevention	I STOPP FALLS / I DON'T FALL
	Innovating elderly care	LONG LASTING MEMORIES
Increased personal independence of the elderly	Fall prevention	FARSEEING / I STOPP FALLS / I DON'T FALL
	Robotics for ageing well	ACCOMPANY / I-SUPPORT
	Innovating elderly care	LONG LASTING MEMORIES
Concepts for the detection of ageing-related risks	Fall prevention	FARSEEING / I STOPP FALLS
	Innovating elderly care	DEM@CARE
	Robotics for ageing well	MARIO / CAREWELL
The reduction of admissions and days spent in care institutions	Fall prevention	FARSEEING / I STOPP FALLS
	Integrated Care	INCA

In conclusion, those projects which had **most impact on an improved quality of life were those related to fall prevention and robotics for ageing well**. Stand-alone projects related to integrated care (INCA) and innovating elderly care (LONG LASTING MEMORIES) also made an impact in this area.

²⁴ Data from 2012.

²⁵ Leorin, Cristian (2016). Consolidated Review Report – INCA. European Commission, CIP Programme, Pg 3.



INCREASED EFFICIENCY OF HEALTH AND LONG-TERM CARE

1.1.3 Impact Area – Increased efficiency of health and long-term care

Increased efficiency of care systems

In the field of integrated care, the CAREWELL project has managed to **optimise the efficiency and the effectiveness of the healthcare services delivered to complex multi-morbid patients over the age of 65 through use of integrated care programmes**. CAREWELL integrates primary care with hospital care, with the two care pathways cutting across organisational boundaries and ensure that healthcare resources are more efficiently and effectively used. This is due to the fact that the ICT platforms and communication channels **enable social and health care coordination and information sharing across organisational boundaries, avoided duplication of efforts and inefficient use of healthcare resources, and improved treatment compliance as well as self-care and self-management**.

The project has also been successful in establishing a **basis for future work** on creating an approach to delivering integrated care for complex multi-morbid patients aged 65 or over, something that can be transferred to other cohorts of the population with other health and social care needs.²⁶

The INCA project has also made a substantial impact regarding the increased efficiency of care systems. This can be seen through the cost-utility analysis (CUA) that was carried out during the project and that highlighted an **annual cost reduction** of 360€/patient in the Valencia pilot, 129€/patient in the Murcia pilot and 214€/patient in the Cyprus pilot, suggesting that **INCA is effective and less costly than standard models**. Other benefits of the implementation of INCA included a **reduction of the GP's work load (Valencia), full vertical integration of care and first-ever horizontal integration of care (Murcia) and the shift of workload from a specialist approach (for fee) to primary care (not for fee)**. Furthermore, in the Valencia pilot, performance was tracked and the login per role demonstrated that the most frequent users were the nurses and the social workers, suggesting a **good level of integration and of empowerment of the social and care managers**. Finally, the INCA project can be seen as a pathfinder project in Croatia as the pilot project was only proof of concept, allowing Croatian Health Insurance Fund to take qualified decisions in the public procurement process. Adoption of this tool would require some legislative changes, however, integrated care is one of the focal points of the new government in Croatia.²⁷

²⁶ Mollenkopf, Heidrun; Ciharova, Katerina; Almedia, Nuno (2016). Consolidated Review Report – CAREWELL. European Commission, CIP Programme, Pg 19.

²⁷ Leorin, Cristian (2016). Consolidated Review Report – INCA. European Commission, CIP Programme, Pg 3.

The BEYOND SILOS project (www.beyondsilos.eu/project/) is **one of the only projects in the initial knowledge base that has applied the MAFEIP model**. BEYOND SILOS enables the **delivery of integrated care to older Europeans to support them to live independently within the community by providing the ICT tools** necessary to join up care pathways across organisations, between social and health service providers. One of the main areas of integration was the provision of common access to home-based platforms for all involved cross-sectorial care teams to improve care coordination and the continuation of care. The case study includes the analysis of the results achieved at Badalona Serveis Assistencials (BSA).

One of the conclusions from the case study was that the **intervention of the BEYOND SILOS project is more effective than current care**, however, that it is also more expensive. Upon comparing the incremental cost-effectiveness ratio (ICER) to the Willingness to Pay (WTP) threshold, the intervention is cost effective if the willingness to pay is at least €6,500 per QALY²⁸²⁹.

With regards to innovating elderly care, the STOP AND GO project (www.stopandgoproject.eu/) has had an impact on the increased efficiency of care systems. The project promises to provide a good learning experience from the pilots in the use of PPI approaches to integrated care and examples of how integrated care enabled by technology can transform service provision. As one report on the Liverpool project noted: **"This case study demonstrates how a PPI enabling procurement approach, together with well targeted grant funding, was used to transform social care service provision and create a framework for further adoption of technology."**³⁰

Facilitate wide implementation of sustainable innovation services

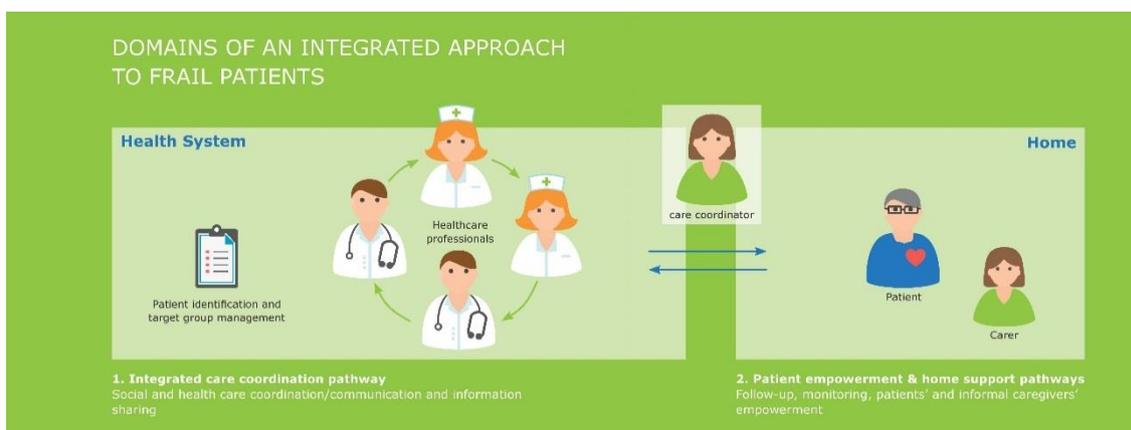
In the area of integrated Care, the CAREWELL project has helped **facilitate the wide implementation of sustainable innovation services through its capacity to exert a significant social and economic impact** both on the regions where implemented and on the overall European debate. This has been possible due to the evidence gained during the project and the scaling up in some of the participating regions of integrated care through two ICT supported pathways.

²⁸Jordi Piera, Clara Faulí, Ruth Vilar, Strahil Birov, Veli Stroetmann, Francisco LupiáñezVillanueva. Support Services for the Management & Utilization of Monitoring & Assessment of the EIP-MAFEIP Tool BeyondSilos Badalona Serveis Assistencials.

²⁹ QALY – Quality-Adjusted Life Year

³⁰ Ilse Bierhoff, Stephan Roijers, Ann Williams and Marcel Olivé Elias. Scaling-up Solutions. www.impact.pub.

Furthermore, the project has contributed to the **long-term sustainability of regional healthcare systems in Europe and has also provided evidence for a replicable plan for the pan-European deployment of integrated care services**. The work carried out within the project has served as a basis for future work to create a critical mass for the large scale, European-wide deployment of ICT-enabled integrated service models, relying on the support of public entities and their capabilities to achieve EU-wide operation of a commonly defined ICT integration infrastructure³¹.



Domains of an integrated approach to frail patients, Carewell Project (CIP Programme).
Source: Photo courtesy of Kronikgune, International Centre of Excellence in Chronicity Research.

Impact from the INCA project can also be seen in this area. The Valencia pilot, carried out at Manises Hospital/Quart de Poblet, was considered to be **a reference model at regional level**. Efforts to scale-up the approach used in Valencia and in Cyprus can be seen through the signing of a MoU between the industrial partners of the project (IDI EIKON, KENUS, INTERFUSION). Furthermore, the **success in Valencia and Murcia could be a good driver for generating further impacts throughout Spain**.

Amongst the projects related to innovating elderly care, the STOP AND GO has had a significant impact in this area. If the project is successful in achieving its goals³², then it will provide **good case studies to promote a broad uptake of innovation procurement in the public sector**. It can be said that the project is likely to have an impact in terms of demonstrating good practice and leaving behind a model for the procurement of integrated technology enabled care services that can be more widely adopted.

STOP AND GO has been successful at **introducing innovation in the procurement process from the very beginning, creating a holistic approach geared to meeting identified service requirements**, rather than seeing it as some separate or "add on" element. Therefore, the project can be said to have contributed to facilitating the uptake of sustainable innovation services.

³¹ Von Tottleben, Malte; Hammerschmidt, Reinhard (2016). D8.2 Interim Report on Dissemination and Exploitation Activities Part A – Exploitation. Pg 121.

³² The project ends in 2017.

Efficiency through consensus and common visions between relevant key stakeholders and cooperation and longer-term research deployment

Regarding the specific MAFEIP indicators, whilst the CAREWELL project could not demonstrate any significant differences between the patients included in the integrated service provision and the control group in terms of the number of hospitalisations, the **length of stay in hospital was shorter among those in the intervention group**. Furthermore, with regards to the cooperation on longer-term research deployment, the identification of financial benefits, plus general conclusions from the pilot sites by predictive modelling, were essential outcomes of the project to support policy-makers and commission professionals in making decisions about integration.

The INCA project also had a substantial impact in this area. INCA is an ICT tool, named Adsum+, that addresses hospitals, healthcare departments, clinics, social services departments dealing with chronic/elder patients and aiming to improve the care provision processes and the roles of and relationships between the different actors. INCA contributes to **better exploit ICT potential and close the gap between these silos**, bringing together different services, organisations and parts of care provision. INCA aimed to overcome silos creating a virtual integration in a wise and pragmatic way in order to leverage the benefits of ICTs, even when other barriers still remain. It can therefore be seen to have had an impact on generating efficiency by establishing a common vision between relevant key stakeholders and cooperation.

Regarding the specific **MAFEIP indicators for this thematic impact area**, the pilots involved in the INCA project presented the following positive results:

- MANISES Hospital (Spain): Hospital stays (-37%), Readmission after 30 days (-39%), Readmission after 6 months (-17%), Readmission after 1 year (-6%).
- MURCIA (Spain):
 - o Results for Heart Failure: Hospital admissions (-15%), Hospital stays (-23%)
 - o Results for Diabetics: Hospital admissions (-15%), Hospital stays (-19%)
- GEROSKIPOU (Cyprus): Results: Hospital admissions (-23%), Hospital stays (-19%)
- Ventspils (Latvia): Results: Hospital admissions (-20%), cardiology encounters (-15%), Hospital stays (-1%), Readmission after 30 days (-8%), Readmission after 1 year (-6%).

- RIJEKA (Croatia)³³: (Hospital admissions (-2.17%), MHD Hospital stays (-10.3%), MHD readmissions after 6 months (-5%³⁴).

Table 2 Summary of the Impact Area – Increased efficiency of health and long-term care

Increased efficiency of Health and Long-term Care		
Sub-category	Project Category	Most influential projects
Increased efficiency of care systems	Integrated care	CAREWELL / INCA / BEYOND SILOS
	Innovating elderly care	STOP AND GO
Facilitate the wide implementation of sustainable services	Integrated care	CAREWELL / INCA
	Innovating elderly care	STOP AND GO
Efficiency through consensus and common visions between relevant key stakeholders and cooperation and longer-term research deployment	Integrated care	CAREWELL / INCA

In conclusion, as can be expected, there is a **clear dominance of the integrated care projects** in this impact area. Both the CAREWELL and INCA projects were highlighted in each of the three sub-categories. The STOP AND GO project was also included in two of the sub-categories, leading this impact area for those projects in the innovating elderly care category.

³³ The project report stated that it was Difficult to calculate the real data starting from the actual data set.

³⁴ IDI EIKON (2016), INCA Project Final Report. Valencia, Spain.



1.1.4 Impact Area – Market growth and expansion

New markets for independent and active living products and services through a set of open standards and integrated platforms

With regards to fall prevention, the FARSEEING project established a **data sharing policy which allowed 3rd party access to the FARSEEING fall repository**. Furthermore, the consortium stated that they were planning to make the **fall detection algorithms openly available to the online community** through their publication in open access journals or by **releasing the algorithm publicly through an online community such as Github**.³⁵

There is a particularly strong presence of projects related to robotics for ageing well that have had an impact on establishing a set of open standards and integrated platforms during their lifecycle. An example of this can be seen in the GIRAFF+ project (www.giraffplus.eu/) which was extremely successful in extending and integrating existing technologies, and in implementing evolving versions of the solution in real-world long-term environments. A final OSGi-based version has been released for desktops and a final mobile android version has also been released for mobile devices on Google Play. The project has also **contributed to international standards for sensor networks**, through involvement in the OSGi Residential Group (OSGi Alliance).³⁶

The RADIO project (www.radio-project.eu/) can also be considered as having an impact in this area. This is because the technical concept for integration of the RADIO system into the wider ecosystem of services for the medical care institutions and informal care-givers, has been developed. With regards to the innovation, the developed prototype system, **both the RADIO robot and its integration into a wider information system for involved stakeholders, may be highly innovative**. Architectural and methodological work in RADIO provides heterogeneous networking solutions to bridge the robotic and smart home network infrastructures and software stacks. This work aims at integrated, secure, and power-aware data collection, transmission and processing within an internet of fixed sensors and mobile robotic platforms.³⁷

In the ROBOTERA project (www.robot-era.eu/robotera/) the contribution of the project is more through the integration of multiple systems than any one particular breakthrough and there is much that has been learned that should be shared with the wider community. The results are expected to

³⁵ Meijer, Kenneth; Razavi, Reza; Stubbs, Richard (2015). Consolidated review Report – FARSEEING. European Commission, FP7, Pg 20.

³⁶ Duffy, Brian; Preucil, Libor; Webb, Philip (2015). Consolidated Review Report – GIRAFF+. European Commission, FP7 Programme, Pg 4.

³⁷ Lanzenberger, Monika (2016). Review Report – RADIO Project. European Commission, H2020 Programme, Pg 7.

have **a lasting significant impact with valuable lessons learnt for work on multi-robot integration in ambient intelligent environments**. It has become a showcase project for sophisticated multi-robot systems embedded in ambient intelligent environments. The result is a **stable and flexible middleware that will be available to other research teams as an open software system**. The project has demonstrated the seamless integration of sensors and robots via the orchestration of the complete systems approach and employing overall context awareness and claim technical readiness level 6 (TRL6). Furthermore, the ROBOT-ERA software has been documented, packaged and released as open-source.³⁸

In the field of knowledge sharing and standardisation, the UNIVERSAAL project (www.universaal.sintef9013.com/index.php/en/) has made **a substantial impact, particularly with regards to integrated platforms**. The project successfully designed and established the uStore, a digital market platform concept inspired by Apple's "App Store". The uStore is a one-stop-shop for UniversAAL end-user services. Furthermore, the project designed and established the UniversAAL developer depot. This will contain all resources needed by developers: all parts of the platform itself, tools, basic services for incorporation in new end-user services, adapter components for interoperability with non-UniversAAL systems, libraries of "drivers" supporting use of different sensors etc. available on the open market. **UniversAAL has built on existing solutions from finished projects (including PERSONA, AMIGO, GENSYS, OASIS, SOPRANO and MPOWER)**. Finally, the project devised a technical strategy for achieving interoperability amongst UniversAAL platform elements.

The project has also worked on aspects related to standardisation. For example, an **IHE DEN and HL7 CDA R2 Consent Directive standardisation process is on-going**, the **UniversAAL framework for user interaction in AAL spaces has become an IEC PAS** and **new standardisation processes have been initiated on a reference model and architecture and device abstraction layer** with the OSGi Alliance.³⁹

Finally, amongst the projects focussing on innovating elderly care, the EWALL project (www.ewallproject.eu/) has been extremely **successful in the integration of all components and the orchestration of services using state of the art technologies**, something which can be considered a technological challenge and a technical contribution in itself. The approach that was followed in the project has generated an **open platform that can be easily expanded and support different services for the ageing population** as well as for people living with chronic disease, providing users with the necessary support and/or assistance to stay healthy, active, and independent. In fact, the final number of features that were either

³⁸ Crowley, James L.; Duffy, Brian R.; Webb, Philip (2016). Consolidated Review Report – ROBOT-ERA. European Commission, FP7 Programme, Pg 6.

³⁹ De Leenheer, Pieter (2013). Consolidated Review Report – UNIVERSAAL. European Commission, FP7 Programme, Pg 2.

developed or customised for eWALL over the course of the project is impressive and speaks for the commendable level of flexibility and integration achieved. The **software developed for the project has been published as open source**, as a route to exploitation, with the rationale that this will promote the participation of other companies in developing software for the product and therefore improve its competitiveness⁴⁰.

Improved competitiveness of EU industry

When looking at those projects that have helped to improve the competitiveness of the EU industry, this is true of ACCOMPANY through its **achievements in furthering the TRL of personal care robots**. Several key components, such as the tactile case for tablet computers (“squeeze-me”), or the platform for activity classification are at an advanced maturity level, and have potential for commercial exploitation. They are elements that could enhance the competitiveness of the EU industry, particularly within the realm of personal care robots.⁴¹



Interaction between the KOMPAĪ -2 robot and an elderly user, MARIO Project (H2020 Programme). Source: Photo courtesy of KOMPAĪ Robotics.

The GIRAFF+ project also helped to improve the competitiveness of the EU industry. An opportunity arose for funding from a consortium from Toronto (Canada) for both the US (primarily) and also EU markets, as a complete Giraff+ solution for tele-health care. It has been positioned as a software and service cloud-based solution with a monthly subscription-based model being considered.⁴²

The SILVER project (www.silverpcp.eu/) has **supported the uptake of new technologies and has broadened knowledge in the area of care robotics**. It has created a highly professional network within the field of public procurement that open ups new opportunities in both national and international context, thus improving the competitiveness of the EU industry.⁴³

The ROBOT-ERA project also had an impact in this area, through the launch of spin-offs to effectively commercialise the product. As a result of the work

⁴⁰ University of Zagreb (2015). eWall - Technical Evaluation Report. Pg. 29.

⁴¹ Almansa, Ana; Crowley, James L.; Almeida, Nuno Luis (2014). Consolidated Review Report – ACCOMPANY Project. European Commission, FP7 Programme, Pg 2.

⁴² Duffy, Brian; Preucil, Libor; Webb, Philip (2015). Consolidated Review Report – GIRAFF+. European Commission, FP7 Programme, Pg 6.

⁴³ Katevas, Nikos (2016). Consolidated Review Report – SILVER. European Commission, FP7 Programme, Pg 3.

carried out in the project, the CO-ROBOTICS srl. company was established.⁴⁴

Strengthened global position of EU industry in service robotics for ageing well

In the ACCOMPANY project, the exploitation plans establish an effective route to the development of an industry for personal care robots. Furthermore, within the project, **links were made with the EU industry through the participation in user and industrial forums/workshops**, as well as carrying out a series of interviews and focus groups with industry experts. These expert interviews are featured in the economic model deliverable (D7.3) while focus group input provided valuable insights for the project as well as providing input into economic values and potential exploitation routes. Finally, the consortium established and had the support of an industrial advisory board throughout the project. This input has also enriched the economic model and project exploitation plan.

The SILVER project has also had a strong impact in this area. According to the programme manager **“In Europe, PCP has so far been an under-utilised tool for promoting innovation. One of the aims of the project was to demonstrate the effectiveness of this approach to address such societal and governmental needs as identifying new technologies and services to support the independent living of the elderly.”** The solution that was selected through the PCP process “LEA Care Robot” is already attracting attention, with the contractor, Robot Care Systems, having won several innovation contests, including the SHELL WIRE 2015 and RABOBANK Innovation awards. The device is also winning over investors, recently securing over EUR 5 million in additional funding. With this solid foundation in place, certification is expected in the fourth quarter of 2016, with mass market production beginning in the second quarter of 2017. The contractor, even went on to **encourage other SMEs to enter pre-commercial procurement projects** stated that they **“provide a good opportunity for developing new solutions and even starting up a new company.** Furthermore, by participating in EU funded projects, SMEs are able to gain credibility which can be helpful, for example, in getting additional funding”⁴⁵. This is a clear example of how a project can strengthen the global position of EU industry in service robotics for ageing well.

In the field of robotics for ageing well, the results from the RADIO project may improve the competitiveness of the companies involved, which have already presented very good relevant initial proposals for exploiting the project results. The **RADIO communication infrastructure will provide critical advantages compared to any already existing solution based on a single solution**, in terms of coverage area, energy consumption as well as traffic capacity. In addition, the design agreed upon during this year

⁴⁴ Crowley, James L.; Duffy, Brian R.; Webb, Philip (2016). Consolidated Review Report – ROBOT-ERA. European Commission, FP7 Programme, Pg 3.

⁴⁵ www.cordis.europa.eu/result/rcn/188523_en.html

assures extensibility to any new and upcoming short range, ultra-low power protocol. Furthermore, the RADIO communication infrastructure can take advantage of a much wider market of sensor modalities and vendors compared to any other solution. This drastically enhances the usefulness, flexibility and adaptability of the proposed infrastructure to diverse use case scenarios; **significantly reducing future deployment costs by remaining independent of any specific sensor/technologies provider.**⁴⁶

Lead position of SMEs in markets for ICT innovative products and services for independent living and active ageing

Amongst the projects focussing on Fall Prevention, within the FARSEEING project, a spin-off company was created by the University of Bologna. The company is called mHealth Technologies srl⁴⁷ and has been operating since July 2014. This company will act as the “external exploiter” of the project results after having sealed proper exploitation agreements with the owner(s) of such products. The company were semi-finalists for the Innovation Radar Prize in 2016⁴⁸.

The projects related to robotics for ageing well seem to have generated a strong impact in this area. For example, the GIRAFF+ project also has shown significant potential for impact in the future in this area and the exploitation strategy is excellent with **approaches being made to secure venture capital to commercialise the major outputs of the work**, something that would have a strong impact on those SMEs involved.

In the RADIO project, several SMEs are involved in the consortium (ROBOTNIK, S&C, and AVN) and the project will have a positive impact on the competitiveness of these companies. In addition to this, the project could also **benefit other European SMEs working and developing innovative solutions in the area of technology and infrastructure development for assistive technologies for the elders**, as well as related technologies including robotics.

The work being carried out in the I-SUPPORT project will also deliver innovation to the markets in order to strengthen the competitiveness and growth of related companies. This will be carried out through the user-centred specification of the requirements, definition of system architecture and the initiation of a wide range of research and development activities to prototype and evaluate an intelligent, adaptive and flexible service robotics bathing system. The project consortium predicts that the successful implementation of I-SUPPORT may definitely offer new service and product opportunities for SMEs, specifically SME partners from the Consortium (ROBOTNIK and OMEGATECH), not only in the area of service robotics for

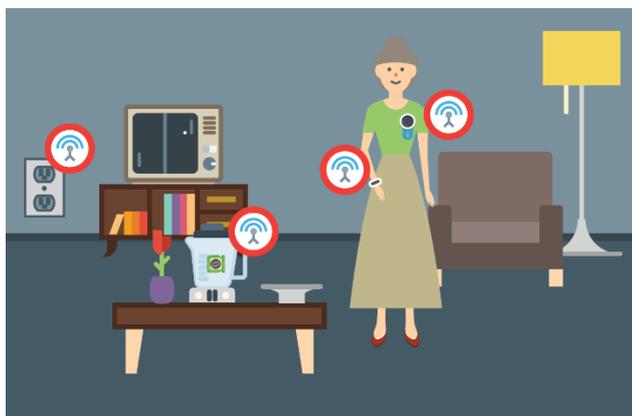
⁴⁶ Lanzenberger, Monika (2016). Review Report – RADIO Project. European Commission, H2020 Programme, Pg 6.

⁴⁷ www.mhealthtechnologies.it/

⁴⁸ www.mhealthtechnologies.it/mht-semifinalist-innovation-radar-prize/

bathing, but in any other area where advanced research and development objectives of this project would find application.⁴⁹

An impact can also be seen amongst those projects related to Innovating Elderly Care. An example of this can be seen through the DEM@CARE which made an impact in this area through the **generation of a number of spin-offs as a result of the work carried out within the project**. These spin-offs include: LTU: Memorizon AB⁵⁰; CERTH: Carealia⁵¹ and INRIA: EKINNOX⁵².



The DEM@CARE Home Setup, DEM@CARE Project (FP7 Programme). Source: Photo courtesy of the Centre for Research and Technology - Information Technologies Institute, Thessaloniki

Finally, within the EWALL project, a startup, Innovation Solution Sprl, together with some of the key researchers in the consortium will lead the commercialisation the platform developed during the project.

Reinforced academic and industrial knowledge base and excellence in multidisciplinary research on ICT for AHA and the creation of a longer term RTD agenda

Within the area of fall prevention, the FARSEEING project made marked progress on the development of a taxonomy of technologies or “common language”. This was made available as an **on-line tool that provides a core way of assessing technologies for the purposes of systematic review**, meta-analysis and evidence synthesis. The project also developed **new knowledge and recommendations regarding older adults’ use of technologies**.⁵³

In the field of robotics for ageing well, the SILVER project has also played its role. The documentation generated during the project lifespan has been used in most other EU PCPs, thus confirming the impact towards the standardisation of the PCP process. The SILVER project has provided an **opportunity to better understand the innovation process within the healthcare technology field, cross organisational and transnational innovation, user driven product development as well as the practical management of complex and explorative projects**. Finally, the project

⁴⁹ Razavi, Reza (2016). Consolidated Review Report – I-SUPPORT. European Commission, H2020 Programme, Pg 10.

⁵⁰ www.memorizon.com

⁵¹ www.carealia.gr

⁵² www.ekinnox.com/wordpress/en/home/

⁵³ Meijer, Kenneth; Razavi, Reza; Stubbs, Richard (2015). Consolidated review Report – FARSEEING. European Commission, FP7, Pg 2.

has provided partners with a set of pre-commercial procurement specific document and reporting templates together with questionnaires for real life testing.⁵⁴

The RADIO project has carried out extensive literature reviews in order to pave the way to develop and implement methods for identifying ADL and their interplay with the various sensors and parts of the RADIO framework. From the end user point of view, the work conducted with regards to the usability and acceptance of the system is interesting and relevant with regards to the current state of the art. This is particularly the case when considering the work conducted under D2.6 in order to **bridge the gap between medical requirements and obtrusiveness**: this work is also relevant with regards to the current state of the art.

In addition to the previous two projects, the ROBOTERA also made a **significant contribution to the academic and industrial knowledge base**. The project made a great deal of **progress regarding the state of the art for service robots and intelligent environments and has become a visible showcase for the use of such technologies for elderly care**. The project impact has been primarily through publications in scientific conferences and journals, as well as raising awareness of the potential contributions that service robots and intelligent environments can play in elderly care.

It is also foreseen that the I-SUPPORT project also will have a strong impact in this area. The **main scientific and technological achievements** of the project are already reflected in scientific publications and include **user-centred specification of user and safety requirements, definition of I-SUPPORT service robotic functional specifications and system architecture for tracking human posture, movements and actions in shower environments etc.** Advanced modules of cognition, sensing, context awareness and actuation are being researched and implemented to enable the robotic bathing system to adapt to the frail senior citizen's abilities and to enable frail senior users to interact with the robotic system in a safe, master-slave mode. The project continues to be highly relevant, promising a scientific and industrial breakthrough.⁵⁵

In the field of innovating elderly care, some of the developments in specific modules of the EWALL project are beyond the state of the art and therefore represent a scientific/technological contribution. This is specifically the case of the face tracking algorithm (identifying faces in an image, even with multiple people present and different landmarks in each face) and the algorithm for activity coaching (methodology for personalisation of goals in activity coaching, that is automatic and self-learning). The introduced storytelling, interactive "intelligent" conversation between eWall (Robin

⁵⁴ Katevas, Nikos (2016). Consolidated Review Report – SILVER. European Commission, FP7 Programme, Pg 3.

⁵⁵ Razavi, Reza (2016). Consolidated Review Report – I-SUPPORT. European Commission, H2020 Programme, Pg 9.

agent) and the user is also a very interesting concept and might be the right way forward. Finally, a new face tracking system has been implemented. The system is built around a Kalman tracker that employs face detection measurements.⁵⁶

Table 3 Summary of the Impact Area – Market growth and expansion

Market growth and expansion		
Sub-category	Project category	Most influential projects
New markets for independent and active living products and services through a set of open standards and integrated platforms	Fall prevention	FARSEEING
	Robotics for ageing well	GIRAFF+ / RADIO / ROBOT-ERA
	Knowledge sharing and standardisation	UNIVERSAAL
	Innovating elderly care	EWALL
Improved competitiveness of the EU industry	Robotics for ageing well	ACCOMPANY / GIRAFF+ / SILVER / ROBOT-ERA
Strengthened global position of the EU industry in service robotics for ageing well	Robotics for ageing well	ACCOMPANY / SILVER / RADIO
Lead position of SMEs in markets for ICT innovative products and services for independent and active ageing	Fall prevention	FARSEEING
	Robotics for ageing well	GIRAFF+ / RADIO / I-Support
	Innovating elderly care	DEM@CARE / EWALL
Reinforced academic and industrial knowledge base and excellence in multidisciplinary research on ICT for AHA and the creation of a longer-term RTD agenda	Fall prevention	FARSEEING
	Robotics for ageing well	SILVER / RADIO / ROBOT-ERA / I-SUPPORT

There is a strong **dominance of the projects related to robotics for ageing well**, particularly with the SILVER, ACCOMPANY, ROBOT-ERA, RADIO and GIRAFF+ projects. Those **projects related to fall prevention also generated a strong impact in this area**, particularly with regards to creating new markets, improving the position of SMEs in markets for innovative products and reinforcing the academic and industrial knowledge base. Finally, the projects related to innovating elderly care also made an impact in this area. A key example can be seen through the EWALL project.

⁵⁶ Noll, Stefan; Stella, Eloisa; de Toledo, Stella (2016). Consolidated Review Report – EWALL. European Commission, FP7, Pg 4.



1.1.5 Impact Area – Dissemination and engagement opportunities

Dissemination of results

The FARSEEING project is a prime example of effective dissemination within an EU funded project. The project developed several quality scientific publications with 23 being published within the final review period. The project was also represented at 28 major scientific events and gave over 78 presentations and publications of scientific posters over the project lifetime. One of the **key dissemination activities from the project was the organisation of the first European Union Falls Festival EUFF2015⁵⁷**, bringing together key stakeholders in Europe related to fall Prevention including the ProFouND Thematic Network and the relevant action groups from the EIPonAHA. The project was also successful in generating public awareness about project activities through their periodic newsletters and presentation and meetings targeting the general public. These included the participation in programmes such as BBC Radio Manchester, which reached an audience of 210,000 and an article in Medical Express Magazine, which achieved 515,629 unique views. Finally, the project website (<http://farseeingresearch.eu/>) is currently still being updated⁵⁸.

In the field of Integrated care, the CAREWELL project is a further example of effective dissemination. The project made a **significant effort in the dissemination of results, both through presence at conferences (such as the IFIC in Barcelona), or through the open publication of project results through a well-maintained website and social media channels**. The major achievements in terms of dissemination activities include the maintenance of the integrated eCare website between CAREWELL, BEYOND SILOS and SMART CARE⁵⁹, participation in approximately 50 public events, including several high profile international conferences, gaining extensive coverage in online and print publications, as well as TV coverage, co-organisation of the joint final conference on integrated care, together with the BEYOND SILOS project and gaining TV coverage of the project in Croatia and Poland following project press conferences.

The brochure “Guidance for implementing integrated care in policy and practice” represents a valuable tool for stakeholders who want to take over the CAREWELL model of ICT supported integrated care. Fact sheets and videos were also produced for each pilot site, explaining the advantages of care integration to the general public. Finally, the project website (<http://carewell-project.eu/norm/home/>) is very professional and clear. It provides a section on the different project deliverables, factsheets, info

⁵⁷ www.eufallsfest.eu/

⁵⁸ UNIBO (2015). FARSEEING – White Paper on Project Results (Second Release).

⁵⁹ www.integrated-ecare.eu

about the pilots etc. The project also has a very strong social media presence, particularly on Twitter (300 followers⁶⁰).

There are also a few examples of impact through effective dissemination strategies amongst the projects related to robotics for ageing well. For example, the ACCOMPANY project was considered to be “exemplary” by the review team with regards to the dissemination of results. **Dissemination was performed through different channels (website, leaflet, twitter and promotional videos), engagement with the public (including “Open House” events, press, radio and TV contributions), and dissemination in scientific and professional publications (57 scientific publications in total) and events.** There was a high download rate of project deliverables: Over 1,100 for some deliverables⁶¹. Furthermore, the project had a very effective website (<http://rehabilitationrobotics.net/cms2/>) and was active on social media with a twitter account and videos present on Youtube describing the main features of the Care-o-bot. Finally, the project consortium was also successful in **gaining coverage in key mainstream media outlets** such as the Daily Mail (UK newspaper).⁶²

The SILVER project can also be seen as a strong example of project dissemination, with the consortium partners being extremely active in promoting the SILVER project as well as its innovative approach in their respective countries, as well as on European level. The results of the project have been disseminated in addition to the pre-commercial procurement tool by giving presentations in national and international seminars such as the AAL Forum and the EAFIP (European Assistance for Innovative Procurement) hosted workshops. Furthermore, during the spring and summer of 2016, the SILVER Consortium delivered two SILVER workshops for European level decision-makers, six national SILVER workshops organised by the procurers and an end-of-project conference and workshop in relation to the end-of-project conference. The Silver project also participated at the 2016 eHealth week in Amsterdam and hosted several local workshops/seminars to highlight the results of the SILVER project and the learnings gained.

The SILVER website (www.silverpcp.eu) is the main communication channel of the SILVER project. It shares the latest news and events and it has been regularly updated to communicate the recent developments within the project. It also acts as a communication channel between the SILVER consortium and the members of the target audiences. All the public deliverable documents as well as communication materials are available for downloads via the SILVER website. The SILVER website will be open until the end of the year 2017. Although the project is active on social media, the

⁶⁰ No of followers as of September 2017.

⁶¹ Amirabdollahian, Farshid; Gorham, Farshid (2014). Deliverable 7.2 Dissemination Report. Pg 4.

⁶² www.dailymail.co.uk/sciencetech/article-2942888/Is-age-robotic-BUTLERS-180-000-AI-helper-responds-commands-bring-drinks-open-doors.html

impact of this channel in particular is not a highlight with a Twitter account with 89 followers and 79 tweets and a LinkedIn Group with only 7 members.

The RADIO project can also be considered to have had an impact in the area of dissemination of project results. The dissemination and exploitation activities that were carried out were of very high quality. The project results have been disseminated through the project website (<http://www.radio-project.eu/>). Public project deliverables have also been made fully available on the project website. With regards to social media, RADIO has a strong presence including Facebook (110 likes), Twitter (198 followers and 278 tweets) and LinkedIn group (52 members). A project video has also been produced visualising the RADIO concept to a broader audience. The RADIO project has also appeared on the EURONEWS TV show. RADIO partners have also participated in various dissemination events.

Dissemination and training activities were also a strong point in the ROBOTERA project. Dissemination activities included a detailed project website and a strong social media presence including a Facebook page with 1.534 likes, a Youtube Channel with 88 subscribers and a LinkedIn group with 137 members. The project also took part in various demonstrations and interviews on television and radio. An interesting feature of the ROBOTERA dissemination strategy was the **organisation of a summer school for doctoral students and young researchers which generated 64 publications, 19 of which have appeared in peer-reviewed scientific journals**. It is clear that these activities have accelerated as the project matured and the level of media coverage has continued to grow significantly during the project. Overall a very strong effort has been made in this area with excellent results.



Participants using the LLM Care Platform, Long Lasting Memories Project (CIP Programme). Source: Photo courtesy of the Aristotle University of Thessaloniki

In the field of Innovating Elderly Care, the LONG-LASTING MEMORIES project is a good example of how impact can be generated through effective dissemination activities.

Individual partners and especially the coordinator were extremely active in dissemination work. The consortium carried out a substantial number of dissemination activities including the development of a project website that was attractive and published information in five different languages; A Network of Interest; Dissemination materials (brochures, leaflets, posters etc.); Social media presence on YouTube. A group was also established on LinkedIn; LLM workshops were carried out and scientific based dissemination materials (papers, articles, presentations, conferences, workshops and exhibitions etc.) were produced.

LLM also sought top level publications in the following journals: Neuroscience & Biobehavioural Reviews (two review articles are in preparation); articles focusing on different aspects of the results in the Annals of Neurology, the Journal of Alzheimer's Disease, Biological Psychology, the International Journal of Psychophysiology, Health Policy, JAMIA, IEEE Trans Inf, Tech Biomedicine and other technical journals.

Involvement of potential users and other stakeholders

Upon analysing those projects focussed on fall prevention, the FARSEEING project can be seen as a success in terms of the participation of potential users. They were **involved in different activities from the conception of the project up to the field trials and validation**. In total, the activities of over 2,800 people were measured (about 2,400 in high-risk geriatric rehabilitation patients, about 400 in community dwelling older subjects).

The I DON'T FALL project was considered by the Commission as an example of **best practice in recruiting and maintaining elderly people in trials under EU funded projects**. The project has performed well to undertake and deliver a large multi-country RCT of 500 patients, in seven pilot sites in four countries without exceeding expected dropout rates – given the age, of over 90, of some of the participants, maintaining the dropout rate at an acceptable level was a great achievement.

In the realms of integrated care, the CAREWELL project has been successful in involving potential stakeholders and other users achieving **good engagement from health care professionals**. Furthermore, all of the pilot sites involved in the project have addressed their policy-makers on both local and national levels and focus on conveying to them the new ICT based integrated health and social care services as well as their concrete benefits.

Regarding robotics for ageing well, in the ACCOMPANY project, potential users, including ageing people, formal caregivers and informal caregivers, were intensively involved throughout the project. They participated in the definition of user needs and scenarios, as well as in the evaluation of the acceptability and usage of project results. The **participation of these potential users has been extremely useful for the project consortium providing information that has been used to construct an economic model and business case development**.

Finally, in the field of innovating elderly care, the LONG-LASTING MEMORIES project was also successful in involving potential users and stakeholders. LLM rolled out its **services in four different countries and directly reached and impacted 1,846 users (elderly people)**. The project consortium managed to reach forty-two homes and thirty-six care centres. Furthermore, LLM project achieved to verify the technical, organisational and legal feasibility of LLM service along the complete value chain of stakeholders, involved through a dedicated network of interest

maintained through the project lifetime, involving more than 350 stakeholders.

Table 4 Summary of the Impact Area – Dissemination and engagement opportunities

Dissemination and engagement opportunities		
Sub-category	Project category	Most influential projects
Dissemination of results	Fall prevention	FARSEEING
	Integrated care	CAREWELL
	Robotics for ageing well	ACCOMPANY / SILVER / RADIO / ROBOT-ERA
	Innovating elderly care	LONG LASTING MEMORIES
Involvement of potential users and other stakeholders	Fall prevention	FARSEEING / I DON'T FALL
	Integrated care	CAREWELL
	Robotics for ageing well	ACCOMPANY
	Innovating elderly care	LONG-LASTING MEMORIES

As dissemination and engagement activities are carried out in all of the EU-Funded projects, we can see how the impact in this area has been across the board, with no specific category of projects taking centre stage. However, the effectiveness of the dissemination activities of the projects related to robotics for ageing well should be commended.



1.1.6 Impact Area – Project sustainability

Use of project results today

In the area of fall prevention, the FARSEEING project identified **10 Prioritised Exploitable Results (PFERs)** qualifying as commercially promising for an early exploitation, soon after the project end. Also, and as previously mentioned, the spin-off company, mHealth Technologies srl. was created to exploit these results following the end of the project. Regarding the fall repository itself, the project partner Robert Bosch Gesellschaft fuer medizinische Forschung mbH (RBMF) has guaranteed the **sustainability of the fall repository 10 years beyond the project** and the data access in line with the data sharing policy established during the project. Furthermore, a meta-database advisory board has been established to control the maintenance of the fall repository as well as to guarantee the compliance with ethical and data protection standards.⁶³

The I STOPP FALLS project has also proved strong evidence of project sustainability in the future, particularly through newly acquired follow-up projects on national level (Germany) and different plans for further exploitation of the projects foreground (single and joint partner activities). Even though the project officially ended in 2014, its researchers have since taken it forward. Over the last two years there has been interest in rolling out the I STOPP FALLS system by the Ministry of Social Affairs in Saxony, Germany, the Ministry of Health in Rhineland-Palatinate, and the Agency for Sports and Exercises in North Rhine Westphalia. The **continuation of the project in Germany can also be seen through the transfer of project results and development to the German National BMBF project MobiAssist**; this is where 3 German partners from I STOPP FALLS are collaborating further. According to the project coordinator, the **project outcomes and developments are also being used in the H2020 project my-AHA**⁶⁴; this is where 4 international partners from I STOPP FALLS are collaborating further. This project was not included in this study as it finishes in December 2019 and is therefore out of the scope of this study.

In the field of integrated care, the CAREWELL project has developed a number of useful tools that can be used for future integrated care projects. An example of this can be seen in the **wiki on integrated care**⁶⁵. The project consortium has also consolidated the lessons learnt from implementing integrated care across the projects under a set of guidelines “Guidelines for CareWell Uptake” and an “Integrated Care Glossary”,

⁶³ Meijer, Kenneth; Razavi, Reza; Stubbs, Richard (2015). Consolidated Review Report – FARSEEING. European Commission, FP7, Pg 3.

⁶⁴ www.activeageing.unito.it/en

⁶⁵ www.wiki.integrated-ecare.eu

representing **important steps towards a common terminology in the area of newly organised services for frail elderly** and suited to be used by interested teams to implement regional integrated care programmes.

The INCA project can also be seen as having generated impact with regards to project sustainability. **3 out of the 5 pilots have already decided to sustain services after the project end.** Furthermore, the success cases will be used to "sell" the model to higher level Public Administrations. Examples of the continuation of services can be seen in the Murcia Region where there will be **full interoperability with the official Electronic Health Records (EHRs) in the region,** paving the way for the sustainability and inclusion of INCA alongside the provider's daily tools. In the Manises hospital pilot in Valencia, there will be an extension of the service to smart-healthy cities. The Manises hospital has established a **Public Private Partnership to ensure the continuation of the Service after it ends.** Furthermore, INCA, named Agenda ECA at Manises Hospital, is now a strategic corporate service at the organisation's portfolio and a unique value proposition in front of Valencia Region Health Ministry. Finally, at Geroskipou in Cyprus, the service will continue after the project ends and a new Medical Centre will be built (starting mid 2016). Interests shown also from private hospitals (Agios Georgios Hospital) and also from public municipalities. The model can be replicated for other social care centres from Cyprus.⁶⁶

Amongst those projects focussing on innovating elderly care, the LONG-LASTING MEMORIES project has been successful in continuing long after the project end. According to the project coordinator, activities have continued, even after project completion in 2012. **Extensive trials and expansions have been attempted as successful pilots for the project proved the capacities for improving the cognitive and physical condition of the elderly by using innovative ICT based services and products in the area of ICT Assisted Cognitive Training and Social Interaction** (Bamidis, P. D., et al. (2015). The positive user acceptance has led to the intention of several LLM partners to continue providing LLM services to users in the piloting environments for some time after the project's end. In 2014, the LLM platform, under the new brand name "LLM Care" passed from the pilot implementation to the market implementation, as a service provided to local stakeholders, public and private elderly care homes, health care professionals, individuals, as well as elderly citizens in need⁶⁷. According to the project coordinator, through the LLM Care ecosystem⁶⁸, an established self-funded initiative in technology driven

⁶⁶ Leorin, Cristian (2016). Consolidated Review Report – INCA. European Commission, CIP Programme, Pg 12.

⁶⁷ Romanopoulou E, Zilidou V, Antoniou P. Spinning off gerotechnology business activities: The LLM care best practice paradigm. In P. Bamidis, I. Tarnanas, L. Hadjileontiadis, & M. Tsolaki Eds (2015). Handbook of Research on Innovations in the Diagnosis and Treatment of Dementia. Hershey, PA: IGI Global. Pgs.426-436.

⁶⁸ www.llmcare.gr/en

elderly social care⁶⁹, numerous such stakeholders are already using the developed services⁷⁰. The project coordinator also went on to state that IPRs and business processes were defined and signed between partners of the LLM consortium for the exploitation of the results of the project. Since the end of the project there has been a continuous collaboration among some of the partners either for the commercialisation process or for new proposals.

The DEM@CARE project is also a good example of impact in project sustainability. Several articles and publications have been published by members of the project consortium such as an Article on "Home healthcare support findings from DEM@" that was submitted to a special issue of The Gerontologist journal by CERTH and DCU. Further applications for funding



DEM@CARE Clinic Lab, DEM@CARE Project (FP7 Programme). Source: Photo courtesy of the Centre for Research and Technology - Information Technologies Institute, Thessaloniki

have also been sought such as "EASILiv@Home: Enhancing And Supporting Independent Living at Home" at SC1-PM-15-2017 and "ELDERCARE" at SC1-PM-15-2017.

According to the project coordinator (CERTH), the project partners have also been busy working and making progress using the results from the DEM@CARE project in the

following ways. CERTH continues to expand research on Dem@Care's results and tools to new areas such as Clinical studies of extended duration (1 year) at people's homes, new clinical applications of the platform to diabetes monitoring and care, in collaboration with MindWork⁷¹, new commercial applications of the platform to drug adherence monitoring, in collaboration with AidPlusCare⁷², expansion to the well-being and active-ageing domain with stress, mood and mental state monitoring applications, clinical trials of physical and cognitive behavioural treatment interventions, such as meditation, in collaboration with Alzheimer's Hellas⁷³ and Buddha Libre⁷⁴. One of the partners (DCU⁷⁵) continues to use the initial work on periodicity detection in lifelogs in several application areas in collaboration with Arizona State University. UBX⁷⁶ continues studies in recognition of objects from egocentric cameras with applications in vision-assisted

⁶⁹ Romanopoulou ED, Zilidou VI, Bamidis PD (2017). Creating and sustaining a Social HealthCareEcosystem: the Case of LLM Care Services in Greece. Hell J Nucl Med.

⁷⁰ www.llmcare.gr/el/map

⁷¹ www.mind-work.gr/

⁷² www.aidpluscare.com/en/

⁷³ www.alzheimer-hellas.gr

⁷⁴ www.buddhalibre.gr

⁷⁵ www.dcu.ie/

⁷⁶ www.u-bordeaux.fr/

neuroprosthesis and fall sensing in Parkinson's. CHUN⁷⁷ continues investigating on the use of automatic speech analysis and speech recognition in clinical practice for the assessment of cognitive impairment in collaboration with the German Centre for Artificial Intelligence (DFKI) and the startup Ki-elements⁷⁸. Finally, INRIA continues investigating on the use of automatic video analysis and monitoring of older people with Nice hospital for national and local projects and with Toyota company for Ambient Assisted Living.

The sustainability of the EWALL project can also be seen as generating an impact. For example, a number of partners have already started to exploit the project results by using them in other projects or by integrating them in their operations. All these efforts confirm a commitment to foster the achieved results of eWALL beyond the planned project activities. Furthermore, the **CloudCare2U⁷⁹ solution is based on the eWALL open-source code**. CloudCare2U will be commercially available in 2017 Q1.

The CARER+ is a further example of the sustainability of project results following the end of the project. According to the project coordinator, a number of activities have been carried out following the project close. Firstly, the **digital competence framework of the Carer+ training programme has been integrated into the French diploma of life assistant**. If the current trends continue, it is expected that around 4,000 people will obtain these French professional diplomas integrating Carer+ digital competence framework. In Spain, a specialist diploma has been created on digital competences that will be included in the Spanish Catalogue of professional qualifications.

Furthermore, a training programme in digital skills, linked to the Professional Certificate "Social and health care to people at home" has been developed on the basis of Carer+ project in the Basque Country. The Italian partner, IRS (Istituto per la Ricerca Sociale), decided to continue the experimentation of the CARER+ training programme for one year after the end date of the project including more training resources contextualised at local level, in cooperation with the local stakeholders.

The website of the project is still available (www.carerplus.eu/), providing access to all the deliverables of the project, mainly the training programme resources, available free of charge and in 6 languages (English, French, Spanish, Italian, Romanian and Latvian). More than 45,000 visits have been received until now and several organisations have asked the training programme files (from Ireland, Italy or Hungary).⁸⁰

The STOP AND GO project can also be considered as having generated an impact in the field of innovating elderly care. According to the project coordinator, the services procured in the project will persist and we expect

⁷⁷ www.chu-nice.fr/

⁷⁸ www.ki-elements.de/

⁷⁹ www.innovationsprint.eu/cloudcare2u/

⁸⁰ Information provided by the Project Coordinator, IPERIA L'INSTITUT.

there will be continued activities. Procuring partners are already being sought for “extra” events such as the 2017 Procurement conference in Tallinn and the AAL Forum in Coimbra. Furthermore, STOP and GO and new actors have been successful in the RITMOCORE⁸¹ project, a similar eHealth services PPI. UK partners are building on Liverpool’s digitalisation of social care achieved in STOP AND GO through the addition of new services based on ambient sensing over low power radio. Other initiatives include a hackathon (#StitchHack) with users and SMEs to frame what these services will look like. This will lead to new service procurements outside of the PPI



Interaction between the KOMPAI -2 robot and an elderly user in a home environment, MARIO Project (H2020 Programme). Source: Photo courtesy of KOMPAI Robotics.

mechanism. The project Coordinator added “I would note that the **STOP AND GO procuring partners have been impressed with services developed as a result of the PPI process to the extent that they will use the STOP AND GO innovation procurement method well beyond the formal end of the project.**”

At the end of the project, a consolidated release of the European specification template and reference business case, suitable for use in all the European regions to support EU strategies depicted in the strategic implementation plan of the EIP on AHA, will be published. In order to further the work of the project and to enable it to be put into practice on a wider scale, this will be an accessible, practical and usable document.

In the field of knowledge sharing and standardisation, the universAAL project, which ended in 2014 has been **continued via a subset of partners of the consortium who successfully applied for a continuation within the reAAL project (CIP programme)**. According to the Coordinator of the universAAL project, **work also continued beyond the ReAAL project**. ReAAL aims to demonstrate the advantages of open ICT solutions through pilot deployment to over 7,000 users across seven countries.

With regards to project sustainability in robotics for ageing well, the SILVER project can be seen as a good example. The project results have already been used at two levels: within the project partners (i.e. the lessons learnt, process and templates), and other actors not directly involved (i.e. new PCPs using project results). The project is acting as a **best practice example and is creating awareness of the PCP model, as well as the**

⁸¹ www.cordis.europa.eu/project/rcn/206004_en.html

solution that reached phase 3 during the PCP process itself. Some procuring authorities will also look to further exploit the results of Project SILVER through networks such as the European Connected Health Alliance⁸², which has a large connector platform with which to share the lessons from project SILVER as well as bring the contractor to a wider market. According to the project coordinator, the contractor (RCS) has continued the development of the product that was the successful candidate in the PCP process, gained medical device certification and is now developing production models and evaluating with organisations in the Netherlands. Once complete the next steps will be to engage with other countries.

Within the field of frailty, early detection and intervention, the exploitation activities of the PERSSILAA project (www.perossilaa.com/) have been mainly carried out in the Netherlands and Italy. The business models included a cost-effectiveness analysis as well as the clinical evaluation. The platform has already been **scaled up in the Netherlands and has been offered to about 10,000 users (situation Nov 2016), in 4 municipalities.** The PERSSILAA platform, service model and business model have been validated and a sustainable implementation in the health care system is envisaged, with clear socio-economic benefits for the service providers. Finally, **13 key exploitable results have been produced in the project, of which 1 application is already on the market, 6 applications are envisaged for 2017 and 2 for 2018/2019.**⁸³

Interaction with other related Framework Programme projects and other national/international R&D programmes and standardisation bodies

With regards to Fall Prevention, the consortium of the FARSEEING project shows adequate interaction with other related projects and programmes such as **concertation and clustering activities with other projects (FP7, CIP-PSP, Thematic Networks) and initiatives such as the EIP-AHA.**

In the field of Integrated care, the CAREWELL project has **established synergies with the BEYOND SILOS and SMART CARE projects** as all three projects agreed to use the same approaches with regard to data collection (MAST framework, integrated database), enabling them to put together all information available. The coordinators have met, a common webinar on change management was held, Veneto and Low Silesia regions participate in the production of a common glossary, and an umbrella website was created for the three projects. In addition, the projects contributed jointly at several occasions to the European Partnership for Active and Healthy Ageing. Finally, **five of CAREWELL's pilot sites**

⁸² www.echalliance.com

⁸³ Sankelo, Merja; Pouillie, Roland; Serral Asensio, Estefanía (2016). Consolidated Review Report – PERSILAA. European Commission, FP7, Pg 3.

successfully applied as Reference Sites⁸⁴ for the European Innovation Partnership on Active and Healthy Ageing (EIPonAHA).

Also in the field of Integrated care, the **INCA** project has taken into account the development of other ongoing projects (epSOS, EXPAND, SEED, SMARTCARE, Trillium Bridge) and especially the path opened by the project epSOS (LSP) towards interoperable healthcare in Europe. INCA, within its own vision, wants to take this one step further. INCA has also used the eServices of SEED project (Pilot B coordinated by IDI EIKON).

In the field of Innovating Elderly Care, the LONG-LASTING MEMORIES project actively collaborated with ten other projects. There have also been preliminary contacts with standardisation bodies. **Other projects have been using LLM achievements e.g. USEFIL (infrastructure) and DISCOVER (training material).**

The project participates in the European Innovation Partnership on Active and Healthy Ageing⁸⁵ as a Candidate Site of EPIonAHA, as well as its Greek localised network activities⁸⁶ and is member of the European Network of Living Labs (ENoLL) with the Thessaloniki Active and Healthy Ageing Living Lab⁸⁷. The latter aims at updating the LLM Care service by facilitating the speeding up of innovation, collaboration, development and testing of more accurate services, which is achieved by the early involvement of users as co-creators.

The DEM@CARE project partners made significant steps with regards to establishing synergies with other projects and initiatives. DEM@CARE has clustered with Haivisio to ensure visibility, awareness and the dissemination of results amongst lots of interested stakeholders. It also became a member of the AFEINNOVNET network, the overarching goal of which is to set up a large EU wide community of local and regional authorities and other relevant EU stakeholders who want to work together to find smart and innovative evidence based solutions to support active and healthy ageing and develop age-friendly environments across the EU.

DEM@CARE also established partnership with the H2020 project UNCAP, which deals with ubiquitous care for ageing people with mild cognitive impairments, the objectives and the settings of which are very similar to DEM@CARE, although the latter has had more impact according to the team carrying out this study. Finally, significant attention should be given to the fact that ontology standardisation efforts were carried out during the course of the project. Consortium partners published

⁸⁴ www.ec.europa.eu/eip/ageing/reference-sites_en

⁸⁵ www.ec.europa.eu/research/innovation-union/index_en.cfm?section=activ...

⁸⁶ www.eiponaha.gr

⁸⁷ Konstantinidis EI, Bamparopoulos G, Bamidis PD. Moving Real Exergaming Engines on the Web: The webFitForAll Case Study in an Active and Healthy Ageing Living Lab Environment. IEEE J Biomed Health Inform. 2017 May;21(3):859-866. doi: 10.1109/JBHI.2016.2559787.

within the LOV (Linked Open Vocabularies) community⁸⁸ the Domain Context Descriptor ontology, which has been developed to formally describe the high-level context pertinent to ADLs.

The EWALL project was also successful in establishing links with other R&D programmes. **Most partners are already involved in other research projects.** The project has designed an **interface to interoperate with the platform developed by the Large Sale Project epSOS.** There is a link with the European Telecommunication Standardisation Institute (ETSI) and a potential project related to "Privacy-by-Design" in eHealth could be started in cooperation with this body. The project also has a link with the Continua Health Alliance, as one of the project partners, CTIF/AAU, has joined Continua Alliance as a university member.

The eWall project has been nominated as a liaison organisation of the CEN TC 251 Health informatics committee, in charge of developing the ISO/IEEE 11073 family of standards. eWALL has also been involved with the ITU (International Telecommunication Union, the United Nations specialised agency for information and communication technologies) in the Internet of Things Global Standards Initiative. Finally, eWALL was present in the 2nd Active Health Ageing Summit that took place in Brussels from 5-8 December 2016. The Consortium participated with a demo booth in the exhibition room.⁸⁹

In the field of knowledge sharing and standardisation, the UNIVERSAAL project **builds on the legacies of a number of EU projects devoted to the production of AAL software infrastructures** (including PERSONA, Amigo, GENSY, OASIS, SOPRANO and MPOWER), consolidating the results from these where feasible and carrying out new development where necessary. Furthermore, **links with European Partnership on Active and Healthy Ageing, Action Group C2, as well as the ReAAL project** have also been established. UNIVERSAAL submitted a commitment to the European Innovation Partnership on Active and Healthy Ageing (EIP on AHA) in 2012, related to general use of multiple project results. UNIVERSAAL subsequently submitted a second commitment to EIP AHA, this time specifically focusing on promotion of the uStore result.

In the field of robotics for ageing well, the SILVER project has also been effective at establishing links with other EU projects and initiatives. **Partners have been able to apply the lessons learnt in the SILVER project when participating in related PCP/PPI proposals and projects.** For example, SILVER partners have been involved in the following projects: SELECT for Cities, CHARM, THALEA, Preforma and ENIGMA.

The SILVER consortium has also identified several networks that are beneficial for disseminating the SILVER project results and thus increasing

⁸⁸ www.lov.okfn.org/dataset/lov/

⁸⁹ Noll, Stefan; Stella, Eloisa; de Toledo, Stella (2016). Consolidated Review Report – EWALL. European Commission, FP7, Pg 25.

the impact. These include, the European Network of Living Labs (ENoLL), Eurocities, the European Network of Social Authorities (ENSA) and Ambient Assisted Living Network (AAL). Finally, the SILVER Consortium has also co-operated actively with the EAFIT and other actors promoting better innovative public procurement, such as Public Procurement Network.

Finally, within the field of innovating elderly care, the STOP AND GO project has established links to various other PPI projects and experts. Evidence of **effective collaboration and peer exchange with other projects** can also be seen along with **connections to other initiatives including PROEIPAHA, HAPPI, EcoQUIP, EPP eHealth projects and the C2 EIP-AHA and the B3 EIP-AHA action groups.**

Table 5 Summary of the Impact Area – Project sustainability

Projects Sustainability		
Sub-category	Project category	Most influential projects
Use of project results today	Fall prevention	FARSEEING / I STOPP FALLS
	Integrated care	CAREWELL / INCA
	Robotics for ageing well	SILVER / PERSSILAA
	Innovating elderly care	LONG-LASTING MEMORIES / DEM@CARE / EWALL / CARER+ / STOP AND GO
	Knowledge sharing and standardisation	UNIVERSAAL
	Frailty, early detection and intervention	PERSSILAA
Interaction with other related Framework Programme projects and other national/international R&D programmes and standardisation bodies	Fall prevention	FARSEEING
	Integrated care	CAREWELL / BEYOND SILOS
	Robotics for ageing well	SILVER
	Innovating elderly care	STOP AND GO
	Knowledge sharing and standardisation	UNIVERSAAL

It is encouraging to see that there is a **strong presence of all project categories in the area of project sustainability**, highlighting the impact that these Top 25 projects have made or are going to make in the near future. Those **projects related to innovating elderly care are particularly predominant in this area** with numerous activities being carried out once the projects had ended.

1.2 Key findings from EU funded research and innovation projects

This section summarises the key findings from the top 25 projects in terms of results with the objective that they can be used and built upon in future projects funded by the next research and innovation agenda for ICT for Active and Healthy Ageing. Links to the key outputs from each of these projects has also been included with the aim of creating a “toolkit” of the most important documents, tools, research, innovations etc. from the EU funded research and innovation projects related to ICT for Active and Healthy Ageing.

1.2.1 Better connected through integrated care

Table 6 Key findings and outputs – Beyond Silos

BEYOND SILOS	
Key Findings	<ul style="list-style-type: none"> - ICT solutions facilitate and improve, access to and sharing of, highly relevant data for better care, real time communication between all care actors and care recipients. They also provide support for a more safe and comfortable life at home. - Pioneer project in making home care services a priority for the new organisation of innovative valuable care settings for long-term conditions at all seven pilot sites. - Local conditions are fundamental in determining the delivery of health and social care across Europe. - The project can be considered as a best practice example of effective recruitment of primary target users with Chronic Obstructive Pulmonary Disease (COPD) and Mild Cognitive Impairment (MCI), their relatives and professional carers for the final demos through the involvement of local associations of seniors in organised workshops. - Effective use of clinical and socioeconomic evaluation at local level using various different methodologies and tools including: <ul style="list-style-type: none"> ○ MAST: Model for the assessment of telemedicine (Telemedicine applications for chronic conditions). ○ ASSIST: Assessment and evaluation tools for e-service deployment in health, care and ageing (data collection and analysis for each pilot site). ○ LIAR: (Assessment of barriers of change at site level and how to overcome them). ○ RAIL: Risks, Actions, Issues, Lessons, Learned (Support monitoring and coordination activities among pilot sites) ○ MAFEIP: Monitoring and assessment

	Framework for the EIP on Active and Healthy Ageing (Case study).
Key Outputs	<ul style="list-style-type: none"> - Development and piloting of integrated care services based on Integrated eCare Pathways - Mentoring and knowledge sharing activities carried out with CAREWELL and SMART CARE - BEYOND SILOS Evaluation Framework - Key conclusions from the application of the MAFEIP methodology: MAFEIP Case Study: Badalona Serveis Assitencials - Integrated Care website in collaboration with SMART CARE and CAREWELL

Table 7 Key findings and outputs – Carewell

CAREWELL	
Key Findings	<ul style="list-style-type: none"> - A significant European-wide impact from a social and economic perspective. - Substantial increase in the knowledge about sustainable integrated health and social care and a model that is well-suited to be transferred to other European regions and to other cohorts of the population with other health and social care needs. - Development of sound empirical evidence for the cost-benefit evaluations needed to convince regional and national policy-makers about the benefits of ICT-supported integrative care. - Integrated care has increased quality of life for older people included in the study. - Optimisation of the efficiency and effectiveness of the healthcare services delivered to complex multi-morbid patients aged 65+ through the use of integrated care programmes. - Five of CAREWELL's pilot sites successfully applied as Reference Sites for the European Innovation Partnership on Active and Healthy Ageing (EIPonAHA). - Generation of a set of consolidated conclusions from implementing integrated care across the projects through a set of Guidelines and Integrated Care Glossary, representing important steps towards a common terminology in the area of newly organised services for frail elderly and suited to be used by interested teams to implement regional integrated care programmes. - Effective use of clinical and socioeconomic evaluations at local level using various different methodologies including: <ul style="list-style-type: none"> o MAST: Model for the assessment of telemedicine (Telemedicine applications for chronic conditions). o ASSIST: Assessment and evaluation tools

	<p>for e-service deployment in health, care and ageing (data collection and analysis for each pilot site).</p> <ul style="list-style-type: none"> ○ RAIL: Risks, Actions, Issues, Lessons, Learned (Support monitoring and coordination activities among pilot sites)
Key Outputs	<ul style="list-style-type: none"> - Guidelines for Integrating Care in Policy and Practice, the Journey to deploying scalable Integrated Healthcare Services - Integrated Care Glossary - Integrated Care Website in collaboration with SMARTCARE and BEYOND SILOS - Wiki on Integrated care

Table 8 Key findings and outputs – INCA

INCA	
Key Findings	<ul style="list-style-type: none"> - Strong contribution to the current state-of-the-art in Chronic Disease Management, aspiring to integrate or facilitate the integration of social programmes beyond the clinical vision of the care chain provision. - Incorporation of developments from other ongoing projects (EXPAND, SEED, SMARTCARE, Trillium Bridge) and the progress made by the project epSOS towards interoperable healthcare in Europe. - INCA/AdsuM+ proved to be more effective and less costly (€360/patient in one pilot) than the control group treatment and stood out with regards to patient satisfaction and self-assessed improvement in Quality of Life. - Impressive reduction of re-hospitalisations after INCA deployment and operation. - Exploitation of the potential of ICT and a reduction of the gap between different services, organisations and parts of care provision. - Deployment and launch of five pilots in four different EU nations is the core of this project with strong sustainability potential. 3 out of the 5 pilots opted to sustain services when the project ended. - Pathfinder project in Croatia as the pilot project was only proof of concept, allowing the Croatian Health Insurance Fund to take qualified decisions in the public procurement process. - Use of the MAFEIP model, with key feedback provided to the MAFEIP team.
Key Outputs	<ul style="list-style-type: none"> - Standards and Interoperability Assessment - Pilots: Trials Testing and Validation

Table 9 Key findings and outputs – inCasa

inCASA	
Key Findings	<ul style="list-style-type: none"> - A clearer understanding of the potential benefits of integrated service delivery for service provider organisations, and a concrete starting point for the future development of more closely integrated health and social care systems across Europe. - Proved that the quality of life of patients who are frail and vulnerable can be improved through the integration of services. - Demonstration of how clinical outcomes can be improved and care can be targeted more effectively and safely, through the re-organisation of existing pathways and the delivery of care closer to home. - Advanced Integration on a functional and technological level, including patient clinical data regarding the patient's health at a local (integration between the electronic medical record (EMR), social dossier and the project's platform) and regional/national level (integration with the EHR). - Progress regarding the development of behavioural data and clinical profiling models, to ensure a better classification of frailty and to increase the diagnosis, care and treatment integrated models.
Key Outputs	<ul style="list-style-type: none"> - An Integrated Architecture for Remote Healthcare Monitoring - System and Functional Specifications

1.2.2 Fall prevention

Table 10 Key findings and outputs – Farseeing

FARSEEING	
Key Findings	<ul style="list-style-type: none"> - Helped to make independent living a realistic option even for those people who are at high risk, providing a 360° perspective on how to prevent, detect and manage falls in various environments. - The Fall Repository is a major breakthrough in scientific and clinical knowledge in the area and sets new standards for the future development and evaluation of fall-related interventions. - The Taxonomy of Technologies shows every sign of becoming a new standard. - Substantial ICT-related improvements in the areas of fall prevention and fall detection through the design and validation of novel algorithms, and subsequently intervention strategies and service models. - Proved that wearable sensors perform well and

	<p>that their only disadvantage is that the battery life is shorter than competing products.</p> <ul style="list-style-type: none"> - Use of an External Advisory Board with a focus on future dissemination and exploitation issues. - Successful commercialisation of FARSEEING'S technology into marketable medical devices available to the mass market through the spin-off company from the University of Bologna, mHealth (www.mhealthtechnologies.it). The company offers a range of wearable and mobile solutions for monitoring, assessment and rehabilitating the motor functions of an ageing population. - Development of a PhD course at Manchester University whereby participants can continue to work with key FARSEEING partners evaluating new technologies for the promotion of active and healthy ageing. - Generation of 10 Preferred FARSEEING Exploitable Results including: Data and Repository, Wearable sensors, Stand-alone application for instrumenting functional tests, Fall detection algorithms, smartphone based fall detection, smarthome solutions, Algorithms for long-term gait analysis, Smartshoes, Taxonomy of technologies and its web based tool, Fall Risk Model. - Exploitation of the smartphone-based solutions in the new PREVENTIT project, financed under the HORIZON 2020 framework. This project aims to develop and test a personalised ICT-based intervention aimed at behavioural change in people who have recently retired, so as to decrease the risks of age-related functional decline.
Key Outputs	<ul style="list-style-type: none"> - Taxonomy of technologies (Report) - Taxonomy of technologies (online version) - Guidelines for the Design and Implementation of Technologies - Standard Fall Data Format - Real-World Fall Repository - FARSEEING PhD Course - PREVENTIT Project Website

Table 11 Key findings and outputs – FATE

FATE	
Key Findings	<ul style="list-style-type: none"> - Development of an algorithm capable of detecting falls with incredible accuracy and a very low false positive ratio. - Established the groundwork for the commercialisation of a portable fall detector that can be worn on a belt with all user/device interactions carried out through an easy-to-use

	<p>Android app.</p> <ul style="list-style-type: none"> - The FATE system reduces fear of falling and improves balance & gait (Tinetti's Scale), as both are positively correlated with reduction in actual falls, and in a user's ability to continue to live independently (Barthel's Index). - Creation of a European startup Sense4Care S.L. (www.sense4care.com) to further develop and commercialise a fall detector based on the work carried out in the FATE project. The "Angel4" detector is a standalone device that works without the usual telecare service charges. It is an innovative sensor that allows direct communication with the user's caregiver or relatives through standard mobile phones. The product is currently being sold in 13 countries throughout the world. - Possible integration of the fall detection algorithm into third-party products under a licensing agreement. MLGtech, in Israel, is currently exploring this possibility after the first pre-production unit evaluation.
Key Outputs	<ul style="list-style-type: none"> - SENSE4CARE's Company Website featuring the commercialisation of the Angel 4 device.

Table 12 Key findings and outputs – I Don't Fall

I DON'T FALL	
Key Findings	<ul style="list-style-type: none"> - Successful in tailoring fall management solutions to specific risk factors, root causes and user needs. - Best practice in recruiting and maintaining elderly people in trials under EU funded projects. Particularly with regards to the key success factors on motivating large numbers of elderly people in these trials. - Deep understanding of end user needs through careful market analysis. These have provided partners with guidance on how they can most effectively move towards effective commercialisation. - Development of a cognitive rehabilitation platform; a robotic rollator – the iWalker – to support patients in physical rehabilitation; a wearable inertial unit to track gait and detect falls and a mobile android-based device connected to the iWalker that sends data to an electronic medical record. - Promising technical results regarding a remote monitoring fall detection system which was tested with 24 patients. - The ICT solutions that were developed during the project have demonstrated clinical and social

	<p>benefits for elderly patients. In some test sites the solutions registered a two-point increase on the Quality of Life index.</p> <ul style="list-style-type: none"> - The project trials of that were carried out at selected sites showed a significant reduction in falls with respect to the previous year (43%) and an increase of 4 points in the BARTHEL Index. Furthermore, the huge amount of data collected will feed into further studies and analysis.
Key Outputs	<ul style="list-style-type: none"> - Study of Risk Factors, Root Causes, Target Populations and Taxonomy of ICT Fall Management Services - Pilot Cases, Use Cases and KPIs - End User selection and Initial Tailoring of Services - Detailed Pilot Operations Plan - Best Practices and Blueprints

Table 13 Key findings and outputs – I Stopp Falls

ISTOPFALLS	
Key Findings	<ul style="list-style-type: none"> - The I STOPP FALLS final report estimates that if 3 % of older adults at risk of falling used the system, the risk of falling could be reduced by 35%. This could save up to EUR 27.7 million a year in fall-related health care costs in Germany alone (2012 data). - Evidence suggests a reduction in the overall fall risk of those studied by 34%, rising to 54% for participants who used the system a lot. The results showed that participants with the highest risk of falling benefitted the most and that there was a reduction in the overall physiological fall risk in comparison to the control group. - A health-economics and secondary stakeholder study has been carried out in different countries in Europe (Germany, Netherlands, Spain) which reveals that there is a potential to save fall related costs by the use of I STOPP FALLS if it were used in a wider population. - Use of relatively inexpensive computer-based gaming techniques to carefully control and monitor specific physical exercises. Although the impact on improved quality of life has not been scientifically demonstrated, users did feel that the system had an impact on their quality of life. - Participants who took part in the I STOPP FALLS field trials experienced significantly less falls than those participants in the control group. There was also a significant reduction in the overall physiological fall risk as compared to the control group. This reduction in fall risk, coupled with the expected beneficial effects of greater motivation to exercise, leading to better health and

	<p>independence, are also successful outcomes of the project.</p> <ul style="list-style-type: none"> - Interest in rolling out a modified version of I STOPP FALLS system has been shown by the Ministry of Social Affairs in Saxony the Ministry of Health in Rhineland-Palatinate, and the Agency for Sports and Exercises in North Rhine Westphalia (Germany). - Project outcomes and developments are continued and used in the H2020 project my-AHA. Four international partners from I STOPP FALLS are collaborating in this project.
Key Outputs	<ul style="list-style-type: none"> - I STOPP FALLS - A Home-based Information and Communication Technologies (ICT) Solution to Predict and Prevent Falls in Older People - Analysis of effects and usage indicators for a ICT-based fall prevention system in community dwelling older adults - ICT-Based Fall Prevention System for Older Adults: Qualitative Results from a Long-Term Field Study - Technology use, adoption and behaviour in older adults: Results from the I STOPP FALLS project - Continued work under the My-AHA project - Continued work in the German project MobiAssist

1.2.3 Frailty, early detection and intervention

Table 14 Key findings and outputs – PERSSILAA

PERSSILAA	
Key Findings	<ul style="list-style-type: none"> - The main innovation in the project is the creation of a screening protocol for finding pre-frail and frail elderly people considering their physical, cognitive and nutritional condition. It integrates all the modules in an interoperable ICT platform. - The solution can have a direct impact on health and quality of life of elderly persons, where an early detection of the problems and prevention is essential. - Findings and recommendations have been provided towards the generation of European Guidelines for the Identification, Monitoring and Management of Pre-frailty. These 43 recommendations could be used to support the development of guidelines on the prevention of frailty and functional decline in European countries and beyond. Given the current lack of guidance on this acknowledged, emerging public health crisis, these recommendations are to be celebrated as an important first step in the process of establishing consensus on the

	<p>management of pre-frailty.</p> <ul style="list-style-type: none"> - Extensive scaling-up actions in the Netherlands where the service has been offered to around 10,000 users in 4 municipalities⁹⁰. In Enschede, most of the exploitation results come from the Dutch spin-off project Langedzond.nl. The services will be licensed in a B2B2C model to the municipalities. - Best practice in addressing potential competitors in the market and the successful engagement and incorporation of external applications. These ranged from training modules (E.g. Guttman Neuro Personal Trainer) to monitoring modules (Fitbit and Withings Smart Scale). - Future deployment of PERSSILAA products and services in Europe through Inzotech, a recently established partnership in the Netherlands. - Development of 13 concrete product/services for exploitation have been identified: 1 is already on the market and 6 are planned for next year.
Key Outputs	<ul style="list-style-type: none"> - Healthcare Related Recommendations - ICT Related Recommendations - Organisational Related recommendations

1.2.4 Innovating elderly care

Table 15 Key findings and outputs – Carer+

CARER+	
Key Findings	<ul style="list-style-type: none"> - Development of a certification process of digital competences for carers in response to the need of their recognition and professionalisation across the EU. - Creation of the Carer+ Digital Competence Framework, an instrument that defines the knowledge, skills and competences of a digitally competent care worker. - Toolkit for developing ICT competences “How to Deliver Smart Homecare”. This Toolkit provides Guidelines, procedures and practice examples to support the successful implementation of the Carer+ programme in the wider care sector. - CARER+ Training programme and learning resources. In order to reinforce the sustainability and transferability of Carer+ training programme and learning resources. - Integration of the Digital Competence Framework of the Carer+ training programme in the French diploma of “Life Assistant”⁹¹ and the creation of a specialist diploma on Digital Competences

⁹⁰ This was the situation in November 2016.

⁹¹ Estimations provided by the Project Coordinator

	included in the Spanish Catalogue of Professional Qualifications.
Key Outputs	<ul style="list-style-type: none"> - Carer+ Digital Competence Framework - Carer+ Training Programme (also available upon request in SCORM format) - Carer+ Portal - Toolkit for developing the Digital Competences of Carers

Table 16 Key findings and outputs – DEM@CARE

DEM@CARE	
Key Findings	<ul style="list-style-type: none"> - The Science and technological impact has been very intense, since the project has progressed beyond SotA in various domains, and the consortium has documented these impacts through the vast plethora of publications in conferences and journals. - Further improvement in the development of wearable and environmental sensor technology, the quality of their algorithms for visual perception, as well as the emotion recognition accuracy from emotional speech. The consortium also demonstrated improvements on the activity recognition algorithms from wearable videos, both in terms of scalability (execution time) and accuracy. - The @Lab testing environment has had a significant impact on the diagnosis and monitoring of early stages of dementia, facilitating differentiation between healthy, MCI and AD participants with relatively high accuracy rates reaching approximately 82% accuracy in distinguishing participants in the 3 aforementioned groups correlating well with existing neuropsychological measures such as FUCAS, FRSSD, and MMSE. - Concrete exploitation results include the foundation of three spin offs (Memorizon, Cerealia and Ekinnox) and the development of joint exploitation initiatives between partners as well as cooperation with enterprises external to the consortium. - Recommendations for current privacy standards in the area of eHealth. D7.11 includes a good overview of the current privacy standards in the area of eHealth and includes a recommendation by the Consortium to the European Commission to “integrate the principle of privacy by design and by default as well as make use of Privacy Enhancing Technologies (PET’s), as foreseen in the proposed Data Protection Regulation”. The Consortium also calls for the implementation of

	pseudonymisation mechanisms with a high level of data protection as those indicated by the new International Standard 25237.
Key Outputs	<ul style="list-style-type: none"> - Ethical Guidelines - Stakeholder Impact - Final Pilot Evaluation - Physiological & Lifestyle Monitoring Early Fusion & Mining - Activity Monitoring and Lifelogging - Multi-Parametric Behaviour Interpretation - Memorizon AB company website. - Carealia company website. - EKINNOX company website.

Table 17 Key findings and outputs – eWall

EWALL	
Key Findings	<ul style="list-style-type: none"> - eWALL successfully delivered more than 50 installations in homes (COPD/MCI patients and seniors with frailty conditions). The subjects provided feedback following a validation framework applied in the project and indicated the technical efficiency of eWALL, as well as the increase of their QoL. - The integration of all the components and the orchestration of services using state of the art technologies within the project is a technological challenge and a technical contribution in itself. - Significant scientific/technological progress in some modules, such as the face tracking algorithm (identifying faces in an image, even with multiple persons present and landmarks in each face) and the algorithm for activity coaching (methodology for personalisation of goals in activity coaching, that is automatic and self-learning). - Open source publication of the platform components and invitations to other players in the market to develop applications or even hardware (sensors, actuators) that runs on top of the platform or communicates with it. - The final number of features that were either developed or customised for eWALL over the course of the project is impressive and speaks for the commendable level of flexibility and integration achieved. - The introduced storytelling, interactive “intelligent” conversation between eWall (Robin agent) and the user is a very interesting concept and might be the right way forward, although it is in an initial stage and needs further research. - Effective use of freeware apps (UISEL Game and Finger Touchscreen Training) to help the elderly

	<p>users involved in the pilot trials to become accustomed to the navigation on a touch screen and to improve their dexterity.</p> <ul style="list-style-type: none"> - A startup, Innovation Solution Sprl, together with some key researchers from the consortium will lead the commercialisation the platform. CloudCare2U is based on the eWALL open-source code. It will be commercially available from 2017 Q1. - Links have been established with other R&D programmes. Most partners are already involved in other research projects. The project has designed an interface to interoperate with the platform developed by the Large Sale Project epSOS. - The eWall project has been nominated as a Liason Organisation of the CEN TC 251 Health informatics committee, in charge of developing the ISO/IEEE 11073 family of standards. eWALL has also been involved with the ITU (International Telecommunication Union, the United Nations specialized agency for information and communication technologies) in the Internet of Things Global Standards Initiative.
Key Outputs	<ul style="list-style-type: none"> - Technical Evaluation Report - Standardisation Contributions - Innovation Solution Sprl company website. - EPSOS project website

Table 18 Key findings and outputs – In LIFE

IN LIFE	
Key Findings	<ul style="list-style-type: none"> - Provision of a wide range of services that may help elderly people to live independently including medical/health services, home & quality of living services, and autonomous mobility services. - Innovative observed cloud-based reference architecture used to integrate services for elderly with cognitive impairment. - Strong impact expected on SMEs in the commercialisation of project results both for the 6 SMEs in the project consortium and further afield as the project will give them the opportunity to offer their new tools. - Potential impact on policy making since it has potentiality to improve care process, and to support independent living in various different aspects. - Large scale pilot testing across Europe. 1218 participants have taken part at the 6 different pilot sites.
Key Outputs	<ul style="list-style-type: none"> - Pilot Plans

Table 19 Key findings and outputs – Long-Lasting Memories

LONG LASTING MEMORIES	
Key Findings	<ul style="list-style-type: none"> - Positive effects on the memory and on the cognitive abilities of elderly people of combined physical and cognitive training. This effect appears to be dose-dependent (increased slightly with the number of training sessions performed) and not dependent on the cognitive status before the training. - Potential to reduce the negative effects of dementia, if this can be further validated, the socio-medical-economic impact would be immense. - Training with the LLM programme made 94% of the participants feel mostly positive (E.g. they felt it was fun, they liked it, they felt cheerful after training with it, they felt refreshed and calm). - 95% of participants believed that exercising through LLM was beneficial for them, most felt LLM was amusing and they enjoyed their sessions with it and LLM met their expectations. - Interviews directly with carers involved in the pilots have also indicated an improvement in their quality of life by managing more easily the daily exercise and training of the elderly. - Various activities have been carried out since the project end in 2012. In 2014 the LLM platform, under the new brand name "LLM Care", made the transition from being a pilot trial to market implementation, as a service provided to local stakeholders, public and private elderly care homes, health care professionals, individuals, as well as elderly citizens in need. - The LLM system is now commercially available in four languages.
Key Outputs	<ul style="list-style-type: none"> - Final Project Report - Technical and Operational Specifications – Integrations Design - LLM Care Service website

Table 20 Key findings and outputs – Sociable

SOCIABLE	
Key Findings	<ul style="list-style-type: none"> - Important scientific results suggesting a positive effect on the cognitive and functional abilities of the elderly using the SOCIABLE ICT solution. - A novel ICT based model for cognitive training and social activation of the elderly. The SOCIABLE platform software runs on both surface tables and tablet PCs. - Development of 27 ergonomic, motivating and pleasant cognitive training games and the "Book of Life" application, a personal diary application,

	<p>where people can store life experiences, memories and thoughts, in the form of texts, pictures and video.</p> <ul style="list-style-type: none"> - Tools are provided for Medical Experts and Health Professionals supervising SOCIABLE sessions. - 7 pilots in 4 countries have been organised involving three main elderly groups suffering from cognitive decline, including healthy elderly, elderly with Mild Cognitive Impairment (MCI) and elderly with mild Alzheimer’s disease (AD). The solution has been validated with over 300 elderly users and approximately 50 health professionals during cognitive training sessions. - Use of “Butterfly Users” in pilot trials to increase participant base. - Further development of the SOCIABLE solution in three EU-funded R+D+i projects (I DON’T FALL, ELDERSPACES, and BRAIN-PLASTICITY).
Key Outputs	<ul style="list-style-type: none"> - Cognitive Training website detailing the steps for commercial exploitation. - Sociable Services Specification

Table 21 Key findings and outputs – Stop and Go

STOP AND GO	
Key Findings	<ul style="list-style-type: none"> - Successful in embedding innovation in the procurement process from the outset, a holistic approach geared to meeting identified service requirements, rather than seeing it as some separate or “add on” element. - Development of a comprehensive method and tools to enable the procurement of innovative solutions, adaptable for any service and any local area across Europe. The approach has been successfully applied to introduce technical and commercial innovation into a range of health and care services delivered to thousands of users. - Proof that an innovative procurement process based on a service delivery approach can clearly prioritise defined clinical and social outcomes. - Good learning experiences from pilot testing in the use of PPI approaches leading to the development of a model for the procurement of integrated technology enabled care services across Europe. - Strong use of co-design and co-creation tools (E.g. multi-stakeholder workshops or working groups) to help design the PPI process helping to reduce resistance, increase engagement and ensure that the service was completely aligned with the real life needs of the user. - In Sant Pau hospital in Spain, the tender specifications defined a new model of

	<p>collaboration between the hospital and the service provider, where the supplier participates in all stages of the healthcare delivery process and shares the risks with the hospital.</p> <ul style="list-style-type: none"> - Publication of the European Specification Template and Reference Business Case, suitable for use in all the European Regions to support EU strategies depicted in the Strategic Implementation Plan of the EIP on AHA. This is an accessible, practical and usable document to help ensure that the results from the project live on and to put the methodology into practice on a wider scale. - STOP AND GO partners in collaboration with new actors have been successful in the RITMOCORE project, a similar eHealth services PPI. UK partners are building on Liverpool's digitisation of social care achieved in STOP AND GO through the addition of new services based on ambient sensing over low power radio. This will lead to new service procurements outside of the PPI mechanism.
Key Outputs	<ul style="list-style-type: none"> - European Specification template - Overview of the Open Market consultation (OMC) - Guidelines on Interoperability Assessment for Deployment - Evaluation Framework for STOP and GO - STOP AND GO: Procurement experiences and lessons learnt (this will be available in March 2018) - RITMOCORE Project website

1.2.5 Knowledge sharing and standardisation related to ageing well

Table 22 Key findings and outputs – universAAL

UNIVERSAAL	
Key Findings	<ul style="list-style-type: none"> - Development of the universAAL platform offering support in three main areas: a runtime, for developers and to support the emergence of an AAL community and marketplace. - Design and launch of the uStore, a digital market platform concept inspired by Apple's "App Store". The uStore is a one-stop-shop for universAAL end-user services. - Creation of the universAAL Developer Depot. This will contain all resources needed by developers: all parts of the platform itself, tools, basic services for their incorporation in new end-user services, adapter components for interoperability with non-universAAL systems, libraries of "drivers" supporting use of different sensors

	<p>available on the open market.</p> <ul style="list-style-type: none"> - Significant work on standardisation. An IHE DEN and HL7 CDA R2 Consent Directive standardisation process was initiated, the universAAL Framework for User Interaction in AAL Spaces became an IEC PAS and new standardisation processes were initiated on Reference Model, Architecture and Device Abstraction Layer with OSGi Alliance. - Further development of the work carried out in universAAL within the reAAL project (AAL programme) to ensure efforts to generate impact continue beyond the universAAL project. According to the Coordinator of the Universaal project, work also continued beyond the ReAAL project.
Key Outputs	<ul style="list-style-type: none"> - Standardisation Usage Plan and Contributions - Tools for Deployment and Management - UStore - ReAAL Project Website - UNIVERSAAL Developer Depot

1.2.6 Robotics for ageing well

Table 23 Key findings and outputs – Accompany

ACCOMPANY	
Key Findings	<ul style="list-style-type: none"> - Good progress in raising the technological readiness level of personal care robots. - A key milestone project towards a long-term vision of emphatic, socially acceptable, co-learning robotic home companions for elderly users, supporting reablement and facilitating independent living. - Clarification of a number of technological and social challenges that needed to be met in order to improve the quality of life of ageing EU citizens with personal care robots. - Commercialisation of the CARE-O-BOT robot in the market as a state of the art useful device to help improve the quality of life of ageing citizens in Europe. - The consortium managed to integrate the personal care robot into a smart home environment providing easy to use tools to construct and personalise complex robot behaviours in a robot independent manner, that can potentially be re-used in future projects. - Scientific and technical innovations include the development of memory architecture for learning and adaptation, new forms of socially aware human robot interaction, empathetic interaction, and demonstration of viable activity monitoring. The computer memory model includes a semantic

	<p>and perceptual memory designed to allow teaching the robot what to do, and episodic memory supplemented with a visualisation tool. These innovations are expected to have a very large impact in science and technology, leading to new research and development approaches for robot-human interaction.</p> <ul style="list-style-type: none"> - Development of effective exploitation plans to establish an effective route to development of an industry for personal care robots. Furthermore, links were made with the EU industry through the participation in User and Industry expert forums/workshops/interviews/focus groups. - Use of an Industrial Advisory Board for the entire project duration helping to enrich the economic model and project exploitation plan. - The project was considered to be “exemplary” by the Review Team with regards to the dissemination of results.
Key Outputs	<ul style="list-style-type: none"> - Evaluation of the ACCOMPANY computational Memory Architecture - Conceptual Framework for Social and Emphatic behaviour for robot Companion - Evaluation of the Activity Recognition System - Economic model for a home companion robot for the independent elderly - Dissemination report

Table 24 Key findings and outputs – GIRAFF+

GIRAFF+	
Key Findings	<ul style="list-style-type: none"> - Strong impact on the European social care system through the support given to the creation of the next-generation integrated solutions for remote supervision. - The use of the robot platform has been good for the social elements of elderly care as it facilitated direct communication and social engagement. - The work on the use of context recognition to analyse the sensory outputs of the system has delivered some of the best scientific novelty in the project. - The project has adhered to, and contributed to, international standards for sensor networks, through involvement in the OSGi Residential Group (OSGi Alliance). - An OSGi-based version of the system has been released for desktops and a final mobile android version has been released for mobile devices on Google Play. - Real life demonstration and testing is a major strength of this project. The diversity of the test sites has stimulated development of the

	<p>previously mentioned “plug-and-play” approach to simplify on-request configuration of the system for individual use cases.</p> <ul style="list-style-type: none"> - The GIRAFF+ project also helped to improve the competitiveness of the EU industry. An opportunity arose for funding from a consortium from Toronto, Canada for both the US (primarily) and also EU markets, as a complete Giraff+ solution for tele-health care. It has been positioned as a software and service cloud-based solution with a monthly subscription-based model being considered.
Key Outputs	- Nonna Lea Youtube Video

Table 25 Key findings and outputs – Silver

SILVER	
Key Findings	<ul style="list-style-type: none"> - The SILVER project has supported the uptake of new technologies and has broadened the knowledge in the area of care robotics. It has also created a highly professional network within the field of public procurement that will open new opportunities in both national and international contexts. - It has provided the opportunity for better understanding of the innovation process within the healthcare technology field, cross organisational and transnational innovation, user-driven product development as well as practical management of complex and explorative projects. - A pioneer example of a PCP process at EU scale, producing guidelines and templates developed for the PCP process itself, as well as supporting information for contractors, providing assistance throughout the entire process. - Development of the LEA Robot, a game changer in its field. From helping with daily routines and housekeeping to serving as a personal trainer or even dance partner, the robotic stroller/walker system has a significant impact on those with mobility or cognitive disabilities. - All the SILVER procurers agreed that there is future potential for LEA Care robot in supporting the SILVER challenge of caring for 10% more care recipients with the same number of staff after further development. - Strong support of European SMEs (such as Robot Care Systems, developers of the LEA system). The PCP process provides a good opportunity for the development of new innovative solutions. - LEA is already attracting attention, with RCS having won several innovation contests, including the SHELL WIRE 2015 and RABOBANK Innovation

	<p>awards. It's has also secured over EUR 5 million in additional funding.</p> <ul style="list-style-type: none"> - Project documents produced have been used in most other EU PCPs, the impact towards PCP process standardisation is evident. - Further exploitation of project results through networks such as the European Connected Health Alliance, which has a large connector platform to share the lessons from Project SILVER as well as bring the contractor to a wider market. - Participation of SILVER partners in other projects such as SELECT for Cities, CHARM, THALEA, Preforma and ENIGMA.
Key Outputs	<ul style="list-style-type: none"> - Consolidated Generic Pre-commercial Procurement process - Generic Pre-Commercial Procurement Templates - Specific Call Documents Phase 1 - Specific Call Documents Phase 2 - Specific Call Documents Phase 3 - Learning and Recommendations Report - Silver Sustainability Plan - Select for Cities Project website - CHARM Project Website - THALEA Project Website - Preforma Project Website - ENIGMA Project website - European Connected Health Alliance Website

Table 26 Key findings and outputs – Radio

RADIO	
Key Findings	<ul style="list-style-type: none"> - An improved quality of life of the elderly, particularly the primary users. - A strong impact in assistive technologies in particular with regards to the approach on innovative technical development based on the integration of a robot in a smart assisted home environment. - Architectural and methodological work in RADIO provides heterogeneous networking solutions for bridging the robotic and the smart home network infrastructures and software stacks. This work aims at integrated, secure, and power-aware data collection, transmission and processing within an internet of fixed sensors and mobile robotic platforms. - The RADIO communication infrastructure will provide critical advantages compared to any already existing solution based on a single solution, in terms of coverage area, energy consumption as well as traffic capacity. - The RADIO communication infrastructure can take advantage of a much wider market of sensor

	<p>modalities and vendors compared to any other solution. This drastically enhances the usefulness, flexibility and adaptability of the proposed infrastructure to diverse use case scenarios; significantly reducing future deployment costs by remaining independent of any specific sensor/technology provider.</p> <ul style="list-style-type: none"> - Improved competitiveness of the EU industry with a particular focus on SMEs. The consortium contains three SMEs (ROBOTNIK, S&C, and AVN). In addition to this, the project could benefit also other European SMEs working and developing innovative solutions in technology and infrastructure for assistive technologies for the elders, as well as related technologies including robotics. - Significant progress in user acceptance and unobtrusiveness through the development of a system that respects individual preferences and promotes dignity, bridging the gap between medical requirements and obtrusiveness and helping citizens to carry out independent lives for longer. - Ethical issues and technical requirements have been well addressed based on the needs of the pilots, satisfying the guidelines of several directives in terms of private data preservation. Moreover, all equipment used was certified and the whole set-up was approved by Ethics Committees for all different pilot environments.
Key Outputs	<ul style="list-style-type: none"> - Guidelines for balancing Medical Requirements and Obtrusiveness - Architecture for extending Smart Homes with a robotic platform - Actual and perceived privacy considerations and ethical and ethical requirements - Conceptual for Sensing Methods and Sensor Data Sharing

Table 27 Key findings and outputs – ROBOT-ERA

ROBOT-ERA	
Key Findings	<ul style="list-style-type: none"> - A showcase project for sophisticated multi-robot systems embedded in ambient intelligent environments. The outcomes of the project are expected to have a lasting significant impact with valuable lessons learnt. - Strong impact through publications in scientific conferences and journals, as well as raised awareness of the potential contributions that service robots and intelligent environments can play in elderly care. - Development and evaluation of personal services

	<p>based on these prototype robots and infrastructure has contributed to making progress in the state of the art in personal robotics for ageing and has helped to clarify how such technologies can be used to assist caregivers providing services for the elderly.</p> <ul style="list-style-type: none"> - Generation of a stable and flexible middleware that will be available to other research teams as an open software system. - Involvement in standardisation activities and engagement with regulatory and advisory bodies. The partners became more active in the standards and certification community by participating in an ISO working group on standards on personal care robot safety. - Demonstration of the seamless integration of sensors and robots via the orchestration of the complete systems approach and employing overall context awareness and claim TRL 6 capability and readiness. - Creation of the CO-ROBOTICS srl. company, which plans to commercialise the solution. - The iterative process for systems design and alignment with real world challenges has proven a valid approach with multi-loop testing and design phases. It has allowed the robot platforms to achieve a considerable degree of maturity.
Key Outputs	<ul style="list-style-type: none"> - New design for domestic and condominium robots - Prototypes and experimental platforms - Co-Robotics Company Website

Table 28 Key findings and outputs – MARIO

MARIO	
Key Findings	<ul style="list-style-type: none"> - Strong progress towards EU scientific and market leadership in service robots and user driven solutions for this major societal challenge. In corporation of recent progress in state of the art technologies, in particular with regards to the semantic technologies and methods for CGA/MPI calculation. - Development of simple applications to promote autonomy and empower people with dementia, reducing loneliness and isolation (E.g Connect My Hobbies Module including My Music, My News and My Games applications). - Reduction of the burden for caregivers as they will have more time to spend on other meaningful tasks and interacting with people with dementia. - Reduction of the strain on the health system through the incorporation of the Comprehensive Geriatric Assessment (CGA), something that would normally take a health care professional

	<p>around 30 minutes per patient to complete. This is likely to be a first worldwide.</p> <ul style="list-style-type: none"> - Use of the developments and work carried out during the DOME0 project previously funded under the Active Assisted Living programme (AAL JP). These include interactions with the user, along with Human Robot Interaction to support cognitive and memory assistance involving semantics. Robosoft, the coordinator of DOME0, is now a partner in MARIO and is responsible for achieving functional and system-related improvements of the new version of the Kompai robot. - Strong progress in the exploitation of natural language processing, placing semantics at the centre of robot applications. - Pathfinder project in terms of the provision of personal service robots that are personable, useful and acceptable to people with mild cognitive disorders through rapid deployment using assemblies of off-the-shelf technologies. - Availability MARIO apps on the RAPP Store. The two that are currently available include the My News app: allowing the user to be up to date with local news events; The Games app: allowing the user to play games providing a series of voice and visual cues that prompt the user so they do not need to rely on memory to play the game. - Continuation of project activities is planned with new collaborations regarding research activities as part of the H2020 over the next few years (2018 and 2019 calls), as well as for business development purposes with collaborations in the context of national bids for pre-commercial procurement of innovations which will make (part) use of the MARIO outcomes. - A partnership has also been established with Zora Robotics to commercialise the Robot systems. - Collaboration with other industrial players such as Ericsson in the demonstration of their 5G capabilities.
<p>Key Outputs</p>	<ul style="list-style-type: none"> - Development of an MPI based on the MARIO Robot CGA Module - MARIO Service Robots - Connect My Hobbies Module - MARIO apps available on RAPP Store - MARIO Ontology Network (pending approval by the EC) - MARIO Robot CGA Module (Pending approval by the EC) - Partnership with Zora Robotics

Table 29 Key findings and outputs – Grow Me Up

GROW ME UP	
Key Findings	<ul style="list-style-type: none"> - Increase the years of independence, active living and the quality of life of older people with light physical or mental health problems who live alone at home. - Development of a more efficient care system, benefitting from smart networking with other systems, users and care givers, making the solution more flexible, cheaper, affordable and smarter in comparison to previously implemented approaches. - The project’s four key innovations include Cloud Technologies; Behaviour and Emotional Understanding; Intelligent Dialoguing aims; and personalised care aims. - Connection to a virtual care network that provides for continuous care, motivation and education to the older persons of how to best use the platform. - Potential cost savings when using the GrowMeUp system instead of regular care practices. - Cloud-based approach expecting to bring up new features and the solution flexibility allowing better market opportunities of the hereby designed and developed robotic home-care system. This concept will help create high flexibility at a reasonably low price of the end-user solutions (care-giving robots). - Strong progress has been made in terms of the project’s scientific and technological goals, particularly with regards to user requirement elicitation and cloud knowledge base. - Collaboration in national and international networks, including EU funded projects. These will provide a platform for the continuous exchange of cutting-edge results and novel ideas in these research areas. Bilateral collaborations with (non-) European research groups and companies have also been established.
Key Outputs	<ul style="list-style-type: none"> - <u>Specification of the User Behaviour Analysis and Environment Analysis component</u> - <u>Design and Specification of the Home Daily Activity Services</u> - <u>Specification of overall system architecture and security and privacy infrastructure</u>

Table 30 Key findings and outputs – I-Support

I-SUPPORT	
Key Findings	<ul style="list-style-type: none"> - A major contribution to the quality of life, autonomy and independent living of the ageing population by enabling them to take care of

	<p>themselves and thus, reducing the amount of personal nursing/care services required and significantly supporting the prolongation of the time spent living in own home.</p> <ul style="list-style-type: none"> - Strengthened competitiveness and growth of SMEs, specifically those in the consortium (ROBOTNIK and OMEGATECH) offering new service and product opportunities not only in the area of service robotics for bathing but also in other areas where the advanced research and development objectives of the project could find an application. - Progress in scientific and technological developments including user-centred specification of user and safety requirements and the definition of I-Support service robotic functional specifications and system architecture for tracking human posture, movements and actions in shower environment. - Key insights into researching methods and control implementations for direct telemanipulation of the robotic soft arm, for robot perception and for recognition of actions, gestures, spoken commands, and the state-of a human user etc. A CAD model was designed to represent the physical system. System hardware and software components are being implemented. - The final I-SUPPORT robotic service will constitute a major contribution to the quality of life, autonomy and independent living of the ageing population by enabling to take care of themselves and thus, reducing the amount of personal nursing/care services required and significantly supporting the prolongation of the time spent living in own home. - Effective use, development and integration of previous work with soft robotics, robot middleware, and available sensor and actuator systems. - Innovation delivered to the markets in order to strengthen the competitiveness and growth of related companies by user-centred specification of the requirement (Use of design-thinking process), system architecture definition and initiation of a wide range of research and development activities to prototype and evaluate an intelligent, adaptive and flexible service robotics bathing system. - Best practice in terms of a thorough analysis of the current State of the Art, with an entire Work Package dedicated to this issue focussing on soft robotic technologies. Use of a "deep Comparison study" to make design decisions was also
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	<p>commended and helped the project to use existing solutions available in the market to enhance the work carried out in the project.</p> <ul style="list-style-type: none"> - Strong plan for contribution to the elaboration of standards for the field of domestic service robotics that involve physical contact between the human and the robot.
Key Outputs	<ul style="list-style-type: none"> - The project is still ongoing, limited public deliverables on project results are available.



LESSONS LEARNT AND
RECOMMENDATIONS
FOR THE FUTURE CONCERNING
RESEARCH AND
INNOVATION PROJECTS

2 LESSONS LEARNT, CONCLUSIONS AND RECOMMENDATIONS FOR THE FUTURE CONCERNING RESEARCH AND INNOVATION FOR POLICY MAKERS

2.1 Lessons learnt from EU funded research and innovation projects on ICT for AHA under FP7, CIP and HORIZON 2020

This section provides an overview of the main lessons learnt from the 58 projects that were analysed by the study team. These lessons learnt have been withdrawn from all the projects included in the Study (both Preliminary Analysis and In-depth Analysis, see Annex IV). They will be used as a basis to establish recommendations for the future concerning research and innovation for policy makers.

To facilitate the accessibility of this document, Table 31 below provides a summary of the lessons learnt that are detailed further in this section.

Table 31 Summary of main lessons learnt from EU funded research and innovation projects

Category of Lesson Learned	Lesson Learnt
2.1.1 Market and competitor analysis	There is a general lack of extensive competitor and state of the art analysis prior to and during project execution
2.1.2 Design process	User requirements elicitation should be carried out early in the process and with regular iterative cycles
	The importance of the design phase should not be underestimated
2.1.3 Stakeholder involvement	Need to involve additional external stakeholders in project activities to provide input to project activities and to help validate conclusions
	The reasons behind insufficient user involvement need to be addressed and taken into consideration in future projects
	Sufficient time is needed to carry out user testing procedures
	User testing is not homogeneous across countries, adaptations need to be made
	The methodology used to select users for pilot trials should be clear and quantified
2.1.4 Project evaluation	Effective data collection methodologies need to be used to facilitate the evaluation of results
	Effective evaluation methodologies need to be used to provide credibility to project conclusions
2.1.5 Exploitation	Issues regarding Intellectual Property Rights (IPR) need to be sufficiently addressed so as to avoid delays and problems with commercialisation
	Commercial agreements are a useful tool to help further develop project results
	Collaboration agreements with industrial players should be actively sought in order to enhance expansion into the market

	A clear and concise presentation of results is required to promote the uptake of project results
2.1.6 Integrated care	Need for commitment from the administrative departments and top-level positions within the healthcare services
	Integrated care services can greatly benefit from the use of personal electronic records
2.1.7 Innovative solutions for the elderly	Key elements to be taken into consideration when preparing an Open Market Consultation (OMC) or a Pre-Commercial Procurement Process (PCP)
2.1.8 Project management	Effective risk management strategies need to be implemented to ensure the smooth execution of the project
	Project objectives should be realistic and attainable
	An interdisciplinary and international composition of the consortium can contribute to a project's success
2.1.9 Dissemination of EU funded research and innovation projects	Project websites should be used more effectively in the dissemination of results
	Need to extend the outreach of dissemination actions – no sole focus on research communities
	Project deliverables should be useful or not exist
	Digital tools are paramount in successfully reaching out to and engaging with the appropriate audiences
2.1.10 Ethical and regulatory issues	A lack of focus on ethical and regulatory issues can lead to serious problems in project execution
2.1.11 Technological and standardisation issues	The importance of adapting technology to different user needs
	Less is more when it comes to the complexity of solutions and testing in user environments
	Beware of the "technical invasion" syndrome in user's homes and the lack of awareness regarding ICT for health
	Industry standards should be taken into consideration from the early stages of the project
	The efforts needed for the integration of technological components should not be underestimated

2.1.1 Market and competitor analysis

There is a general lack of extensive market, competitor and state of the art analysis prior to and during project execution

Upon analysing the review documentation for the 58 projects included in the initial knowledge base, on various occasions, a lack of market, competitor state of the art analysis can be seen. This has often resulted in delays in the project, with **time spent catching up on the state of the art or even leading to misspent opportunities for collaboration with/incorporation of existing solutions** which already provide the desired services that are being developed.

For example, in the CARER+ project, reviewers commented that the project consortium did not seem to be aware about the overall situation in Europe regarding the subject of ICT in the Labour, Market and Legislation contexts. It was suggested that this could have an effect on the sustainability of the

project taking into account that the main objective of CARER+ was to develop the CARER+ digital competencies of care workers so as to enable those persons to provide better quality of care to the lives of elderly recipients.⁹²

This was also the case in the FATE project where the project was encouraged to further investigate the market for wearables, the attractiveness of these devices and their practical applications with regards to fall prevention. This is because the FATE system did not make a great contribution to the state of the art and that these new devices not only detect a fall, but also collect information regarding the activities and health status of the user which can be used to predict falls.⁹³ They would have therefore been a valuable addition to the FATE solution.

In the RADIO project, the consortium was also requested to **further examine existing studies and literature regarding user interface design, especially for elderly primary end users.**⁹⁴ This came following the need to use more systematic methods for user interface evaluation in order to provide more insights on the usability of existing user interfaces and the subsequent development of the RADIO system's interfaces.

In the case of the LIFE 2.0, one of the main objectives was to build product-service solutions that increase the opportunities for social contacts between elderly people in their local area. However, from the review documentation available, the project consortium could have made further analysis of the competition and how to deal with it.⁹⁵ For example, they **did not consider social networks to be main competition nor a threat, and did not see the opportunity to engage with them to provide and enhance LIFE 2.0 services.**

In some cases, projects even spent a considerable time catching up with the state of the art. This was the experience of the MIRACULOUS-LIFE project, financed under the FP7 programme, where the **consortium spent the first two years of the project catching up on the theoretical, empirical and, in some cases, technological state of the art.**⁹⁶

The MOBOT project also overlooked the state of the art, however, this time in relation to robotics for ageing well. The performance of the gesture, audio commands recognition, and the combination of them during the demonstration, were considered to be below expectations, particularly taking into account the extensive existing state of the art, which is also

⁹² Klepfisch, Georges (2015). Consolidated Review Report – CARER+. European Commission, CIP Programme, Pg 3.

⁹³ Barelle, Caroline; Lowe, Charles; Pouillie, Roland; Ellis, Tim (2017). Consolidated Review Report – FATE. European Commission, CIP Programme, Pg 6.

⁹⁴ Lanzenberger, Monika (2016). Review Report – RADIO Project. European Commission, H2020 Programme, Pg 3.

⁹⁵ King, Geoff (2013). Consolidated Review Report – LIFE 2.0. European Commission, CIP Programme, Pg 3.

⁹⁶ Sala Soriano, Pilar (2017). Consolidated Review Report – MIRACULOUS LIFE. European Commission, FP7 Programme, Pg 2.

often open source, based on the same type of sensors, for example the Kinect system.⁹⁷

A similar situation also occurred in the RAMCIP project where, even though a Market analysis was carried out (D9.4 Market Analysis and Business Plan), the comparisons made with existing robots such as Tiago, Hobbit and care-o-Bot, were not very precise. These are robots which have hardware capabilities that are very similar to the RAMCIP robot and they are involved in other EU projects. The assessment that has been made only focusses on RAMCIP's strengths and does not consider its weaknesses such as autonomy or entertainment. It is important that this analysis takes place with projects so as to identify possible added values and collaborations during the trials.⁹⁸

2.1.2 Design process

User requirements elicitation should be carried out early in the process and with regular iterative cycles

According to the evidence gathered during both the preliminary and in-depth analysis phases of this project, on various occasions, the study team detected incidences where the user requirements were not identified sufficiently early enough during the project life span. For example, in the ALFRED project, late on in the validation cycles, elderly users were requesting that the text used on the apps be in their mother tongue and they were still demanding proper training/usage instructions inside the apps themselves. Furthermore, in one of the project validation reports, it mentioned that potential users were not used to test the concept of app updates or even app marketplaces.⁹⁹ **These late insights in the iterations of validations/usability tests are avoidable, casting doubts on the requirements elicitation that was carried out earlier on in the project.**

A similar situation also occurred during the BEYOND SILOS project where the pilot sites indicated that the **ICT platform that was being tested was not always easy to use for elderly people (E.g. Buttons and icons were too small)**, and that problems were being experienced with data transfer, logging into accounts, system failures and learning curves for ICT tools¹⁰⁰. This therefore suggests that an insufficient user requirement elicitation process was carried out early in the design cycle.

⁹⁷ Van der Kooij, Hernan; Driankov, Dimiter; De Mauro, Alessandro (2016). Consolidated Review Report – MOBOT. European Commission, FP7 Programme, Pg4.

⁹⁸ Amirabdollahian, Farshid (2017). Consolidated review Report – RAMCIP. European Commission, H2020 Programme, Pg 9.

⁹⁹ Hempel, Thomas; Moreno, Sofia; Sparpaglione, Massimo (2016). Consolidated Review Report – ALFRED. European Commission, FP7 Programme, Pg 16.

¹⁰⁰ Buguña Hoffman, Laura; Leorin, Cristian; Klepfisch, Georges (2016). Consolidated Review report – BEYOND SILOS. European Commission, CIP Programme, Pg 3.

In some cases, it was even **unclear what processes had been used to map user requirements to system requirements, and how the latter are changed based on new user requirement findings**. This was the case with the GROW ME UP project (WP 1 End User Needs Analysis and Functional Specification) where further documentation was requested to explain the process that had been used for the iterative technology development.¹⁰¹

In the HOBBIT project, problems were detected later in the project with the adaptation of the robot to elderly user's homes. Many technical limitations were identified such as the incapacity of the solution to go through a 66cm door or the ability to pass over 25mm thresholds without any risks. **These issues could and should have been identified before the pilot trials through a thorough mapping of elderly standard homes.**¹⁰²

In the GIRAFF+ project, it was commented that one of the lessons learnt was the need to include a **more iterative approach with more feedback loops in the design process**. This would, in turn, allow for a more thorough analysis of user requirements and the development of a product or solution that is in line with the user's real-life needs.¹⁰³

The importance of the design phase should not be underestimated

An additional point that was highlighted in the project review reports was the importance of the design process itself and how it should not be underestimated. An example of this can be seen in the MIRACULOUS-LIFE project where the **critical problems that occurred during the project stemmed from the architectural and technological decisions that were taken during the design phase**¹⁰⁴. These decisions included the selection of the technology for speech recognition, distributed architecture with avatar generation at server side, strong dependency on wireless networks etc. In response to these decisions, the only solution was to rethink the complete system with the subsequent knock-on effects that this generates in terms of time and money.

In the FATE project, the review panel highlighted the fact that the project consortium tended to blame errors on the operation of the system during pilot testing or misuse by the users. However, **systems should be designed to minimise the opportunity for misuse of the system** and this was clearly not the case in FATE. Some examples of these poor design decisions include the fact that user had to define the time range that they

¹⁰¹ Bulgheronia, Maria (2017). Consolidated Review Report – GROW ME UP. European Commission, H2020 Programme, Pg 4.

¹⁰² Borgolte, Ulrich (2015). Consolidated Review Report – HOBBIT. European Commission, FP7 Programme, Pg 5.

¹⁰³ Duffy, Brian; Preucil, Libor; Webb, Philip (2015). Consolidated Review Report – GIRAFF+. European Commission, FP7 Programme, Pg 6.

¹⁰⁴ Sala Soriano, Pilar (2017). Consolidated Review Report – MIRACULOUS LIFE. European Commission, FP7 Programme, Pg 3.

were to stay in bed¹⁰⁵. Furthermore, the device has to be usable, for example, some users didn't like the light indicators on the device as they were visible when the user was outdoors and other people could see that they were wearing a strange device (even if worn beneath clothes).

2.1.3 Stakeholder Involvement

Need to involve additional external stakeholders in project activities to provide input to project activities and to help validate conclusions

A recurring request from the review panels was the need to involve additional external stakeholders in the project activities. This can be seen in the DEM@CARE project, where the consortium was **encouraged to include additional stakeholders such as investors, policy makers, Ministries of health and national public health organisations.**¹⁰⁶

This was also the case in the EWALL project, with an additional request from the review panel to **engage with formal patient groups** related to any of the three main pathologies identified during the project: Chronic Obstructive Pulmonary Disease (COPD), Mild Cognitive Impairment (MCI) and Acute Respiratory Infections (ARI).¹⁰⁷

A greater involvement of industry representatives was also highlighted in a number of cases such as GUIDE, I STOPP FALLS (More specifically the equipment manufacturing sector)¹⁰⁸ and KSERA (focus on market players such as vendors of robotic platforms)¹⁰⁹.

Problems were also experienced regarding the commitment from GPs and nurses in some pilots. This was the case in the BEYOND SILOS project where the dropout rate was 20%. This lack of commitment from the professionals and other user groups at some sites was below target.¹¹⁰

The reasons behind insufficient user involvement need to be addressed and taken into consideration in future projects

One of the lessons learnt with regards to insufficient user involvement was that some projects have **too strong a focus on technological objectives**, meaning that they were **unable to fulfil user objectives**. An

¹⁰⁵ Barelle, Caroline; Lowe, Charles; Pouillie, Roland; Ellis, Tim (2017). Consolidated Review Report – FATE. European Commission, CIP Programme, Pg 5.

¹⁰⁶ Konstantinos, Perakis (2015). Consolidated Review Report – DEM@CARE. European Commission, FP7 Programme, Pg 16.

¹⁰⁷ Noll, Stefan; Stella, Eloisa; de Toledo, Stella (2016). Consolidated Review Report – EWALL. European Commission, FP7, Pg 5.

¹⁰⁸ Skiczuk, Peter (2015). Consolidated Review Report – ISTOPFALLS. European Commission, FP7 Programme, Pg 12.

¹⁰⁹ Katevas, Nikos; Noll Stefan; Schmitt, Sophie (2013). Consolidated Review report – KSERA. European Commission, FP7, Pg 3.

¹¹⁰ Buguña Hoffman, Laura; Leorin, Cristian; Klepfisch, Georges (2016). Consolidated Review report – BEYOND SILOS. European Commission, CIP Programme, Pg 3.

example of this can be seen in the ALFRED project, particularly in WP4 regarding the User-Driven Interaction Assistant. Here, the objectives were completely fulfilled from a technological point of view, but input from the target group was ignored.¹¹¹

A lack of user focus can also be seen in the CONFIDENCE project which was strongly RTD oriented but **did not have a sufficient user-oriented focus as expected from a project within the FP7 e-Inclusion programme** that is aimed specifically at improving life conditions for people with special needs and the elderly¹¹². The same occurred in the **DALI** project which remained technology driven and did not manage to cross borders to blend research into an authentic interdisciplinary approach which meant that the overall impact of the project on the end users is modest¹¹³.

A further problem of many projects was the difficulties encountered when recruiting people for user trials. Firstly, **the effort needed to undertake a user recruitment process is often underestimated**. This was the case with the COMPANIONABLE project, which had a negative impact on the amount and quality of the testing and evaluations carried out at different sites and a general delay in the pilot testing in itself.¹¹⁴

Further difficulties in recruiting a sufficient number of users can be seen in the INDEPENDENT, ISISEMD and DOREMI projects where the number of users involved in the pilots were substantially lower than those initially targeted (E.g. in DOREMI, the project trial was conducted in the UK and Italy with 32 volunteers, very different from the original anticipated plan to include more than 80).¹¹⁵

Projects also encountered **problems in recruiting specific types of users**. For example, in the EWALL project, consortium partners had difficulties in recruiting MCI users. A similar situation occurred in the SOCIABLE project, where the consortium partners experienced difficulties in recruiting people with mild Alzheimer's disease, resulting in only half the planned number of users taking part.¹¹⁶

The different types of testing environments also played a role in creating difficulties regarding shortages of users. For example, in the LONG LASTING MEMORIES, CONFIDENCE and VM projects there were a **shortage of pilot users in home environments**, meaning that firm conclusions in these

¹¹¹ Hempel, Thomas; Moreno, Sofia; Sparpaglione, Massimo (2016). Consolidated Review Report – ALFRED. European Commission, FP7 Programme, Pg 5.

¹¹² Pouillie, Roland (2011). Consolidated Review Report – CONFIDENCE. European Commission, FP7, Pg 19.

¹¹³ Hallenborg, Kasper (2014). Consolidated Review Report – DALI. European Commission, FP7, Pg 4.

¹¹⁴ Avramov, Dragana; Katevas, Nikos; Keijer, Ulf; Pons, José Luis; Vernooij-Dassen, Myrra (2012). Consolidated Review Report – COMPANIONABLE. European Commission, FP7 Programme, Pg 12.

¹¹⁵ Logtens, Hans; Lofti, Ahmad; Schmitt, Sophie (2016). Consolidated Review report – DOREMI. European Commission, FP7, Pg 4.

¹¹⁶ Avramov, Dragana (2012). Consolidated Review Report – SOCIABLE. European Commission, CIP Programme, Pg 17.

projects could not be drawn in this area. Furthermore, whilst the DEM@CARE was a largely successful project in terms of impact, the consortium did have **difficulties in recruiting participants, particularly in the trials that were conducted at nursing homes**. This is a situation that could have been avoided and resulted in the trials lacking in sample size and providing results in this area¹¹⁷.

Sufficient time is needed to carry out user testing procedures

From many of the project review reports and associated documentation, it was clear that **sufficient time is needed both to plan and prepare the user trials as well as to run them and achieve the expected results**. Feedback from the BEYOND SILOS project also highlights that when users are selected and agree to participate in the user trials, adequate time for teaching them how to use the systems/solutions being tested must be made, with **proper time also reserved for home reinforcements during the first few months**.¹¹⁸

The HERMES project provides us with an example of where a **project needed to carry out pilot testing over a more extended period of time** with a sample of more diversified users and a more robust system, particularly in the user's home environments¹¹⁹. This was also the case in the EWALL project, where the proof of concept tests for MCI users in Italy were carried out over a period of 4 weeks and it was suggested that longer was needed in order to demonstrate whether the adoption of EWALL contributes to a significant "prolongation of functional capacity, delay in institutionalisation, increased autonomy and participation in society"¹²⁰.

User testing is not homogeneous across countries, adaptations need to be made

Strong differences were encountered between pilot testing environments across the countries involved within the projects. For example, in the PERSILAA project, it was highlighted that the situation in Italy and the Netherlands was very different, with very few ICT literate older people in Italy. Due to this, the trial activities and evaluations had to be adapted accordingly.¹²¹

There was a similar situation during the INCA project where the **INCA users in Croatia and Latvia had insufficient ICT literacy and eHealth education, coupled with a low trust of data protection policies**. In

¹¹⁷ Konstantinos, Perakis (2015). Consolidated Review Report – DEM@CARE. European Commission, FP7 Programme, Pg 3.

¹¹⁸ Buguña Hoffman, Laura; Leorin, Cristian; Klepfisch, Georges (2016). Consolidated Review report – BEYOND SILOS. European Commission, CIP Programme, Pg 3.

¹¹⁹ Carrico, Luis; Janse, Magdalena; Slater, Jim (2011). Consolidated Review Report – HERMES. European Commission, FP7 Programme, Pg 9.

¹²⁰ Noll, Stefan; Stella, Eloisa; de Toledo, Stella (2016). Consolidated Review Report – EWALL. European Commission, FP7, Pg 11.

¹²¹ Sankelo, Merja; Pouillie, Roland; Serral Asensio, Estefanía (2016). Consolidated Review Report – PERSILAA. European Commission, FP7, Pg 10.

order to combat this, courses were organised for these users were organised.¹²²

During the INLIFE project, Italian, French and German languages were not included in the multilingualism supports. This was highlighted by the review panel as something that needed to be addressed and corrected as it could be important to the future marketing of the system.¹²³

The methodology user to select users for pilot trials should be clear and quantified

In order to ensure effective user testing, **a clear methodology should be in place that defines how many users will be involved in the trial and how they will be selected (Age ranges, health problems, type of environment etc.)**. An example can be seen in the FLORENCE project during the testing of the AAL services. Whilst the results from the user testing were presented to the European Commission, the report would have further benefitted from a clear indication of how many users (primary/secondary/students) participated in the trials and how they were chosen.¹²⁴

A similar situation was also highlighted in the HOBBIT project where **the inclusion criteria of users was not done by using quantitative markers and the individual differences were not taken into consideration** when designing the behaviour of the robot. As can be expected, none of the participants in the user trials acknowledged that HOBBIT increased their independence as hoped.¹²⁵

2.1.4 Project Evaluation

Effective data collection methodologies need to be used to facilitate the evaluation of results

The methodologies used in some of the projects for data collection was an area for improvement, particularly during the user testing processes. An example of this can be seen in the DEM@CARE project, whereby reviewers highlighted that, from a methodological point of view, **a more detailed protocol of steps to collecting data, particularly when performing qualitative analysis of interviews and focus group outcomes was needed.**¹²⁶

¹²² Leorin, Cristian (2016). Consolidated Review Report – INCA. European Commission, CIP Programme, Pg 13.

¹²³ Kraemer, Horst (2017). Consolidated Review Report – IN LIFE. European Commission, H2020 Programme, Pg 2.

¹²⁴ Ackermann, Ralf (2013). Consolidated Review report – FLORENCE. European Commission, FP7 Programme, Pg 8.

¹²⁵ Borgolte, Ulrich (2015). Consolidated Review Report – HOBBIT. European Commission, FP7 Programme, Pg 38.

¹²⁶ Konstantinos, Perakis (2015). Consolidated Review Report – DEM@CARE. European Commission, FP7 Programme, Pgs 2,5.

Even in projects where the methodology for conducting user trials could be considered as a best practice for other projects, such as HERMES, the methods used for data collection were not strong enough. **The lack of a detailed methodology in this area meant that the project was unable to prove that it supports people with memory failures** based on these results.¹²⁷

In successful projects, rather than a critical problem, **a lack of rigour in data gathering, documenting and analysis could be considered as being a missed opportunity**. This was the case for the ROBOT-ERA project where a lot of useful information was gathered during the lifetime of the project, that may have not been exploited to its full potential. The specific methodologies that were chosen were said to be “arbitrary, poorly justified, and with arguable validity”¹²⁸. This led to the consortium’s lack of ability to substantiate claims made during the project.

Effective evaluation methodologies need to be used to provide credibility to project conclusions

One important lesson learnt from the analysis that has been carried out by the study team is the **need to have an effective evaluation methodology in place from the beginning of a project**. In various cases, projects simply had not established an evaluation methodology, something that was detrimental in drawing scientific conclusions out of the results. An example of this can be seen in the CONFIDENCE project (D5.8.2-5 Report on the Usability, Accessibility and Acceptability of the System). This document describes the results of the evaluation by users. In total, 21 people participated in the evaluation of the CONFIDENCE fall detection/prevention system which took place in Sweden and Finland. Whilst the information gathered from primary and secondary users and experts was extremely useful, **due to the limitation and setup of the evaluation process and the subsequent statistical analysis, no real scientific conclusions could be drawn from the results**.¹²⁹

In both the INDEPENDENT and UNCAP projects, **a lack of appropriate indications on the effectiveness of the service/solution (respectively), led to a lack of credibility of both and therefore hindering the exploitation of the outcomes**. An effective evaluation methodology to analyse the information being generated in the pilots could have been beneficial.

Even in more successful projects, weaknesses were pointed out with regards to the evaluation results and methodologies. For example, in the ROBOT-ERA project, vague terminology was used in the presentation of the results with words such as “mostly” being used. Also, the **methodology**

¹²⁷ Carrico, Luis; Janse, Magdalena; Slater, Jim (2011). Consolidated Review Report – HERMES. European Commission, FP7 Programme, Pg 2.

¹²⁸ Crowley, James L.; Duffy, Brian R.; Webb, Philip (2016). Consolidated Review Report – ROBOT-ERA. European Commission, FP7 Programme, Pg 5.

¹²⁹ Pouillie, Roland (2011). Consolidated Review Report – CONFIDENCE. European Commission, FP7, Pg 9.

changed between the first and second iterations of the pilot testing meaning that no comparison could be made between the results.

There was no consolidated plan put in place throughout the project for collecting and comparing data for comparative analysis, something that was flagged by the review panel who requested that the “presentation and acquisition of usability data be presented in a coherent and transparent way”¹³⁰. The lack of a strong evaluation strategy can result in restrictions in proving how much the usability improvements have impacted on the operational scenarios which can be seen as a missed opportunity in this case.

Finally, in the VM project, although the results of the testing were well analysed and suggested an overall improvement in cognitive abilities for people who underwent the cognitive training programme, **no sufficient comparisons nor benchmarking was carried out with existing solutions on the market** such as Brain Training devices.¹³¹

2.1.5 Exploitation Issues

Issues regarding Intellectual Property Rights (IPR) need to be sufficiently addressed so as to avoid delays and problems with commercialisation

IPR issues arose during the execution of the research and innovation projects and should be clarified from an early stage in the project. For example, in the SILVER project, the project coordinator (RCS) was encouraged to make arrangements concerning the use of 3rd party IPR in order to avoid later conflicts that may have arisen from 3rd parties. During the project, one of the project partners (TU-Delft) informally supplied their know-how to the project coordinator, when formal agreements would have been expected.¹³²

In the UNIVERSAAL project there were also problems that arose concerning the licencing of software with the owner (Philips) establishing initial conditions that were deemed “potentially damaging to project progress and exploitation prospects”¹³³. Following communication between the project coordinator and Philips, the latter changed their position and accepted the licensing terms proposed by the other partners.

The need for a clear understanding regarding IPR issues from the beginning of the project can also be seen in those projects where there are a number of ownership interdependencies amongst the project consortium. For example, in the FARSEEING project, the FARSEEING database (architecture) was 100% owned by project partner

¹³⁰ Crowley, James L.; Duffy, Brian R.; Webb, Philip (2016). Consolidated Review Report – ROBOT-ERA. European Commission, FP7 Programme, Pg 9.

¹³¹ Tsakou, Ioanna (2011). Consolidated Review Report – VM. European Commission, FP7 Programme, Pg 6.

¹³² Katevas, Nikos (2016). Consolidated Review Report – SILVER. European Commission, FP7 Programme, Pg 3.

¹³³ De Leenheer, Pieter (2013). Consolidated Review Report – UNIVERSAAL. European Commission, FP7 Programme, Pg 15.

RBMF and the Repository (physical implementation of the FARSEEING database) was 100% owned by NMLF. However, what would happen if NMLF needed to change their implementation which would potentially impact RBMF as it would mean changing the reference implementation of their architecture?¹³⁴. It is important that these issues are investigated and resolved at an early stage of the project so as not to hinder the potential exploitation of results.

Commercial agreements are a useful tool to help further develop project results

One of the tools that was used to help ensure the further development of project results were Commercial Agreements at consortium level, which covered things such as different IPR issues and the responsibilities of the different project partners. An example can be seen in the IDONTFALL project where a Memorandum of Understanding between the project partner Universitat Politècnica de Catalunya (UPC) and sister University IBEC in Barcelona was established to further develop the iWalker fall prevention system to specifically address the rehabilitation, brain injury and elderly care market segments by offering a range of modular versions of the iWalker that address the different needs of the market.

A similar case can be seen in the UNIVERSAAL project where a **Commercial Agreement was recommended by the review panel to govern the use of IPR beyond the end date of the project's Collaboration Agreement and to help develop the commercial exploitation of the project results**¹³⁵. The SOCIABLE project also took the same approach establishing a Cooperation Agreement between partners, based on the positive results from the operational pilots. The agreement defined issues regarding IPR and was used to help promote the commercialisation and sustainability of project results.¹³⁶

In some cases, the interest in the **future commercialisation of project results was concentrated on the industrial partners within the project consortiums**. For example, in the INCA project, the industrial partners (IDI EIKON, KENUS and INTERFUSION) signed a Memorandum of Understanding that established the foundation for a joint commercialisation of project results.¹³⁷

However, **simply having an agreement in place is not sufficient enough**. In some projects such as SMILING, despite having the "Smiling Agreement" in place, it was deemed by the Review Panel as "not detailed enough to cover all potential problems that may arise in the future due to

¹³⁴ Meijer, Kenneth; Razavi, Reza; Stubbs, Richard (2015). Consolidated review Report – FARSEEING. European Commission, FP7, Pg 6.

¹³⁵ De Leenheer, Pieter (2013). Consolidated Review Report – UNIVERSAAL. European Commission, FP7 Programme, Pg 15.

¹³⁶ Avramov, Dragana (2012). Consolidated Review Report – SOCIABLE. European Commission, CIP Programme, Pg 7.

¹³⁷ Leorin, Cristian (2016). Consolidated Review Report – INCA. European Commission, CIP Programme, Pg 2.

potential restrictions imposed by IPRs (already registered or under registration by some consortium partners)¹³⁸. It is **essential that these documents are sufficiently detailed in order to be of benefit in the future when exploitation activities occur.**

Collaboration agreements with industrial players should be actively sought in order to enhance expansion into the market

In addition to the necessary commercial agreements at consortium level, the review panels also highlighted the **importance of developing collaborations with other industrial players**. In the SOCIABLE project, the consortium was applauded for the cross-marketing strategy that they developed with the companies Asus and Microsoft. However, they were encouraged to exploit potential collaborations with other mixed PC/Tablet or Tabled manufacturers. This is due to the fact that home-based individual cognitive training services and medical assessment could be run over such devices and platforms.¹³⁹

A clear and concise presentation of results is required to promote the uptake of project results

An EU funded research and innovation project will often produce a wide range of different results. However, **a clear and concise presentation of these results is the key to ensuring their uptake by relevant stakeholders and thus help to ensure their sustainability**. An example of this can be seen in the INDEPENDENT project where, although several positive results were generated, **they were not presented in a comprehensive, consistent and easy to understand manner** (particularly with regards to cost-benefit data and projection). **This is fundamental when addressing key policy and decision makers in the public and private sector.**¹⁴⁰

In the CAREWELL project, the consortium highlighted that the **identification of financial benefits and the general conclusions from the pilot sites in six European regions would be essential in supporting policy makers and commissioning professionals in making decisions** such as the uptake of the CAREWELL platform¹⁴¹. CAREWELL was deemed one of the top 25 projects and ranked second in terms of impact. If other projects could use this type of predictive modelling, it could help convince decision makers with regards to the large-scale uptake of innovative ICT products and services.

¹³⁸ Duysens, Jacques; Katevas, Nikos, Pouillie, Roland (2011). Consolidated review report – SMILING. European Commission, FP7 Programme, Pg 3.

¹³⁹ Avramov, Dragana (2012). Consolidated Review Report – SOCIABLE. European Commission, CIP Programme, Pg 7.

¹⁴⁰ Moreno, Sofia; Lange, Mark; Katevas, Nikos (2013). Consolidated Review Report – INDEPENDENT. European commission, CIP Programme, Pg 4.

¹⁴¹ Mollenkopf, Heidrun; Ciharova, Katerina; Almedia, Nuno (2016). Consolidated Review Report – CAREWELL. European Commission, CIP Programme, Pg 2.

2.1.6 Integrated Care

Need for commitment from administrative departments and top-level positions within the healthcare services

This could be seen in the BEYOND SILOS project, where the consortium concluded that even if the horizontal integration of care has helped to define clear roles and provide closer contact between professionals and project partners, **the lack of support from the administrative departments within the healthcare services has been a limiting factor.** Furthermore, integration is expressed at professional, organisational and institutional level. When these three levels cooperate well and are perfectly in line, an integrated system can grow. However, **without clear commitment from top level administration, it is impossible to reach top level integration and full integrated care.**

It is important to take into consideration that **integration is mainly based on human factors and that coordination, interactions and integration largely depend on the will of the professionals to break down barriers and establish alliances.**

Integrated care services can greatly benefit from the use of personal electronic records

During the BEYOND SILOS project, it was highlighted that **new services that aim to reach high quality integrated care, benefit greatly from the use of a personal electronic record containing both health and social data information.** These electronic personal records speed up communication, facilitate the exchange of information of care relevance and help to prepare a common agenda of care. **The use of these electronic Health records or EHRs present great opportunities for case/care managers, particularly with chronic diseases such as cardiac failure, respiratory insufficiency and diabetes which all share the need to be followed up by means of objective clinical measurements (blood pressure, weight, etc.).** However, it is important to note that these should not be stand-alone/replacement ICT solutions but complimentary tools in order to avoid the risk that patients rely on the ICT without any physical contact.¹⁴²

The role of the social care sector should be prioritised within integrated care

In the COMMONWELL project, a report summarising the work carried out at all the pilot sites (D7.2 Pilot Outcomes) concluded that the **driving force for the social and health care integration comes much more from the social care sector than from the health care sector.** This should be

¹⁴² Buguña Hoffman, Laura; Leorin, Cristian; Klepfisch, Georges (2016). Consolidated Review report – BEYOND SILOS. European Commission, CIP Programme, Pg 5.

taken into consideration when developing integrated care intervention projects.¹⁴³

This is supported by evidence from the BEYOND SILOS project which concluded that, in general, **the social sector seems to be less mature than the health sector to introduce changes in service organisation and the use of new technologies.** Therefore, the social sector should receive more attention and support in this area.

2.1.7 Innovative solutions for the elderly

Key elements to be taken into consideration when preparing an Open Market Consultation (OMC) or a Pre-Commercial Procurement Process (PCP)

From the execution of the STOP AND GO project, some key insights were highlighted regarding the organisation of an Open Market Consultation (OMC). Based on feedback from questionnaires and events carried out, it became clear that **no one single organisation would be able to provide the entire service that was being procured and that collaboration would be needed.** This is particularly difficult within the context of an OMC due to the need for competitors and potential partners to share ideas. Technology suppliers needed external support to build relationships to help them to work together with other organisations. **It is important that extra support is provided during the consortia preparation phase, a process that can be started both before the submission of bids and after having received bids.** An example can be seen in the preparation of matchmaking events by the project partner, Eastern Cheshire. "In retrospect we would spend more time with technology suppliers, supporting them through development of personalised menu of technology enabled care. Brokerage of the NHS, Technology and Education provider's relationships would have come later in the process once a technology offer had been drafted."

Furthermore, since the aim of the OMC is to procure innovative services, it is very difficult to previously identify all the relevant indicators. Therefore, in the tender specifications, the consortium included a request for bidders to include a coherent set of additional indicators to measure the functionality and performance of the proposed solutions. This places the responsibility to the bidder to establish the most appropriate manner to measure the innovative nature of its solution.¹⁴⁴

In the SILVER project, the consortium emphasised the need for **better planning and preparation during the tender preparation stage within a PCP (E.g. specifications, market consultation etc.) in order to ensure that the objectives are met.** This was particularly the case during Phase 0, in agreeing the terms for the tender specification and the

¹⁴³ Katevas, Nikos (2012). Consolidated Review Report – COMMONWELL. European Commission, CIP Programme, Pg 13.

¹⁴⁴ All Project Partners (2013). Overview Open Market Consultation – STOPANDGO. Project Consortium, Pg 46.

subsequent assessment of bids. Although the PCP instrument is designed to drive innovation for procurers by specifying the characteristics of the product they would invest in, after Phase 3, many of the project partners did not feel that the product had the right characteristics for them and that it was more suitable for private purchasers. This was considered as one of the main lessons learnt during the project and an insight of great importance for future projects.¹⁴⁵

2.1.8 Project Management

Effective risk management strategies need to be implemented to ensure the smooth execution of the project

The **need for the implementation of effective risk management strategies** were highlighted in some projects. This was the case in the ALFRED project where risk management was deemed as not being satisfactory. Despite having a risk management strategy in place, and having received recommendations from the review board about these risks, **the contingency measures that were put in place were not sufficient to improve the project outcomes.**¹⁴⁶

A similar situation can be observed in the DEM@CARE project. Again, despite having a proactive risk management strategy in place, problems arising from user recruitment and acceptance should have been anticipated at an earlier stage and should have been dealt with. The result of not paying attention to this risk led to the trials carried out in Nursing Home environments lacking a sufficient number of users and therefore **generating results and evaluations that were not significant from a statistical point of view.** Simply having a risk management strategy in place is not enough, the **risks should be given sufficient priority and attention so that deviations could be avoided.**¹⁴⁷

In the CAALLYX project, there was a **general lack of ability to foresee potential risks with the project implementation activities.**¹⁴⁸ For example, the need to seek ethical approvals was overlooked, leading to problems in the execution of the project. This was also the case in the HOME SWEET HOME project, where the project failed to establish a proper risk management strategy. Despite having received advice from the EC reviewers at an earlier stage, the consortium did not identify risks that occurred later and could have been avoided.¹⁴⁹ **Such a lack of a risk**

¹⁴⁵ Katevas, Nikos (2016). Consolidated Review Report – SILVER. European Commission, FP7 Programme, Pg 2.

¹⁴⁶ Hempel, Thomas; Moreno, Sofia; Sparpaglione, Massimo (2016). Consolidated Review Report – ALFRED. European Commission, FP7 Programme, Pg 16.

¹⁴⁷ Konstantinos, Perakis (2015). Consolidated Review Report – DEM@CARE. European Commission, FP7 Programme, Pg 3.

¹⁴⁸ Klepfisch, Georges (2013). Consolidated review Report – CAALLYX MV. European Commission, CIP Programme, Pg 9.

¹⁴⁹ Buiza Bueno, Cristina (2014). Consolidated Review Report – HOME SWEET HOME. European Commission, CIP Programme, Pg 2.

management strategy could result in a project of this kind failing to reach its objectives.

Project objectives should be realistic and attainable

One of the recurrent features of the project review reports was the **overly ambitious project objectives that had been established, often setting a project up for failure, or to experience delays due to the need to change objectives or make adjustments** to other major parts of the project. A key example of this was the DREAMING project where project management and over-ambition were highlighted as the weak points by the review panel. The consortium set far too ambitious objectives including the implementation of a Randomised Control Trial (RCT) which, at the time, was a largely unresearched and unproven technique for complex technological interventions. They also wanted to test four different technologies at the same time, when other projects had even considered two to be a challenge. The consortium also wanted to do this in six different countries when their budget pro rata was substantially less than in other RCTs.¹⁵⁰

The FATE project also suffered the consequences of over-ambitious objectives. The original fall detector system that was proposed in the project was too complex to be used by the target population and too expensive to be economically viable. Due to this, a much simpler version had to be developed.¹⁵¹

The I-SUPPORT project was also **overly ambitious in its original technological objectives**, with a plan to incorporate a significant amount of sensor systems within the I-SUPPORT system including vision, audio, force, shape and motion tracking sensors. This was highlighted by the review panel who requested that only those that were deemed necessary to successfully implement the system be included, suggesting that this could have become a problem as the project evolved.¹⁵²

Over ambition was also mentioned in the STOP and GO, ENRICHME and RAMCIP projects, particularly **with regards to the project timeline and objectives**, respectively. The RAMCIP consortium was requested by the review panel to clarify the project's main objectives: designing a robot for home with non-professional care givers vs a robot that would serve as support to professional care givers at home. It was highlighted that both orientations could not be pursued at the same time within the remaining timeframe.¹⁵³

¹⁵⁰ Lowe, Charles (2012). Consolidated Review Report – DREAMING. European Commission, CIP Programme, Pg 3.

¹⁵¹ Barelle, Caroline; Lowe, Charles; Pouillie, Roland; Ellis, Tim (2017). Consolidated Review Report – FATE. European Commission, CIP Programme, Pg 2.

¹⁵² Razavi, Reza (2016). Consolidated Review Report – I-SUPPORT. European Commission, H2020 Programme, Pg 7.

¹⁵³ Amirabdollahian, Farshid (2017). Consolidated review Report – RAMCIP. European Commission, H2020 Programme, Pg 3.

An interdisciplinary and international composition of the consortium can contribute to a project's success

The review panel reported that a **key success factor** for one of the most influential projects in the study, CAREWELL, was the **interdisciplinary and international composition of the project consortium**. They went on to highlight that it has been "well balanced in terms of partners from health and care sciences and practice, technical partners and consultancies experienced in eHealth and eInclusion".¹⁵⁴

2.1.9 Dissemination of EU funded research and innovation projects

Project websites should be used more effectively in the dissemination of results

Under the topic of dissemination, one of the recurrent subjects that came up was the **need for projects to better use their webpages to effectively disseminate results and to help them to reach a larger audience**. An example of this can be seen in the COMPANIONABLE project where the review panel highlighted that the project website did not present the project's achievements in the most attractive way. There were indications that, within the public section of the web page, **the results should be separated according to audience type** (E.g. end-users, technical, medical, social, decision makers, industrial entities etc.) and that the **contact details for the person responsible for each deliverable be made clear**¹⁵⁵. Furthermore, the consortium was encouraged to make more use of videos to promote the project.

This was also the case for the SMILING project who were encouraged to include dedicated sections with customised content for each of the audience groups including: general public, scientific community, health/care institutions etc. They were also requested to **establish a process through which public enquiries into project activities would be responded to after the end of the project** (E.g. who would reply to the general public, researchers, market players etc.).¹⁵⁶

In the CONFIDENCE project the consortium was asked to increase the amount of public information available on the website with regards to the current status, history of the project, achievements, lessons learnt, outcomes, results and future plans. Furthermore, it was requested that the

¹⁵⁴ Mollenkopf, Heidrun; Ciharova, Katerina; Almedia, Nuno (2016). Consolidated Review Report – CAREWELL. European Commission, CIP Programme, Pg 2.

¹⁵⁵ Avramov, Dragana; Katevas, Nikos; Keijer, Ulf; Pons, José Luis; Vernooij-Dassen, Myrra (2012). Consolidated Review Report – COMPANIONABLE. European Commission, FP7 Programme, Pg 3.

¹⁵⁶ Duysens, Jacques; Katevas, Nikos, Pouillie, Roland (2011). Consolidated review report – SMILING. European Commission, FP7 Programme, Pg 5.

public information available be related to the original objectives of the project with a focus on the final results.¹⁵⁷

The INLIFE project was also asked to better arrange the visibility of the tools on their website so that they were in line with the INLIFE service platform, by creating categories such as independent living, driving etc.¹⁵⁸

Need to extend the outreach of dissemination actions – no sole focus on research communities

A further lesson learned with regards to dissemination activities is the need to **extend the focus of dissemination actions and not only focus on the research community**. An example of this can be seen in the COMPANIONABLE yearly workshop/forum that they carried out, the last two of which primarily reached out to the research community and other stakeholders were not sufficiently involved.¹⁵⁹

A similar situation can be seen in the EWALL project. In this case, the scientific and technical dissemination was commended by the review panel. However, the **lack of effort devoted to dissemination activities that were focussed on potential users and prescribers** (healthcare professionals), as well as a **lack of engagement activities with formal patient groups, government and industrial bodies** was also highlighted. A stronger effort was requested with regards to communicating the project results to the wider stakeholder community (National health services, health and social care organisations, government agencies, agencies responsible for the care of ageing people, companies manufacturing solutions for active ageing etc.).

Furthermore, the review panel also highlighted that **it was especially troubling the fact that that all communications had only been carried out in English**, restricting public awareness from other countries, including those where the final demos took place.¹⁶⁰

The **lack of industry representation** was also highlighted in some of the extremely successful projects such as FARSEEING. This can be seen in the organisation of the European Union Falls festival (EUFF2015) where a lack of representation of industrial representatives in comparison to academia and research communities can be seen.¹⁶¹

¹⁵⁷ Pouillie, Roland (2011). Consolidated Review Report – CONFIDENCE. European Commission, FP7, Pg 7.

¹⁵⁸ Kraemer, Horst (2017). Consolidated Review Report – IN LIFE. European Commission, H2020 Programme, Pg 2.

¹⁵⁹ Avramov, Dragana; Katevas, Nikos; Keijer, Ulf; Pons, José Luis; Vernooij-Dassen, Myrra (2012). Consolidated Review Report – COMPANIONABLE. European Commission, FP7 Programme, Pg 3.

¹⁶⁰ Noll, Stefan; Stella, Eloisa; de Toledo, Stella (2016). Consolidated Review Report – EWALL. European Commission, FP7, Pg 5.

¹⁶¹ Meijer, Kenneth; Razavi, Reza; Stubbs, Richard (2015). Consolidated review Report – FARSEEING. European Commission, FP7, Pg 5.

Project deliverables should be useful or not exist

A problem that particularly stood out amongst those projects that did not make the top 25 most influential projects was the that **some of the deliverables that were produced did not bring anything to the table**. An example of this can be seen in the CONFIDENCE project with regular reminders that the project deliverables should “not be overloaded by the repetition of old material and long theoretical considerations”¹⁶². From the information in the final review report, it can be seen that this problem was not rectified.

Repeated material could also be seen in DOREMI and HERMES. The latter included project deliverables which contained a lot of repeated material and it was sometimes unclear what the added value of that specific deliverable was and why various deliverables reporting the same or similar information were not combined.¹⁶³

Digital tools are paramount in successfully reaching out to and engaging with the appropriate audiences

The use of **digital tools can be seen as being extremely successful in reaching out and engaging with appropriate target audiences**. The GIRAFF+ project was exemplary with regards to this, developing an excellent external profile in both scientific and popular media. For example, the Nonna Lea video, featuring a 94-year-old participant played a key role in increasing the profile of the project worldwide.¹⁶⁴

In the PERSILAA project, the consortium also launched a video animation to reach people with low levels of ICT skills and knowledge. This was considered to be an excellent initiative by the Review Panel.¹⁶⁵

A different approach was taken in the CAREWELL project where, in collaboration with SMARTCARE and BEYONDSILOS a wiki on integrated care was established: www.wiki.integrated-ecare.eu. This initiative has enabled the joint presentation of synergies between the projects.

2.1.10 Ethical and Regulatory Issues

A lack of focus on ethical and regulatory issues can lead to serious problems in project execution

This was considered to be one of the major problems of the CAALYX MV project that was suspended in 2012 and was asked to provide ethical approvals for the pilots. During the suspension period, the consortium

¹⁶² Pouillie, Roland (2011). Consolidated Review Report – CONFIDENCE. European Commission, FP7, Pg 7.

¹⁶³ Carrico, Luis; Janse, Magdalena; Slater, Jim (2011). Consolidated Review Report – HERMES. European Commission, FP7 Programme, Pg 7.

¹⁶⁴ Duffy, Brian; Preucil, Libor; Webb, Philip (2015). Consolidated Review Report – GIRAFF+. European Commission, FP7 Programme, Pg 6.

¹⁶⁵ Sankelo, Merja; Pouillie, Roland; Serral Asensio, Estefanía (2016). Consolidated Review Report – PERSILAA. European Commission, FP7, Pg 7.

attempted to gain approvals from the Spanish and Italian Ethical Committees. However, the **project was terminated by the EC on the 28/11/2012 due to their failure to provide ethical approvals during this period**¹⁶⁶. This highlights the **importance of having a proactive approach to ethical issues in EU funded research and innovation projects**. Ethical issues have also caused delays in the start of the pilots and the deployment of system in the UNCAP project, as some of the pilots had not received the necessary approvals from their responsible authorities¹⁶⁷.

A **sufficient grasp of the current European Directives and national legislation is also important** to plan for certain situations and avoid delays when exploiting project results. An example of this can be seen in the FARSEEING project where the consortium was made aware that, according to EU Directives and Italian national legislation, the FARSEEING self-adaptive intervention that was based on information collected via a smartphone, carries out diagnostics/therapeutic actions to prevent falls, and therefore qualifies as a medical device. This meant a drastic change of perspective for the entire intervention study and would require significant corrective actions in order to conform to the Medical Devices Directive 93/42/EEC prior to exploitation.¹⁶⁸

2.1.11 Technological and standardisation issues

The importance of adapting technology to different user needs

This was an important lesson learned in the DEM@CARE project which highlighted the need to define different user interfaces for the different users. In the case of the DEM@CARE solution, this meant the development of two interfaces, one for patients and one for informal carers, as their needs and skills differed a great deal.¹⁶⁹

Less is more when it comes to the complexity of solutions and testing in user environments

This was an important discovery during the FATE project, where the **complexity associated with the installation of the system at the user's home was particularly time-consuming**. A typical FATE installation took between two to three hours. This complexity is due to the need to guarantee a correct ZigBee network coverage at the user's home. A coverage map had to be constructed for each installation and, if coverage could not be guaranteed for each area in the user's home, alarms were generated if the user did not carry the smartphone. **Technical**

¹⁶⁶ Klepfisch, Georges (2013). Consolidated review Report – CAALYX MV. European Commission, CIP Programme, Pg 2.

¹⁶⁷ Walterova, Iva (2017). Consolidated review Report – UNCAP. European Commission, H2020 Programme, Pg 5.

¹⁶⁸ Meijer, Kenneth; Razavi, Reza; Stubbs, Richard (2015). Consolidated review Report – FARSEEING. European Commission, FP7, Pg 5.

¹⁶⁹ Konstantinos, Perakis (2015). Consolidated Review Report – DEM@CARE. European Commission, FP7 Programme, Pg 7.

installations during pilot testing should be streamlined and efficient to ensure the maximum uptake in user participation and therefore, more robust results.

A further example can be seen in the GIRAFF+ project. The demonstration during the review meeting of the GIRAFF+ system for early detection and adaptive support showed a nice balance between functionality and usability. **The project consortium had not attempted to get too complex and this was reflected in the success of its real-world implementation.**¹⁷⁰

Beware of the “technical invasion” syndrome in user’s homes and the lack of awareness regarding ICT for health

A further issue that was detected during the FATE project was the sensation of a “technical invasion” that was felt by the elderly people when the system was installed. This was caused by the **complex installation process** in this case (see previous point) and the fact that they are **not able to fully understand the purpose of all the components compiling the system**. In some cases, the subjects felt overwhelmed by the FATE setup. Furthermore, since some components are installed in the user’s bedroom participants fear that this may have a negative impact on their health (usually a fear of radiation side effects). These fears caused several dropouts during the pilot testing period.¹⁷¹

In the INCASA project, most of the 5 pilot sites had heard of telehealth previously, but only one pilot had experience of using it. Furthermore, the majority of the users during the pilot trials were unfamiliar with new technologies which led to some user acceptance issues, particularly regarding monitoring with sensors. Due to this, a more “inclusive” approach is necessary when presenting and implementing a service involving end users, starting from the initial contact¹⁷². The team in charge of the trials should help the users to become conscious of their fears and needs and help them to understand and accept the technology that is being deployed.

Industry standards should be taken into consideration from the early stages of the project

This was highlighted during the DEM@CARE project whereby the review panel stated that it would have **been of “added value” if the consortium partners had taken into consideration the usability standards** (E.g. World Wide Web Consortium (W3C) and the Web Accessibility Initiative (WAI)) especially for the design of the People with Dementia (PwD) user interface.¹⁷³

¹⁷⁰ Duffy, Brian; Preucil, Libor; Webb, Philip (2015). Consolidated Review Report – GIRAFF+. European Commission, FP7 Programme, Pg 5.

¹⁷¹ Barelle, Caroline; Lowe, Charles; Pouillie, Roland; Ellis, Tim (2017). Consolidated Review Report – FATE. European Commission, CIP Programme, Pg 5.

¹⁷² Author unavailable (2013). Consolidated Review Report – INCASA. European Commission, CIP Programme, Pg 5.

¹⁷³ Konstantinos, Perakis (2015). Consolidated Review Report – DEM@CARE. European Commission, FP7 Programme, Pg 7.

Projects should also attempt to adhere to and even contribute to international standards where possible. An example of this can be seen in the GIRAFF+ project which did just that and contributed to international standards for sensor networks through their involvement in the OSGI Residential Group (OSGI Alliance¹⁷⁴), formerly known as the Open Services Gateway Initiative, an open standards organisation.

The efforts needed for the integration of technological components should not be underestimated

In the MOBISERV project, the consortium **underestimated the effort that was needed for the integration of components which, in turn, led to delays in the technical integration of the prototype**. These delays also had knock-on effects on the planning and execution of the validation studies, although their quality was not affected. This was due to problems which emerged with the initially chosen architecture (Microsoft Robotics Studio). Very late on, a new architecture, based on open standards had to be defined and implemented, causing severe delays for the integration of the end prototype.¹⁷⁵

¹⁷⁴ OSGI Alliance: www.osgi.org/

¹⁷⁵ Skiczuk, Peter; Janse, Magdalena; Borgolte, Ulrich (2013). Consolidated Review Report – MOBISERV. European Commission, FP7 Programme, Pg 7.

2.2 Conclusions and Recommendations for policy makers for the future research and innovation agenda in ICT for AHA

In this section, the study team have highlighted the main conclusions from the study and have identified a series of recommendations to the European Commission Services for future research and innovation on issues related to digital solutions for active and healthy ageing for policy makers. Both the conclusions and recommendations that have been made are based on the key findings and impact from the 25 most influential projects and the lessons learnt from the full range of 58 projects included in the initial knowledge base.

2.2.1 Main conclusions from the study

The main conclusions from the Study have been summarised:

- The geographical representation in the R&I projects related to Active and Healthy Ageing within the initial study knowledge base of 58 projects (See Annex I) were dominated by representative organisations from Spain, Italy, Greece, Germany and the United Kingdom.
- There was limited representation of representative organisations from the Nordic countries (with the exception of Sweden) and from the eastern European Member States. When analysing the geographical representation of projects coordinators, the results were similar, however there was no representation from organisations from Eastern European Member States.
- Regarding the Impact Area: improved quality of life, those projects related to fall prevention and robotics for ageing well had the strongest impact, alone with stand-alone projects related to innovating elderly care and integrated care.
- Regarding the Impact Area: increased efficiency of health and long-term care, there was a clear dominance of integrated care projects with some projects related to innovating elderly care also proving to be quite influential in this area.
- Regarding the Impact Area: market growth and expansion, those projects related to robotics for ageing well demonstrated the strongest impact. The projects related to fall prevention also were very influential, particularly in the creation of new markets. Finally, the projects related to innovating elderly care also made an impact in this area.
- With regards to the Impact Areas: dissemination and engagement opportunities and sustainability, all six categories of projects demonstrated a strong impact with particularly impressive work

carried out by the projects related to robotics for ageing well in dissemination and engagement. Furthermore, the projects related to innovating elderly care were extremely effective in ensuring the sustainability of project results.

- The top three projects with regards to overall impact after the in-depth analysis (See Annex III) included FARSEEING (FP7), CAREWELL (CIP) and ACCOMPANY (FP7) covering the following three domains: fall prevention; better connected through integrated care and robotics for ageing well.
- The FARSEEING project has provided a 360° perspective on how to prevent, detect and manage falls in various environments. One of the greatest achievements of the projects has been the development of the Fall Repository, representing a breakthrough in scientific and clinical knowledge in the area of fall prevention and has raised the bar for the future development and evaluation of fall-related interventions. Other important innovations include the development of the Taxonomy of Technologies and the design and validation of novel algorithms. The impact of the project can be seen through the successful commercialisation of the technology developed during the project through the spin-off company mHealth.
- The CAREWELL project has increased the knowledge about sustainable integrated health and social care and has generated model that can be transferred to other European regions and to other cohorts of the population with other health and social care needs. It has successfully demonstrated that Integrated care can increase the quality of life for older people and has developed sound empirical evidence for the cost-benefit evaluations needed to convince regional and national policy-makers about the benefits of ICT-supported integrative care. The project has also generated a set of consolidated conclusions from implementing integrated care across the projects through a set of Guidelines and Integrated Care Glossary. The success of the project can be seen in the fact that five of Carewell's pilot sites successfully applied as Reference Sites for the European Innovation Partnership on Active and Healthy Ageing (EIPonAHA).
- The ACCOMPANY project has made good progress in raising the technological readiness level of personal care robots, representing a key milestone towards a long-term vision of emphatic, socially acceptable, co-learning robotic home companions for elderly users, supporting reablement and facilitating independent living. It has clarified a number of technological and social challenges and has successfully commercialised the CARE-O-BOT robot in the market. A number of scientific and technical innovations have also be generated during the project including the development of memory architecture for learning and adaptation, new forms of socially aware human robot

interaction, empathetic interaction, and demonstration of viable activity monitoring. These innovations are expected to have a very large impact in science and technology, leading to new research and development approaches for robot-human interaction.

- Through both the preliminary (58 projects) and in-depth analysis (40 projects) that were carried out, a series of very interesting lessons learnt were highlighted. These lessons learnt cover different aspects of R&I projects related to active and healthy ageing ranging from the importance of the design process, the need for increased stakeholder involvement and the need to focus on the exploitation of project results.
- The focus on stakeholders is clearly an area for improvement for R&I projects related to ICT for AHA. This aspect can be separated into two categories, firstly the importance (and current lack of) involvement of external stakeholders (industry representatives, formal patient bodies etc.) in project activities and secondly, aspects related to the involvement of users themselves. The latter of the two is extremely important with issues such as insufficient user involvement, the need for clearer and more quantified user selection methodologies, the need for more lengthy user testing periods and sufficient adaptation of user testing methodologies to take into account differences between pilot testing environments.
- The evaluation and subsequent exploitation of project results and outcomes can also be seen as an important area of work for R&I projects related to ICT for AHA. Aspects to take into account here include the use of effective data collection and evaluation methodologies to provide credibility to project conclusions. The need to present these conclusions in a clear, concise and attractive way was also highlighted as being paramount to attracting potential clients/outlets to uptake the results. Finally, the use of collaboration agreements with industrial players along with other types of commercial agreements amongst the project consortium are important to clear up issues such as IPR and to help facilitate the successful exploitation of project results and therefore increase the impact of EU-funded R&I.
- Three, category specific, lessons learnt have also been identified focussing on projects related to integrated care and projects related to innovative solutions for the elderly. For the integrated care projects, a lack of commitment from administrative departments and top-level positions within healthcare services was noticed along with a potential opportunity to maximise the benefits from Electronic Health Records (EHRs). With regards to innovative solutions for the elderly, the spotlight here was on main elements and lessons learnt from the preparation and execution of Open Market Consultations

(OMCs) and Pre-Commercial Procurement processes (PCPs) for the development of highly innovative ICT solutions that respond to real life needs.

- A number of lessons learnt were also highlighted on transversal issues related to R&i projects such as the need to carry out an appropriate market and competitor analysis, issues related to project management, dissemination along with specific lessons learnt related to ethical, regulatory, technological and standardisation issues.
- The need to improve dissemination tactics and activities within EU funded R&I projects was particularly touched upon with a focus on a more effective use of project websites to disseminate results, the development of high quality deliverables, extensions of dissemination activities to a wider audience and an increase in the use of digital tools to enhance reach.
- Various issues related to technology and standardisation were highlighted throughout the review documentation as important things for R&i projects to take on board. From the technological point of view, aspects such as the adaptation of technology to different needs, the use of less complex solutions in user testing environments and the need to generate and continuously work on user awareness of technology, are key areas of work. An increased awareness and proactive attitudes regarding industry standards from early on in the projects are also extremely important.

2.2.2 Recommendations for policy makers for the future research and innovation agenda for ICT for AHA

Taking into account all of the work that has been undertaken in the study, the following recommendations have been made to the European Commission Services for future research and innovation on issues related to digital solutions for active and healthy ageing for policy makers.

Each recommendation responds to a Lesson learnt including the key findings from projects as evidence to justify the recommendation itself, highlighting best practice examples from the FP7, CIP and H2020 programmes.

Table 32 Summary of the Recommendations for policy makers for the future research and innovation agenda in ICT for AHA

Recommendation	Related Lessons Learnt
Recommendation 1: Implementation of validated evaluation methodologies and practices to ensure the generation of quantitative results and to improve scientific credibility	Effective evaluation methodologies need to be used to provide credibility to project conclusions
Recommendation 2: Increased	A lack of focus on ethical and

consideration should be given to ethical and regulatory issues with proactive steps put into place to sufficiently address them	regulatory issues can lead to serious problems in project execution
Recommendation 3: A more thorough and deeper analysis of the State of the Art and Market/Competitors should be demanded of EU funded projects related to ICT for AHA at different stages of the project lifecycle	There is a general lack of extensive market, competitor and state of the art analysis prior to and during project execution
Recommendation 4: The user should be placed at the centre of the design process through the adoption of tried and tested methodologies and sufficient, well-documented iterative cycles	User requirements elicitation should be carried out early in the process and with regular iterative cycles / The importance of the design phase should not be underestimated
Recommendation 5: Introduction of user recruitment practices to effectively engage, convince and maintain users in trials	The reasons behind insufficient user involvement need to be addressed and taken into consideration in future projects
Recommendation 6: Inclusion of counter-measures from early on in the project to help improve the digital skills of potential users for the pilot trials	User testing is not homogeneous across countries, adaptations need to be made
Recommendation 7: Take into account alternative ways of exploiting project outcomes and results	Collaboration agreements with industrial players should be actively sought in order to enhance expansion into the market
Recommendation 8: The uptake of project management methodologies/tools can increase project efficiency	Effective risk management strategies need to be implemented to ensure the smooth execution of the project/Project objectives should be realistic and attainable
Recommendation 9: Use of organisational structures/processes to identify and engage with key stakeholders related to the theme of the project at hand	Need to involve additional external stakeholders in project activities
Recommendation 10: A greater emphasis should be given to expand the participation in EU-funded Research and Innovation programmes related to ICT for Active and Healthy Ageing	Information from the section Overview of the impact of key EU research and innovation projects – Impact on a Geographical level

Recommendation 1: Implementation of validated evaluation methodologies and practices to ensure the generation of quantitative results and to improve scientific credibility

Related Lessons Learnt: Effective evaluation methodologies need to be used to provide credibility to project conclusions

The need for an effective evaluation methodology from the initial stages of the project is paramount and is strongly related to the sustainability of results, due to a consortium's ability to provide scientific, credible

conclusions to potential investors/clients. The analysis of the projects involved in the study demonstrated that many projects did not have an effective evaluation methodology in place and that, if one was in place, it was not done sufficiently early enough, something that can be detrimental to the generation of scientific results (CONFIDENCE¹⁷⁶). In other projects, a lack of appropriate indications on the effectiveness of a service/solution led to a lack of credibility and had knock-on effects on the exploitation of outcomes (INDEPENDENT and UNCAP). A lack of sufficient benchmarking/comparative analysis of results with existing solutions of the market was also highlighted (VM¹⁷⁷). Even in more successful projects (ROBOT-ERA) a distinct lack of a consolidated plan throughout the project for collecting and comparing data for comparative analysis was noted¹⁷⁸.

There are numerous existing tools that can be used by projects to effectively carry out clinical and socioeconomic evaluations, representing the building blocks of the system of measurement of local and regional initiatives. **The assessment of a local initiative should aim to satisfy the strategic objectives pursued through its implementation.** It should be **based on validated methodologies able to support the link between the activities performed** (in other words the innovation) **and the expected strategic results.**

Specific evaluation tools could also be promoted for use in future research and innovation projects. For example, the **MAST (Model for the assessment of Telemedicine (Telemedicine applications for chronic conditions))** was developed by previous EU initiatives and has already been applied in Renewing Health¹⁷⁹ and United for Health and provides a complete framework of indicators. An example can be seen in the use of the MAST model by three of the projects focussing on integrated care that were financed under the CIP programme (BEYOND SILOS, CAREWELL and SMARTCARE). One of the synergies that was identified and acted upon was the agreement to use the same approaches with regards to data collection through the application of the MAST framework and integrated databases. The integrated database collected information in cooperation with the other two projects was an excellent source of information to be further explored, used and developed to increase the impact of the projects. The three projects also worked together to create a common glossary of terms and have been active in contributing to the EIP on AHA on several occasions¹⁸⁰.

In terms of the analysing the cost-effectiveness of solutions, **the MAFEIP (Monitoring and Assessment Framework for the EIP on Active and**

¹⁷⁶ Pouillie, Roland (2011). Consolidated Review Report – CONFIDENCE. European Commission, FP7, Pg 9.

¹⁷⁷ Tsakou, Ioanna (2011). Consolidated Review Report – VM. European Commission, FP7 Programme, Pg 6.

¹⁷⁸ Crowley, James L.; Duffy, Brian R.; Webb, Philip (2016). Consolidated Review Report – ROBOT-ERA. European Commission, FP7 Programme, Pg 9.

¹⁷⁹ Renewing Health Assessment Methodology: www.renewinghealth.eu/assessment-method

¹⁸⁰ Mollenkopf, Heidrun; Ciharova, Katerina; Almedia, Nuno (2016). Consolidated Review Report – CAREWELL. European Commission, CIP Programme, Pg 3.

Healthy Ageing) should be mainstreamed across research and innovation projects in the future programmes. It was developed by IPTS in cooperation with DG CNECT and DG SANCO to assess the evolution and impact of the European Innovation Partnership on Active and Healthy Ageing (EIP on AHA) as well as the outcome and output of the Action Groups within the EIP on AHA.

It is a flexible tool that offers projects the opportunity to carry out a cost-effectiveness/Cost-utility analysis. It is the **only free tool currently available that can offer you a quantitative single result on a specific innovation to support decision making.** According to the MAFEIP website¹⁸¹, currently 14 case studies have been made on different solutions related to active and healthy ageing throughout Europe. Out of the top 41 projects included in the In-Depth Analysis, only one of the projects (BEYONDSILOS) has been used as a case study¹⁸². The MAFEIP tool is completely complimentary to the MAST framework. In fact, the parameters used in the MAFEIP tool can be extracted from MAST.

A more extensive use of the MAFEIP tool along with support tools in using it (webinars, easy to use guidance manuals) could be championed by the Commission, in order to promote the generation of more quantitative results regarding the cost-effectiveness of the innovative solutions that are being developed. This, in turn, would have a knock-on effect of the impact that these solutions can generate in the market as more credible evidence will be available as to the benefits of said solutions.

Furthermore, consortiums should be asked to express which frameworks will be used to evaluate the results that they generate. This should be specified from early on, even at proposal stage, and should be positively scored during the evaluation process. Examples of the practical use of the aforementioned methodologies should also be provided to help facilitate their implementation and appropriate use.

Recommendation 2: Increased consideration should be given to ethical and regulatory issues with proactive steps put into place to sufficiently address them

Related Lessons learnt: A lack of focus on ethical and regulatory issues can lead to serious problems in project execution

The failure to take into account the ethical and regulatory issues in the preparation and during the execution of a research and innovation project related to ICT for AHA can lead to delays and the need to take corrective

¹⁸¹ MAFEIP Website: www.mafeip.eu/

¹⁸²Support Services for the Management and Utilization of Monitoring and Assessment of the EIP - MAFEIP Tool BeyondSilos Badalona Serveis Assitencials (BSA).

actions (FARSEEING¹⁸³ and UNCAP¹⁸⁴) or even the suspension of a project (CAALYX MV¹⁸⁵).

Once again, **these issues should be addressed from early on in the project lifecycle with some considerations even mentioned during the proposal stage.** Some good examples of how ethical and regulatory issues can be addressed in a project can be seen in the CAREWELL project where medical coordination, ethics and data protection management issues have been specified in one document "**Data Protection framework**". Furthermore, in this project all relevant ethical and data safety issues were handled in the setup and operational stages of the project and no data breaches or safety issues were reported¹⁸⁶. STOP AND GO is another project where legal, ethical and regulatory issues were effectively handled across the four countries involved and the generation of the **Legal, Ethical and Regulatory (LER) handbook**¹⁸⁷.

The EWALL project also provided all the necessary ethical guidelines in order to protect the rights of the MCI participants in the final demos. Furthermore, the consortium provided a **24/7 helpline during the testing period, a Help Manual embedded in the GUI of the platform, and the presence of a psychologist during the initial training period**¹⁸⁸.

Ethical issues were also addressed through a specific **Ethics Board** in some projects (INCASA, IN LIFE, MARIO, RADIO) and were all considered to be projects where ethical issues were addressed properly based on the needs of the pilots.

Whilst current application templates for EU-funded programmes do require candidates to include information on how **ethical and regulatory issues** are going to be handled, **more precise planning and actions could be demanded from the initial proposal stage.** Sufficient actions should also be put in place during pilot trials to ensure that these issues are appropriately addressed.

With regards to regulatory issues, **consortiums should be expected to carry out a thorough analysis of the existing regulatory framework and specify how this will have an impact on the development of project results.**

¹⁸³ Meijer, Kenneth; Razavi, Reza; Stubbs, Richard (2015). Consolidated review Report – FARSEEING. European Commission, FP7, Pg 5.

¹⁸⁴ Walterova, Iva (2017). Consolidated review Report – UNCAP. European Commission, H2020 Programme, Pg 5.

¹⁸⁵ Klepfisch, Georges (2013). Consolidated review Report – CAALYX MV. European Commission, CIP Programme, Pg 2.

¹⁸⁶ Mollenkopf, Heidrun; Ciharova, Katerina; Almedia, Nuno (2016). Consolidated Review Report – CAREWELL. European Commission, CIP Programme, Pg 9.

¹⁸⁷ All Project Partners (2013). Overview Open Market Consultation – STOPANDGO. Project Consortium, Pg 3.

¹⁸⁸ Noll, Stefan; Stella, Eloisa; de Toledo, Stella (2016). Consolidated Review Report – EWALL. European Commission, FP7, Pg 7.

Recommendation 3: A more thorough and deeper analysis of the state of the art and market/competitors should be demanded of EU funded projects related to ICT for AHA at different stages of the project lifecycle

Related Lessons learnt: There is a general lack of extensive market, competitor and state of the art analysis prior to and during project execution

This study has highlighted a general lack of extensive market, competitor and state of the art analysis throughout the entire project cycle, from proposal preparation to project execution. Even though this is taken into account in current work programmes and forms part of the application forms for each of the three programmes, it seems that this is insufficient, and projects are often spending time and money catching up with the state of the art (MIRACULOUS-LIFE)¹⁸⁹ or missing opportunities due to a lack of awareness regarding competitor activities and market progress as a whole (LIFE 2.0¹⁹⁰, MOBOT¹⁹¹ and RAMCIP¹⁹²).

There are a number of **good practices from projects that have worked**, such as the ISUPPORT project which dedicated a work package to carrying out a systematic review of the current state of the art in soft robotic technologies which resulted in a design decision taken for the development of the actuation system. A “deep comparison study” was used to decide whether to design a motorised chair from scratch or redesign an existing product. While the preliminary design of a motorised chair equipped with 2 degrees of freedom was presented in the early stages of the project, a commercially available motorised chair from Pressalit was been deployed, which “demonstrates an appropriate balance between not reinventing the wheel and allowing the project focus on its clear contribution to the field”¹⁹³.

A further good example in this area was the PERSSILAA project that not only **addressed potential competitors in the market**, but also managed to **engage and incorporate external applications successfully**. These ranged from training modules (E.g. Guttman Neuro Personal Trainer) to monitoring modules (Fitbit and Withings Smart Scale).¹⁹⁴

¹⁸⁹ Sala Soriano, Pilar (2017). Consolidated Review Report – MIRACULOUS LIFE. European Commission, FP7 Programme, Pg 2.

¹⁹⁰ King, Geoff (2013). Consolidated Review Report – LIFE 2.0. European Commission, CIP Programme, Pg 3.

¹⁹¹ Van der Kooij, Hernan; Driankov, Dimiter; De Mauro, Alessandro (2016). Consolidated Review Report – MOBOT. European Commission, FP7 Programme, Pg4.

¹⁹² Amirabdollahian, Farshid (2017). Consolidated review Report – RAMCIP. European Commission, H2020 Programme, Pg 9.

¹⁹³ Razavi, Reza (2016). Consolidated Review Report – I-SUPPORT. European Commission, H2020 Programme, Pg 7.

¹⁹⁴ Sankelo, Merja; Pouillie, Roland; Serral Asensio, Estefanía (2016). Consolidated Review Report – PERSILAA. European Commission, FP7, Pg 2.

It is **essential that this problem is addressed at different stages of EU funded projects:**

Application process: **Future research and innovation programmes (post H2020) should continue to provide an initial insight into the current state of the art in the related field.** Furthermore, the section of the application form on current state of the art should be assigned the appropriate weighting in terms of the evaluation of the project proposals that are received. **A thorough analysis of the current state of the art should be carried out and clear examples of how the project will contribute to that state of the art should be highlighted.** Applicants should also be required to comment on existing solutions/services in the market that will be used to enhance their project and details should be provided on how the consortium will go about executing those collaborations / partnerships.

During the project execution: Project consortiums should be **constantly aware of what is happening in the market where they are operating, particularly in rapidly advancing environments such as robotics for ageing well.** "Market watch" boards or specific work packages could be assigned for this role and to ensure that the project solution/service that is being developed does not fall behind the market and takes advantage of all the possible opportunities that exist.

Recommendation 4: The user should be placed at the centre of the design process through the adoption of tried and tested methodologies and sufficient, well-documented iterative cycles

Related Lessons learnt: User requirements elicitation should be carried out early in the process and with regular iterative cycles / The importance of the design phase should not be underestimated

Although many of the research and innovation projects under study involved the development of a product or service, it became clear that users were often not placed at the centre of the design process and sometimes even considered later on in the project lifecycle. In some cases, this lack of engagement early on in the design process, and a lack of an effective user requirement elicitation process has led to flaws in the product or service design being detected late on in the project with little time to manoeuvre and set them back on track (ALFRED¹⁹⁵, HOBBIT¹⁹⁶ and BEYOND SILOS¹⁹⁷).

In some cases, even though user requirement elicitation was carried out, how these requirements led to design specifications was not sufficiently documented with no concrete process in place to implement the input from

¹⁹⁵ Hempel, Thomas; Moreno, Sofia; Sparpaglione, Massimo (2016). Consolidated Review Report – ALFRED. European Commission, FP7 Programme, Pg 16.

¹⁹⁶ Borgolte, Ulrich (2015). Consolidated Review Report – HOBBIT. European Commission, FP7 Programme, Pg 5.

¹⁹⁷ Buguña Hoffman, Laura; Leorin, Cristian; Klepfisch, Georges (2016). Consolidated Review report – BEYOND SILOS. European Commission, CIP Programme, Pg 3.

the users in the product or service (GROW ME UP¹⁹⁸). Furthermore, the need for additional iterative cycles in the design process was also highlighted with an indication that this would, in turn, allow for a more thorough analysis of user requirements and the development of a product or solution that is in line with the user's real-life needs (GIRAFF+¹⁹⁹).

In those projects which focus on the development of a product or service, **the user must be placed at the centre of the design process. The co-design and co-creation of solutions are extremely powerful tools to reduce resistance, increase engagement and ensure that the product or service is completely aligned with the real life needs of the user.** Specific examples of ways to do this include **multi-stakeholder workshops** or **working groups with users** where the creators work in direct contact with the users throughout the design process. A good example of this can be seen in the STOP AND GO project²⁰⁰.

A **"Design Thinking" approach could be strongly encouraged and evaluated positively.** This is due to its emphasis on an empathic understanding of the needs and requirements of the users and their environment as well as providing an iterative and incremental framework to carry out user-centred design and developments. A successful example of this approach being used can be seen in the ISUPPORT project where the first mock-up of the soft arm (made using silicone) resulted in it being considered as "disgusting, creepy or odd/uncommon". This was valuable feedback to help guide the remaining work throughout the project.²⁰¹

At the end of the design process, there are a number of tools that can be used to gauge additional user needs that may fall outside of the project scope but could provide food for thought for future developments or projects. An example of this can be seen in the GIRAFF+ plus project where **exit interviews were used at the end of the design process providing key insights** such as the desire for more mobile-based options (phone/tablet). This example feedback was later incorporated into the design providing added value to the solutions.

Finally, for any of the tools or approaches that are used, **detailed documentation should be kept for each iterative cycle with clear mapping of the subsequent changes/modifications to the design process.** Not only will this help the consortium to understand the evolution of their product or service, but it will also ensure that all user requirements are taken into account and, if something is not possible, alternative solutions area adopted.

¹⁹⁸ Bulgheronia, Maria (2017). Consolidated Review Report – GROW ME UP. European Commission, H2020 Programme, Pg 4.

¹⁹⁹ Duffy, Brian; Preucil, Libor; Webb, Philip (2015). Consolidated Review Report – GIRAFF+. European Commission, FP7 Programme, Pg 6.

²⁰⁰ All Project Partners (2013). Overview Open Market Consultation – STOPANDGO. Project Consortium, Pg 48.

²⁰¹ Razavi, Reza (2016). Consolidated Review Report – I-SUPPORT. European Commission, H2020 Programme, Pg 7.

Recommendation 5: Introduction of user recruitment practices to effectively engage, convince and maintain users in trials

Related Lessons learnt: The reasons behind insufficient user involvement need to be addressed and taken into consideration in future projects

A distinct lack of user involvement was highlighted in various projects, something that was particularly common amongst those projects that did not make the Top 25 Most influential Projects (See Annex II). For some projects, they simply had too strong a focus on RTD, and were unable to fulfil user objectives (ALFRED²⁰², CONFIDENCE²⁰³ and DALI²⁰⁴). Difficulties in recruiting users for the trials was also one of the motives for poor user involvement in certain projects (COMPANIONABLE²⁰⁵, INDEPENDENT, ISISEMD, DOREMI²⁰⁶, EWALL and SOCIABLE²⁰⁷). The different types of testing environments also played a role in creating difficulties regarding shortages of users. For example, a shortage of users for home environments (LONG LASTING MEMORIES, CONFIDENCE and VM) and a shortage of users for trials in nursing homes (DEM@CARE²⁰⁸).

Future research and innovation projects should **base the planning and execution of their user trials on best practice examples from earlier EU-funded projects**. For example, the I-DON'T-FALL project is considered to be a best practice example in recruiting and maintaining elderly people in trials under EU funded projects. On the project website, information is publicly available with regards to the project's [Pilot Cases, Use Cases and KPIs](#), [End User selection and Initial Tailoring of Services](#) and [Detailed Pilot Operations Plan](#).

There have also been a number of other best practices identified in the more successful projects such as the active involvement of primary target users with Chronic Obstructive Pulmonary Disease (COPD) and Mild cognitive Impairment (MCI), their relatives and professional carers in the BEYOND SILOS project. Some of the partners involved local associations of seniors in organised workshops with the objective of recruiting participants for the final demos.

²⁰² Hempel, Thomas; Moreno, Sofia; Sparpaglione, Massimo (2016). Consolidated Review Report – ALFRED. European Commission, FP7 Programme, Pg 5.

²⁰³ Pouillie, Roland (2011). Consolidated Review Report – CONFIDENCE. European Commission, FP7, Pg 19.

²⁰⁴ Hallenborg, Kasper (2014). Consolidated Review Report – DALI. European Commission, FP7, Pg 4.

²⁰⁵ Avramov, Dragana; Katevas, Nikos; Keijer, Ulf; Pons, José Luis; Vernooij-Dassen, Myrra (2012). Consolidated Review Report – COMPANIONABLE. European Commission, FP7 Programme, Pg 12.

²⁰⁶ Logtens, Hans; Lofti, Ahmad; Schmitt, Sophie (2016). Consolidated Review report – DOREMI. European Commission, FP7, Pg 4.

²⁰⁷ Avramov, Dragana (2012). Consolidated Review Report – SOCIABLE. European Commission, CIP Programme, Pg 17.

²⁰⁸ Konstantinos, Perakis (2015). Consolidated Review Report – DEM@CARE. European Commission, FP7 Programme, Pg 3.

The GIRAFF+ project created a User Forum, which was a constructive discussion forum with secondary and potential tertiary users that discussed the advantages of the system including cost-benefit, autonomy, social communication with remote family and urgent incident management²⁰⁹. It was good example of how to involve and maintain users in pilot trials.

An additional **way to increase the number of users involved in the trials can be seen in the SOCIABLE project whereby so-called “Butterfly Users” were incorporated**. These were interested elderly users using the platform in an informal way without adhering to the SOCIABLE clinical trial protocol, thus making them easier to recruit. Quite appropriately their feedback was not used for the clinical evaluation, but it did provide valuable insights as part of a broader stakeholders’ evaluation²¹⁰.

User recruitment activities should begin as early in the project as possible due to the, often underestimated, amount of time that it can take to engage, convince and maintain users in the trial activities. Additional participants should also be recruited to try and counter balance the dropout rate during the trial period.

Recommendation 6: Inclusion of counter-measures from early on in the project to help improve the digital skills of potential users for the pilot trials

Related Lessons learnt: User testing is not homogeneous across countries, adaptations need to be made

The importance of involving users in real life testing and placing them at the centre of the design process has been emphasised in previous recommendations. However, **when consortiums are working across different countries, the needs and capabilities of these users can differ a great deal**. For example, strong differences in the level of ICT skills between testing environments have led to the need for trial activities and evaluations to be adapted accordingly (PERSSILAA²¹¹) or additional training activities had to be included (INCA²¹²) leading to obvious delays in the user testing itself.

These **differences should be taken into account from the start of the project with a plan in place for those users who have low or no digital literacy**. Future projects could include **workshops to work with these users in the trail plan**, therefore accounting for these possible delays and leading to a more streamlined user trial period. Future projects should also **take advantage of various freeware apps that exist on the**

²⁰⁹ Duffy, Brian; Preucil, Libor; Webb, Philip (2015). Consolidated Review Report – GIRAFF+. European Commission, FP7 Programme, Pg 6.

²¹⁰ Avramov, Dragana (2012). Consolidated Review Report – SOCIABLE. European Commission, CIP Programme, Pg 8.

²¹¹ Sankelo, Merja; Pouillie, Roland; Serral Asensio, Estefanía (2016). Consolidated Review Report – PERSILAA. European Commission, FP7, Pg 10.

²¹² Leorin, Cristian (2016). Consolidated Review Report – INCA. European Commission, CIP Programme, Pg 13.

market and that can be used to help improve digital literacy. An example of this can be seen in the EWALL project, where two freeware apps were used (UISEL Game and Finger Touchscreen Training) to help the elderly users become accustomed to the navigation on a touch screen and to improve their dexterity²¹³.

Recommendation 7: Take into account alternative ways of exploiting project outcomes and results

Related Lessons learnt: Collaboration agreements with industrial players should be actively sought in order to enhance expansion into the market

Whilst it is important that collaboration agreements are sought both internally (amongst the project consortium) and externally (with key industrial players), EU-funded research and innovation projects could be encouraged to take things a step further regarding the active commercialisation of project results. For example, four of the top 25 most influential projects under study generated or collaborated with startups/spin-offs. An example of this can be seen in the EWALL project where the startup "Innovation Solution Sprl", involving some external stakeholders together with some of the key researchers from the consortium, led the commercialisation of the EWALL platform. **The adoption of the project results by a startup was considered to be a "good measure to maximise the project's impact".**²¹⁴

In the FARSEEING project, a spin-off company from the University of Bologna was founded to act as an "external exploiter" of the project results after having established exploitation agreements with the owners of the product. The company "mHealth Technologies srl" has been operating since July 2014 and is **an example of the direct creation of a company as a result of an EU funded research and innovation project.**²¹⁵

A similar situation occurred in the ROBOT-ERA project which generated the establishment of the startup "Co-Robotics srl." which will commercialise the developed solution. Finally, in the PERSILAA project, the main exploitation of the results in the ENSCHEDE region will be produced by the Dutch spin-off project www.Langgezond.nl.

The development of startups and spin-off projects to exploit and commercialise the results and outcomes of EU funded projects could be actively promoted by the Commission. Consortia applying for EU funding in future research and innovation programmes could be asked exactly how they are going to exploit the project results. Having a simple agreement in place (SMILING project²¹⁶) is often simply not enough.

²¹³ Noll, Stefan; Stella, Eloisa; de Toledo, Stella (2016). Consolidated Review Report – EWALL. European Commission, FP7, Pg 16.

²¹⁴ Noll, Stefan; Stella, Eloisa; de Toledo, Stella (2016). Consolidated Review Report – EWALL. European Commission, FP7, Pg 24.

²¹⁵ Meijer, Kenneth; Razavi, Reza; Stubbs, Richard (2015). Consolidated review Report – FARSEEING. European Commission, FP7, Pg 2.

²¹⁶ Duysens, Jacques; Katevas, Nikos, Pouillie, Roland (2011). Consolidated review report – SMILING. European Commission, FP7 Programme, Pg 3.

Recommendation 8: The uptake of project management methodologies/tools can increase project efficiency

Related Lessons learnt: Effective risk management strategies need to be implemented to ensure the smooth execution of the project/Project objectives should be realistic and attainable

Introducing effective risk management strategies and a good definition of a project's objectives can minimise the risk of problems occurring during project execution. However, sometimes delays can occur for unforeseen circumstances and **it is important that project consortiums are well versed in appropriate project management tools and methodologies** to be able to deal with these delays/problems and get back on track so as not to jeopardise the project as a whole.

An example of this can be seen in the DEM@CARE project which experienced significant delays in project execution during the second and third year of the project. In order to respond to these delays, increase efficiency and get the project back on track, the consortium adopted the **Sprint development methodology**. By using this approach, the project managed to deliver a robust integrated version of the prototype on time, which was later used in the pilot trials and evaluations. In the BEYOND SILOS project, the consortium benefitted from the implementation of the **LIAR tool to assess barriers of change at site level and learn how to overcome them**, helping to enhance mutual learning. The consortium of the CAREWELL project adopted **a web based tool (RAIL - Risks, Actions, Issues, Lessons learnt)** to support monitoring and coordination of activities amongst pilot sites. This tool helped to dynamically register all activities that were carried out by pilot sites in the deployment of the pilot operations. All pilot sites had access to the tool and could upload information.

A list of tried and tested project management methodologies could be provided in the information provided to the project coordinators. This could also be reiterated during the initial training received by the project coordinators in some funding programmes. It should then be up to the project consortium as to which tool/methodology they wish to use and when.

Recommendation 9: Use of organisational structures/processes to identify and engage with key stakeholders related to the theme of the project at hand

Related Lessons learnt: Need to involve additional external stakeholders in project activities

Whilst the project involved in this study were often extremely focussed on the research and technological development objectives at hand, on numerous occasions it was highlighted that they failed to sufficiently involve external stakeholders including investors, policy makers, national public health organisations, formal patient groups, healthcare professionals and

industry representatives (DEM@CARE²¹⁷, EWALL²¹⁸, GUIDE, ISTOPFALLS²¹⁹, KSERA²²⁰ and BEYOND SILOS²²¹)

In order to promote the contact with external stakeholders, **External Advisory Boards could be promoted and encouraged in EU funded Research and Innovation Projects**. Examples of the successful use of these External Advisory Boards can be seen in the ALFRED project where this body has a strong focus on the creation of a Startup to help commercialise overall project results²²². The FARSEEING project also set up and External Advisory Board with more of a focus on future dissemination and exploitation issues²²³.

In some cases, the Advisory Board was industry specific. For example, in the ACCOMPANY project, an Industrial Advisory Board was set up for the entire project duration helping to enrich the economic model and project exploitation plan²²⁴.

By doing this, it provides the project with a **formal structure through which to involve the key stakeholders related to the field in which the project is begin carried out**. Whilst the focus of the advisory boards may be different from project to project, the consortium is guaranteed an external point of view through which to see how well the project is progressing, which can help to reduce risks and identify opportunities in the market to exploit project results.

Recommendation 10: A greater emphasis should be given to expand the participation in EU-funded Research and Innovation programmes related to ICT for Active and Healthy Ageing

Related Lessons Learnt: Information from the section Overview of the impact of key EU research and innovation projects – Impact on a Geographical level

It is clear from the analysis of the statistics regarding the participation of different Member States in the Research and Innovation projects related to

²¹⁷ Konstantinos, Perakis (2015). Consolidated Review Report – DEM@CARE. European Commission, FP7 Programme, Pg 16.

²¹⁸ Noll, Stefan; Stella, Eloisa; de Toledo, Stella (2016). Consolidated Review Report – EWALL. European Commission, FP7, Pg 5.

²¹⁹ Skiczuk, Peter (2015). Consolidated Review Report – ISTOPFALLS. European Commission, FP7 Programme, Pg 12.

²²⁰ Katevas, Nikos; Noll Stefan; Schmitt, Sophie (2013). Consolidated Review report – KSERA. European Commission, FP7, Pg 3.

²²¹ Buguña Hoffman, Laura; Leorin, Cristian; Klepfisch, Georges (2016). Consolidated Review report – BEYOND SILOS. European Commission, CIP Programme, Pg 3.

²²² Hempel, Thomas; Moreno, Sofia; Sparpaglione, Massimo (2016). Consolidated Review Report – ALFRED. European Commission, FP7 Programme, Pg 6.

²²³ Meijer, Kenneth; Razavi, Reza; Stubbs, Richard (2015). Consolidated review Report – FARSEEING. European Commission, FP7, Pg 5.

²²⁴ Almansa, Ana; Crowley, James L.; Almeida, Nuno Luis (2014). Consolidated Review Report – ACCOMPANY Project. European Commission, FP7 Programme, Pg 14.

active and healthy ageing that there is **underrepresentation from both the Nordic countries, and even more so from the Eastern European Member States.**

Whilst the success of project proposals depends on their quality and adherence to the objectives stated in the Work Programmes, **more promotional activities could be carried out in these geographic areas in order to enhance awareness about the EU funding programmes available in this area.** More **workshops, infodays or direct contact could be established with the national research and innovation communities** in order to generate interest and participation in these funding opportunities.

Due to the low rate of project coordinators from these countries, in addition to awareness activities regarding the programmes, a series **of training activities could also be launched to help empower organisations from these areas to assume project coordinator roles** in potential project proposals.

Lessons could be learnt from those Member States where there is an influx of organisations participating in the funding programmes (Spain, Italy, Greece, Germany, the United Kingdom). Insights can be gained as to how their network of National Contact Points (NCPs) work and how other promotional and training activities are carried out.

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