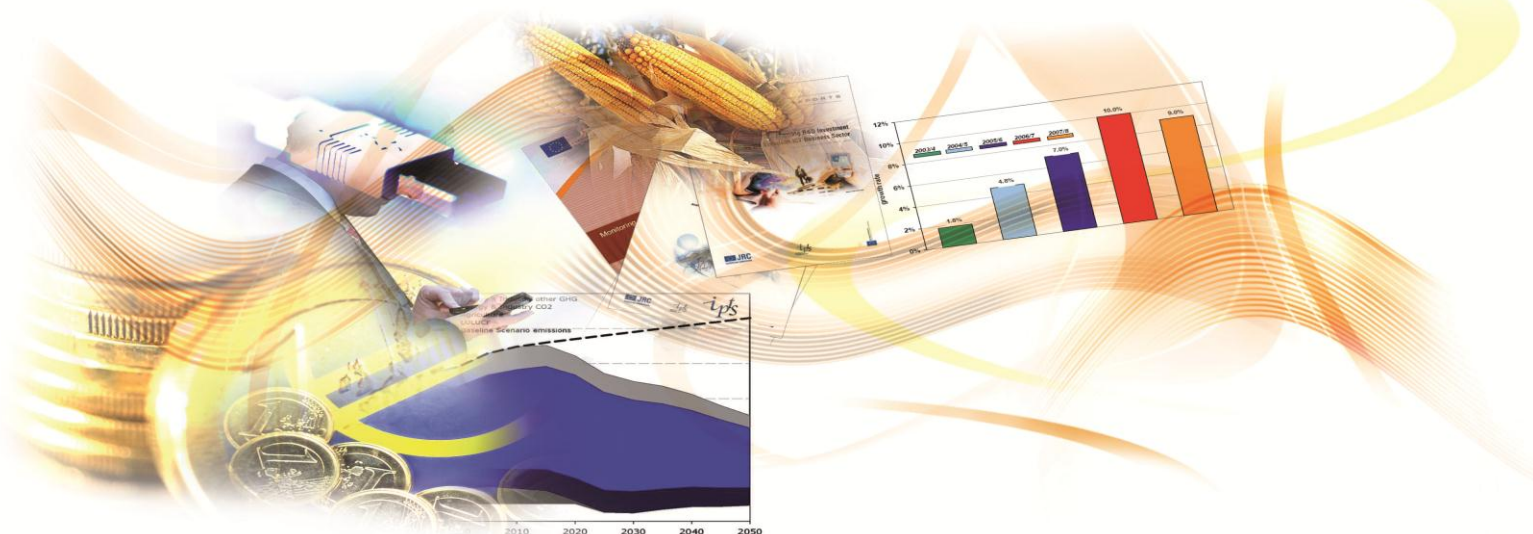# JRC SCIENCE AND POLICY REPORTS

Technology-enabled Services for Older People Living at Home Independently:

Lessons for public long-term care authorities in the EU Member States

Dr Stephanie Carretero

2015

Abstract

This report presents six policy lessons that could help public authorities at all levels of the EU Member States for use new technologies in long-term care service provision for older people. These policy lessons have come out of the ICT-AGE research project carried out by the JRC-IPTS and funded by DG EMPL, based on the cross-analysis of good practices in technology-enabled services to help older people live independently at home.

These lessons could help public long-term care authorities to modernise their social protection systems in the field of long-term care, ensuring effectiveness, adequacy and sustainability. They could enable the Member States to carry out the actions and recommendations set out in the 2013 European Commission policy on Social Investment for Growth and Cohesion (SIP) and to implement the country-specific recommendations of the European Semester.

The report also describes the different existing instruments offered by the European Union, which could help public authorities to implement these policy lessons.

Acknowledgements

---

[1] A list of experts who attended the Workshops is available at the following web page: http://is.jrc.ec.europa.eu/pages/EAP/eInclusion/carers_ICTAGE.html

Preface

This report puts forward a set of policy lessons for the Member States. These will enable them to implement long-term care policy strategies using technology-enabled services to help older adults to live at home independently. The policy lessons have been obtained by identifying and mapping good practices of these services and analysing the business models and cases, and organisation and integration models, etc. of selected cases.

This is the third deliverable of the research project "Long-term care strategies to help older people to live independently (**ICT-AGE**)". The Directorate General of Employment, Social Affairs and Inclusion (DG EMPL) commissioned the Joint Research Centre (JRC) to do this study through an Administrative Arrangement[2] (AA). The work is being carried out by the 'ICT for Employability and Inclusion' team of the Information Society Unit at the Institute for Prospective Technological Studies (IPTS).[3] The project started in May 2013 and was completed in December 2014.

ICT-AGE aims to help DG EMPL support the Member States (MS) in the development of long-term care strategies which promote the use of technology-enabled services for older people living independently at home. These solutions refer to all kinds of technology, including Information and Communication Technologies (ICT), that empower older adults to manage by themselves despite their frailties and with quality of life. They also improve the organisation of care provision and increase the productivity and quality of long-term care delivery.

The ICT-AGE project is one of the actions of the 2013 European Commission policy on Social Investment for Growth and Cohesion - Social Investment Package (or SIP) - (2013a,b). This policy aims to help the Member States to implement the country-specific recommendations of the European Semester for more effective and efficient long-term care policies.

The lessons learned in this project will help the Member States to implement technology-enabled services for independent living, and to achieve the objectives of the SIP and the country-specific recommendations for long-term care.

Previous reports and **more information on the project** can be found at:
http://is.jrc.ec.europa.eu/pages/EAP/eInclusion/carers_ICTAGE.html

This report may be referenced as follows: Carretero, S. (2015). 'Technology-enabled services for older people living at home independently: Lessons for public long-term care authorities in the EU Member States'. Seville, Joint Research Centre, Institute for Prospective Technological Studies, JRC Scientific and Technical Reports Series.

---

[2]   JRC Nº 33156-2013-05 EMPL D.3.
[3]   IPTS is one of 7 research institutes that form the European Commission's Joint Research Centre.

Table of Contents

Executive Summary

This report contains **six policy lessons that can support public authorities of the EU Member States at all levels in their efforts to implement and use of new technologies in long-term care service provision for older people.** These lessons will **help public long-term care authorities to modernise their social protection systems in long-term care, ensuring effectiveness, adequacy and sustainability.** They will enable the Member States to carry out the actions and recommendations set out in the 2013 European Commission policy on **Social Investment for Growth and Cohesion (SIP)** and to implement the **country-specific recommendations** of the European Semester.

These **policy lessons have been obtained by the ICT-AGE research project** which was carried out during 2013 and 2014 by the JRC-IPTS for DG EMPL. This project focused on the analysis of **good practices of technology-enabled services to help older people live independently at home**. These services **aimed to achieve the policy objectives of the SIP** regarding independent living, carer productivity, quality of care and sustainability of care systems. The benefits of these policies have been acknowledged by the scientific literature, and are highlighted in the research on which this report is based.

These policy lessons emerged from the cross-analysis of the following four good practices, which were implemented by different levels of government in their public long-term care systems. They were obtained from a sample of fourteen good practices of technology-enabled services for older people in the first step of the project:

- Advanced Telecare, a home automation system coupled with telecare, implemented in the Limousin Region in France
- TELBIL, a telemonitoring service for chronic conditions implemented in the primary care centres of Bilbao in the Basque Region in Spain
- Action, a technology-based home care service implemented mostly in the municipality of Borås in Sweden
- TDP, a telecare service launched by the Scottish Region (UK)

For each good practice, the business case and model, scaling-up, technology and interoperability, impact evaluation, and service integration, were analysed. We also looked at the role policy could play in their wider implementation. The policy lessons extracted from this analysis were discussed with stakeholders and an advisory group of experts in the field.

We believe that the **following six lessons on how to implement services that use new technologies could be useful for public authorities in their provision of long-term care for older people**:

1. *Establish a policy framework* to support the creation and implementation of these services in public long-term care systems, with policies and funding.
2. *Build a sustainable business model* able to generate social and economic returns, and make the service affordable and accessible to the users. The evaluation of impacts and building partnerships between public and private organisations are relevant for this sustainability.
3. Engage all the stakeholders – care providers, the older people and their carers, technical providers, researcher centres, professionals, localities and policy-makers – to build confidence and trust.
4. *Use a well-established entry point for the new service.*

5. _Share experiences_ of design and implementation of the services with other localities, regions and countries through exchanges, cooperation, and participation in development and innovation projects.
6. _Be alert to issues of interoperability._

The European Union can help the public authorities concerned to implement these policy lessons with **the following existing instruments** by:

- Disseminating the policy lessons among different organisations and committees, and conferences
- Facilitating mutual learning among Member States through the exchange of good practices. Several EU programmes such as the European Innovation Partnership on Active and Healthy Ageing already exist.
- Using policy frameworks and initiatives developed by the European Commission to implement the services, such as the Social Investment Package for Growth and Cohesion
- Funding the creation, design and implementation of these services, through initiatives such as Horizon 2020, the Active Assisted Living Research and Development Programme, or the European Structural and Investment Funds.

1. Purpose and scope of the policy lessons

This report contains a set of **policy lessons which could benefit the Member States' public long-term care authorities at all levels of the Member States. Their national ministries of health, social affairs and long-term care** are represented in the Social Protection Committee Working Group on Ageing (SPC-WG-AGE).

The **aim** of these policy lessons is **to help the Member States modernise their social protection systems for long-term care,**[4] **ensuring effectiveness, adequacy and sustainability**. These lessons will enable the Member States to carry out the actions and recommendations set out in the 2013 European Commission policy on Social Investment for Growth and Cohesion and to implement the country-specific recommendations of the European Semester.

The lessons focus on modernising European public long-term care systems. They show how social investment[5] in technologies can help older people to lead independent lives at home. These technologies can also achieve greater efficiency in long-term care services. In fact, the SPC-WG-AGE working group and DG EMPL already acknowledge the existence of innovative and proactive approaches of this kind in several Member States. These approaches have shown that technologies can achieve the objectives of independent living and greater efficiency. However, more solid knowledge is needed about how they could be successfully implemented, and which business models are working (Social Protection Committee and European Commission, 2014).

In order to find out what makes the use of technology-enabled services successful in helping older people to live independently at home, we studied good practices implemented by different levels of government in public long-term care systems. On the basis of this study, we developed the policy lessons described in this report. This study was part of ICT-AGE research project ("Long-term care strategies for independent living of older people"), carried out during 2013 and 2014 by the JRC-IPTS and commissioned and funded by DG EMPL.

---

[4] Long-term care for older people refers to a range of services and assistance for people who depend, over an extended period of time, on help with the basic activities and/or instrumental activities of daily living. Measures to help prevent, postpone or mitigate the onset of long-term care needs are included (Social Protection Committee and European Commission, 2014).

[5] Social Investment: the provision and use of finance to generate social as well as economic returns, aim at addressing emerging social risks and unmet needs, and focus on public policies and human capital investment strategies that help and prepare individuals, families and societies to adopt to various transformations, manage their transition towards changing labour markets and face other challenges, including for example the acquisition of new skills for future job rich sectors (European Parliament, 2012)

2. How the policy lessons were developed

These policy lessons resulted from the ICT-AGE project and were obtained by identifying and cross-analysing examples of the successful use of technology-enabled services to help older people live independently. These examples of good practice had been implemented by different levels of governments in their public long-term care systems.

The following methodology was used:

1. We identified and mapped good practices in technology-enabled services that help older adults with different needs to live independently at home. We defined good practices as those technology-enabled public or private services that had shown scientific evidence of effectiveness in one or more of the four policy objectives for long-term care in the Social Investment Package. Fourteen initiatives were identified as good practices in Europe, the United States and Japan, according to the criteria defined for the research. More details on methodology and results are available in the report: *Carretero, S. (2015). Mapping of effective technology-based services for independent living for older people at home. Seville: Joint Research Centre, Institute for Prospective Technological Studies, JRC Scientific and Technical Reports Series.*[6]

2. We carried out case studies of four of these fourteen good practices. We collected information based on variables related to the implementation of the services. The variables were obtained following a bespoke template. We collected the data from a literature review and interviews with promoters. More information on the selection criteria for the four good practices, the variables and the template and also the results of the case studies are available at: *Carretero, S. and Kucsera, C. (2015). Report on case studies of the technologies for independent living for older people. Sevilla: Joint Research Centre, Institute for Prospective Technological Studies, JRC Scientific and Technical Reports Series.*

3. We discussed the shape and direction of policy lessons learned with independent experts in the project's first stakeholder consultation workshop.[7.]

4. We carried out a cross analysis of the four individual cases of good practice following a variable-oriented strategy (Miles and Huberman, 1994). The variables were identified after discussion between the research team and DG EMPL of the European Commission (see Annex 1 for the template and Annex 2 for the results of the cross-analysis).

5. Two draft versions of the policy lessons produced were revised in October and November 2014 by an Advisory Board with the following members:

   • Geja Langerveld – Dutch national management of the Ambient Assisted Living Joint Programme (AAL JP) at ZonMw, the Netherlands.

   • Maude Luherne – AGE Platform Europe, Belgium.

   • Stefan Lundberg – The Royal Institute of Technology (KTH), Sweden.

   • Sue Yeandle – Centre for International Research on Care, Labour and Equalities (CIRCLE) of the University of Leeds, UK.

6. The policy lessons were also discussed and validated in a second stakeholder validation workshop held in Brussels on 3 – 4 November 2014 (see footnote 6 for online access to the agenda and the participants) and a meeting of the Advisory Board on the following day.

---

[6] http://publications.jrc.ec.europa.eu/repository/handle/JRC91622

[7] A list of experts of the Stakeholders Consultation Workshop is available at the following web page: http://is.jrc.ec.europa.eu/pages/EAP/eInclusion/carers_ICTAGE.html

3. What are technology-enabled services that help older adults live independently?

Previous work at the Institute for Prospective Technological Studies (JRC-IPTS) identified *technologies for independent living services as those technologies which aim to prolong the time old people can live decently in their own homes by increasing their autonomy and self-confidence, and enabling them to live and participate actively in society* (Dries et al., 2006; Cabrera and Özcivelek, 2009). The role played by technologies in assisting older people to live independently at home is increasing in many European countries. Today, technology-enabled services for independent living are provided via different devices and applications. Descriptions of the different types can be found in the literature (Dries et al., 2006; Malanowski et al., 2008; Gassner and Conrad, 2010; Lewin et al., 2010; SCAN Foundation, 2010; Billings et al., 2013). We have classified them as follows (Carretero, 2014):

- **Generic information and communication technology (ICT) products, services and applications**. These are generic because they are ICT products, services and applications available on the market and developed for everybody. However, they also help older adults to continue living independently at home. They consist mainly of communication devices, such as mobile phones, tablets and applications on the Internet. Older people can use them to participate remotely, for example, in social, working, learning or leisure activities. These devices can open up many opportunities for people with restricted mobility: for example, to contact distant family or kin and to maintain friendship networks. Older people can obtain information, advice and educational content, participate in cultural and political life, and benefit from improved technical arrangements to help them stay in work. They can also access services which support everyday life, such as banking or shopping. For example:
  - Teleworking services help people to work from home for an employer, a voluntary organisation or for themselves.
  - Information and training platforms train them and provide information and material for education.
  - Social networking technologies can support the creation of social networks and build communities of interest that help older adults communicate, organize, and share with other older adults and their care providers. These technologies include platforms from which meetings can be organised on the Internet or in real life, and can help older people with their leisure activities and social lives. Examples are chat, talent exchange, flea markets, search for former friends, partner search forums, Internet communities, and computer assistance (Empirica, 2005).
  - Online services on the Internet such as those offering shopping or banking.
- **Assistive technologies** refer to devices and equipment that compensate for sensory, physical/mobility, and cognitive impairments. They include voice recognition software, text telephones, accessible keyboards, speech recognition software (Pew and Van Hemel, 2004), intelligent electric magnifiers and reading lenses, other devices which help the user to drive a car or to participate in sports (Gassner and Conrad, 2010), and memory aids on smart phones or tablets.

  These technologies also include robots, which help older people with physical disabilities to carry out daily life activities or to recover or maintain some capacity. These robots can be prosthetics that replace lost or damaged parts of the body; mobility aids i.e. non-prosthetic technology which replaces or extends the functionality of a leg or an arm; robots for individual training, exercise and rehabilitation; and robots that carry out logistical and cleaning tasks, and can also be used for personal care (Hansen, 2011).
- **Smart homes** refer to houses in which different technologies have been integrated, to help, for example, older people to perform everyday life activities independently. They include remote-
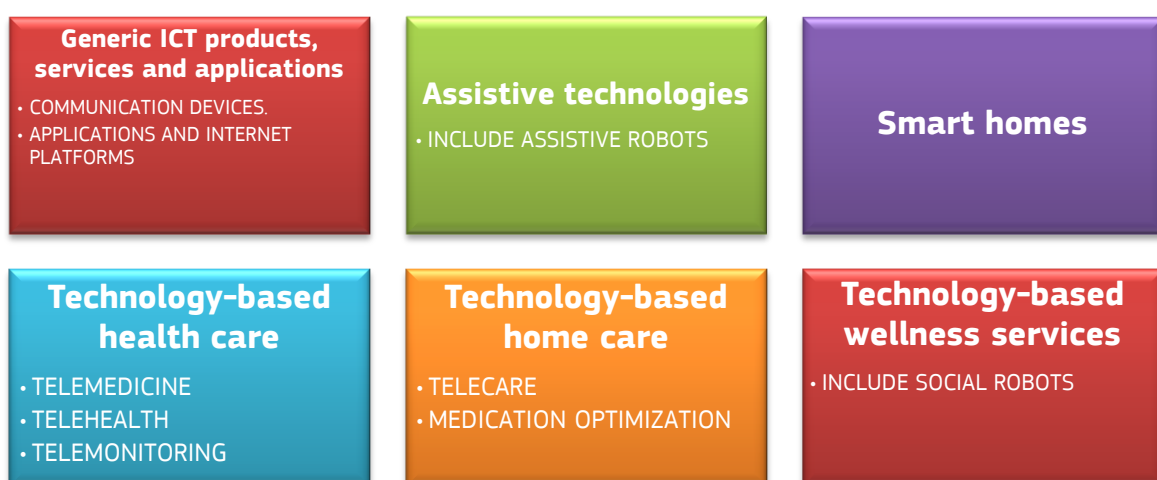
controlled home automation systems, which have various sensors for doors and gates; microwaves or normal stoves; security devices; lighting; and on/off switches for various appliances and home entertainment (Allen et al., 1995). Lighting and heating systems may be controlled, for example. They can also include access to generic ICT applications such as online services offering tele-shopping or tele-banking (Gassner and Conrad, 2010). Smart homes are fitted with sensors, actuators, controllers, a central unit, networks and an interface (Laberg et al., 2005). The ICT components are programmed to react and communicate with each other through a local network, and with their surroundings via the Internet, ordinary fixed telephones, mobile phones or tablets. The technology can be used to monitor, send alerts and carry out functions according to specified criteria.

- **Technology-based healthcare**. Healthcare technologies can help prevent, detect early, cure, and manage chronic conditions:
  - *Telemedicine* is defined by the WHO as "the delivery of healthcare services, where distance is a critical factor, by all healthcare professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of healthcare providers, all in the interests of advancing the health of individuals and their communities" (WHO, 1998). Telemedicine involves secure transmission of medical data and information, such as biological/physiological measurements, alerts, images, audio, video, or any other type of data needed for prevention, diagnosis, treatment and follow-up monitoring of patients (European Commission, 2009).
  - *Telehealth* or disease management applications deliver services from a healthcare provider to a citizen, from one health professional to another, or between citizens and family members (Stroetman et al., 2011). Telemedicine and telehealth are similar and in many documents appear as the same concept, but the former refers to services delivered by physicians only, and the latter to services provided by health professionals in general, including nurses, pharmacists, and others (WHO, 2009). In this framework of long-term care needs, home telehealth refers to a range of support, typically including not just clinical (medical) monitoring and intervention, but also a broader range of homecare support that more traditionally falls within the scope of social/homecare services (Empirica, WRC and European Commission, 2010).
  - *Telemonitoring or remote patient monitoring* is the remote exchange of physiological data between a patient at home and healthcare professionals at a hospital to assist in diagnosis and monitoring. Some technologies remotely manage and monitor a range of health conditions, and collect/send information about vital signs to a monitoring centre for interpretation. A home unit measures and monitors temperature, blood pressure and other vital signs for clinical review at a remote location (e.g., a hospital) using phone lines or wireless technology (COCIR, 2011). Point-of-care (e.g., home) monitoring devices, such as scales, glucometers, and blood pressure monitors, may be used individually to collect and report health data, or they may be part of a fully integrated health data collection, analysis, and reporting system that communicates to multiple nodes of the health system and provides alerts when health conditions decline (SCAN Foundation, 2010).

- **Technology-based home care** refers to the use of ICTs to monitor well-being and to provide a secure home environment. They include:
  - *Telecare:* this refers to the provision of social care from a distance using telecommunications (Empirica and WRC, 2010). Three generations of telecare have been identified (Empirica and WRC, 2010):
    - First-generation telecare consists of social/emergency alarms which use a telephone unit and a pendant with a button that can be pressed when help is required by the users. When the users press the button, the monitoring centre system receives the call and identifies the callers and their address. An initial

diagnosis of the nature and urgency of the need can be explored by voice link. Nominated response personnel (informal or formal carers) are then alerted as required by the situation, following an established protocol.

- Second-generation telecare adds a 'passive' or automatic alarm dimension (no need for the older person to actively trigger the alarm) enabled by the installation of sensors such as smoke, fire and flood detectors, among others, in the older person's home. When activated, these trigger an alert to the call centre and initiate the necessary response.

- Third-generation telecare collects everyday activity data automatically through various sensors such as front door open/closed detectors, fridge open/closed detectors, pressure mats, bed/chair occupancy sensors and electrical usage sensors. The data produced is available to care personnel or family carers to monitor the wellbeing of the older people and to assess their needs for help and support.

- *Medication Optimization* refers to a wide variety of technologies designed to help manage medication information, dispensing, adherence, and tracking. Technologies range from fully-integrated devices that use ICTs to inform and remind stakeholders at multiple decision and action points throughout the patient care process to simpler, stand-alone devices with more limited functionality.

- **Technology-based wellness services** deliver services for healthier lifestyles to older people at home. They include mainly cognitive and physical fitness and assessment technologies, such as thinking and cognitively challenging games to maintain or improve cognitive health. Many cognitive fitness technologies are computer- or Internet-based, and they include an assessment and tracking component. They can also include social robots whose tasks is to maintain some form of interaction (Fong et al., 2003), and to engage older adults in natural social exchanges (Breazeal, 2000). They give a sense of social presence in an interaction and the capacity for touch and physical interaction (Kidd and Breazeal, 2005).

Figure 1 classifies technology-enabled services that help older people to live at home independently.

Figure 1: Classification of technology-enabled services to help older people live at home independently

Generic ICT products, services and applications
- COMMUNICATION DEVICES.
- APPLICATIONS AND INTERNET PLATFORMS

Assistive technologies
- INCLUDE ASSISTIVE ROBOTS

Smart homes

Technology-based health care
- TELEMEDICINE
- TELEHEALTH
- TELEMONITORING

Technology-based home care
- TELECARE
- MEDICATION OPTIMIZATION

Technology-based wellness services
- INCLUDE SOCIAL ROBOTS

4. The benefits of technology-enabled services for older people

There is growing evidence of the value of technologies such as telecare, telemedicine and telehealth, to support older people with both physical and mental long-term conditions, and relieve carers, and their use is becoming more widespread (Carretero et al., 2012a; Billings et al., 2013; Carretero et al, in press). Reviews and studies are emerging that reveal that these technology-enabled services can:

- Improve the quality of life of older people and their carers, reducing social isolation, increasing perceived health status and security, and allowing carers to balance care and work (Carretero et al, 2012, in press)
- Reduce hospital admissions, patients' length of stay in hospital (Benatar el al., 2003; Cleland et al., 2005; Dar et al., 2009; Polisena et al., 2010; AKTIVE consortium, 2013), the non-attendance rates of patients at consultations and the number of trips to the care centre (Hasvold and Wootton, 2011; Wootton et al., 2011).
- Benefit the broader sustainability of social and health systems and the effective use of resources, through the reductions described above. There is reliable evidence that some technology-enabled services for older people at home do in fact improve the delivery and efficiency of health and social care systems and can be taken as examples of good practice for long-term care policies among Member States (Carretero et al., 2012a; Billings et al., 2013).

In the first deliverable of the ICT-AGE project (Carretero et al., 2014), the **literature review revealed** a total of 14 good practices in technology-enabled services that help older adults to live at home independently.   An analysis of these good practices in relation with the four policy objectives of the SIP (independence, carers' productivity, quality of care, and cost-efficiency) revealed that these services improve long-term care in the following ways:

- 10 improved the <u>independence</u> of older people at home (ISISEMD, Advanced Telecare, PAPERO, HAL, SAS, HOMEKIT, Action, WEST LOTHIAN TELECARE, TDP, and BRAIN AGE),
- 6 increased <u>professional carers' productivity</u> (ADVANCED TELECARE, TAIWAN TELEHEALTH, KAISER TELEHEALTH, Action, WEST LOTHIAN TELECARE, and TDP),
- 3 improved the <u>quality of care</u> (TAIWAN TELEHEALTH, KAISER TELEHEALTH and Action), and
- 10 generated <u>savings for the public long-term care system</u> (ADVANCED TELECARE, HAL, and HOMEKIT, TAIWAN TELEHEALTH, KAISER TELEHEALTH, WSD TELEHEALTH, Advanced Telecare, Action, WEST LOTHIAN TELECARE, and TDP).
- One achieved improvements in all these four policy objectives (Action).

Table 1 summarises the impacts found in relation to each of these four policy objectives.

Table 1: Impacts of technology-enabled services for independent living according to policy objectives

Policy objectives	Findings of the practice evidence
To increase the independence of both older adults and carers	Older adults were more independent because they: • were less reliant on informal carers for daily activities • had fewer falls at home and fewer hospitalizations as a result of falls • were less affected by depression • were more active when alone • had better walking ability, balance and speed • were better able to maintain their physical and cognitive status • had better cognitive functions • remained in their homes • felt safer at home Informal carers were also more independent in their tasks and responsibility, they reported: • better quality of life • better health • more safety • more freedom and peace of mind • less stress
To increase the productivity of carers	Carer workers were more productive because the technology-enabled services: • saved time and money • facilitated timely medical responses in emergency conditions • reduced the length of patients´ visits • provided more information on care • provided more time to be dedicated to more basic needs • improved carer workers' satisfaction with the job • allowed new ways of working • helped them to have more respect for the independence and dignity of older people • helped them have fewer worries • helped them retain their jobs • helped them to improve their relationship with the older adults
To increase the quality of care	More quality of care: • reduction of medication non-adherence • improvement of medication safety • maintenance of quality of care • increase in the care competence of informal carers • more client satisfaction with the care provided by carer workers • reduction in mortality rate
To improve the sustainability of the care system	Cost-effectiveness: • low cost of the technology • reduction in total average (mean) costs of care • reduction in the use of institutional care • reduction in the use of health care resources • more rapid discharge from hospitals • reduced hospital admissions • avoided nursing home admissions • Savings for the care system, e.g.: ○ The cost of *Advanced telecare* is 1,700 € per package (which could be partially or totally covered by public or private organisations), while while the cost of the hospital stay per fall is 8,000€ per person for the regional government ○ Using *TELBIL* the telemonitoring system for chronic conditions in the primary care centres was cheaper for the public health care system than the usual care for these conditions (€-2,230,63 per year) ○ The use of *TDP* allow to the regional public social care system to obtain financial benefits of 91 m€ for 2006-2010, because of faster discharge from hospitals, reduced hospital admissions, and avoidance of nursing home admissions ○ *Action* calculated a saving of 10,300 € per family and year for the municipality ○ The annual cost for caring older patients with chronic conditions was $2,674/patient for usual care and $1,948/patient for those using Kaiser Telehealth for the private health care insurance

5. Policy lessons

In this section, we aim to share policy lessons from the analysis of the four case studies to support public authorities in the EU Member States by providing a framework for the adequate implementation and use of new technologies in the field of long-term care service provision for older people. As explained in Section 2, these policy lessons have been obtained from a case study of four good practices:

- *Advanced Telecare* is a home automation system coupled with telecare, implemented in the Limousin Region in France. The service aims to allow older people to live independently at home. The system uses different available technologies such as sensors and light paths installed at home to prevent accidents and keep older people safely in their homes. The technologies at home are connected through a bracelet or a pendant, worn by the older person, to a telecare system. The telecare system is available 24/7 and it can be activated either by the older adults if they need help or automatically through the sensors if they have an accident, thus allowing professionals to appropriately intervene. The system also helps to better provide care at home.

- *TELBIL* is a telemonitoring service for chronic conditions implemented in the primary care centres of Bilbao in the Basque Region in Spain. It targets chronic patients affected by heart failure and chronic lung conditions, and whose functional limitations make it difficult for them to leave their homes to receive treatment. This service is designed to monitor patients' health in their own homes, in order to address deterioration in their health and deal with emergencies. The service was implemented by the Basque region from 2009 - 2014 as part of a health care policy to address the impact of the increase of chronic patients. The telemonitoring system consists of a smart phone personal digital assistant that records the patient's health data and sends it to a web manager. These data are accessible to the health care professionals at the primary health care centres, who check their patients' status every day remotely, and respond to any deterioration in their health or emergencies. The service was provided inside the public health care service portfolio.

- *Action* is a technology-based home care service implemented mostly in the municipality of Borås in Sweden. ACTION aims to increase the autonomy, independence and quality of life of frail older people and their family carers. These objectives are achieved by providing a self-care and family care support service, which gives end users access to information, education and support via the use of Information and Communication Technology in their own homes. ACTION has four components: i) integrated multimedia caring programmes that families access via their ii) personal computers iii) ACTION call centre and iv) education and supervision programmes for users and for staff working directly with the service in the municipalities.

- *TDP* is the Scottish Telecare Development Programme, which was launched by the Scottish Region (UK) in August 2006 and lasted until 2011. The aim is to help more people in Scotland live at home for longer, safely and securely, by promoting the use of telecare through the provision of a development fund and associated support. Telecare is understood as the remote or enhanced delivery of health and social services to people in their own homes by means of telecommunications and computerized systems. Telecare usually refers to equipment and detectors that provide continuous, automatic and remote monitoring of care needs, emergencies and lifestyle changes, using information and communication technology (to trigger human responses, or shut down equipment to prevent hazards).

5.1 Establishing a policy framework

The four cases studied showed that those public authorities that made available a policy framework promoted the development and use of technology-enabled services for older adults more successfully in the public long-term care system. The reasons for this success seem to be that a policy framework:

- Provides a leader who legitimates setting-up and implementing the initiative.
- Increases the funding available to support the initiative.

- Provides a <u>framework of shared values</u> which can inspire the stakeholders involved and convince them to commit to the service.
- Provides, in some cases, <u>policy guidelines and a legal framework</u> that helps the private and public sectors work together to implement the service.
- Supports <u>integration</u> of the service into the publicly-funded care system.
- Makes available <u>policies at various levels of government</u>, respecting the different powers: thus ensuring the implementation at local level, and the policy and funding support at regional, national and European levels.

Operationally, different kinds of policy framework were set up in the four cases studied. We list below some of them as examples that could inspire other governments to develop and establish similar initiatives:

- *Action* was promoted by the European Research Framework Programme and by the European policies on "ageing in place" and on the development of information and communication technologies for social inclusion. European and national policies, which support services for older people to remain in their homes and the use of information and communication technologies could act as umbrella policies that put forward a strategy to address long-term care. They identify technologies as potential resources for preventing and dealing with the increasing needs for care, as outlined recently in the Joint Report on "adequate social protection for long-term care needs" of the Social Protection Committee and the European Commission (2014).
- *TELBIL* was developed as a regional policy strategy which addressed long-term health care needs, where solutions such as the use of technology to enable services were considered, and actions were put in place to implement these solutions. This regional policy strategy involved:
  o Setting medium-term goals to transform the health care system as regards chronic diseases/conditions and related functional limitations, addressing all the stakeholders involved (older people, carers, health care professionals).
  o Putting in place policies to achieve these medium-term goals, focussing on prevention, care and disease management, and rehabilitation of chronic diseases/conditions.
  o Carrying out strategic projects to contribute to and implement the vision and the policies, by creating public structures and making funding available for promotion and implementation.
- *TDP* implemented a comprehensive national policy framework focused on prevention and provision of long-term care at older adults' homes and communities through telecare. The framework was composed of:
  o A political agenda, which included the creation of governmental bodies for the follow-up of the implementation of telecare and strategic actions such as an awareness plan for stakeholders.
  o A call, offering funding for local partnerships led by municipalities, for proposals to deliver telecare in cooperation with private and public technical and care providers. The continuity of funding depended on results achieved in relation to the framework's policy objectives.

5.2   Build a sustainable business model

All four cases received public funding to set up and start implementing services. However, we observed during the cross-case analysis that those which are still running are those which have shown that they are sustainable. They are therefore still receiving political and economic support from their public authorities. It seems that this sustainability depends on:

- the service being able to show that it could generate social and economic returns. This convinced the public authorities to mobilise resources.
- the service having a business model which helped the public authorities to make it affordable for users, implement it and reach a sufficient number of service users.

The cross-case analysis indicated that the public authorities launched small studies before implementing the service in order to have some prior data on the results. These studies showed that the services generated:

- **Social returns** as they improved the independence and quality of life of older adults at home (e.g. by reducing falls and preventing subsequent hospitalisations, preventing and combating depression and isolation, and developing informal networks), and they benefited carers, by improving their quality of life and the quality of their care provision. For example, after a one year intervention, *Advanced telecare* showed that only 31% of the equipped older people fell compared to 50% of those non-equipped; the *TELBIL* users perceived a better quality of life related to health than the usual care users; and *Action* increased social support and contacts with family and friends.

- **Economic returns**, as they generated savings through contained and reduced use of care services by decreasing care needs and/or using and organising care services more effectively. For example, *TDP* allowed the regional public social care system to obtain financial benefits of €91 million in the period 2006-2010, by making it possible to discharge patients from hospitals faster, reducing hospital admissions, and avoiding nursing home admissions.

Operationally, these small studies used different methodologies in each case:

- *Advanced telecare* and *TELBIL* used an experimental study which randomly selected a small sample of older people, and compared users and non-users of the service, during a 12 month period. Comparisons of pre-post intervention groups could be used if individuals for control groups were lacking. *TELBIL* also included the evaluation of professionals. These evaluations looked at baselines and outcome variables using standardised instruments and medical and clinical records (variables and instruments in Annex 2 in the section on evaluation of impact).

- *Action* carried out a multi-method evaluation over 12 months with older people and their informal carers, using a quantitative and qualitative approach. These evaluations looked at baseline and outcome variables using standardised instruments and medical and clinical records, as in *Advanced Telecare* and *TELBIL*, but they also used interviews and focus groups to obtain the information on variables.

- *TDP* managed to cover a huge sample of around 29,000 users, using a specific data collection strategy based on the quarterly returns from the 32 local partnerships involved. These returns were a condition of the continuation of funding. In this case, a quantitative approach to variable evaluation, similar to *Advanced Telecare* and *TELBIL,* was used.

- In all the cases, ethical issues were considered: interviewees gave their informed consent and their participation in the research was voluntary. They could abandon it in any moment of the study. Data protection regulation was also respected.

Advanced Telecare and *TDP* **managed to produce a sustainable business model**:

- In *Advanced Telecare*, the General Council created a Public Service Delegation contract to provide *Advanced Telecare*. In this contract:
  - the provision of the service is outsourced to a care provider – selected via a public tender.
  - end-users make co-payments to several public and private organisations with which the General Council of the Department has agreements. The latter makes the service affordable to the service users, which ensures that they keep using it. The users pay between the 16.5% (public subsidy) and the 60% (private insurance) of the total cost of the service depending on their incomes.
  - the General Council retains responsibility for identifying eligibility for the service and service quality and ownership of the devices.
  - the care provider is responsible for providing the service and for its installation, maintenance and repair.

- In *TDP*, the government encouraged the development of partnerships led by the local councils and composed of complementary stakeholders (care service and technical providers for example):
  - Each partnership was checked for eligibility, selected and funded by the government, and was given overall responsibility for providing care, including installing and maintaining the equipment.
  - Partnerships reported annually against economic, social and health indicators, and continued funding depended on these outcomes.
  - The government supported the development of physical infrastructure, established technology standards, and promoted R&D.
  - The government also conducted awareness-raising activities directed at policy makers and professionals (user awareness raising was carried out by the local partnerships).

Both cases operationalised their business model in the following manner to make it sustainable:

- Regional or local governments outsourced the delivery of technology-enabled services at older people's homes to a care provider. This provider was a private company or a group of stakeholders led by a local public council. The government assigned public budget to pay the care provider to deliver the service.

- Services to users were co-funded through agreements by private and public organisations. The public authority ensured economic returns and the accessibility of the service to the older people, agreeing with public and private organisations such as insurance companies that they would cover part of the cost of service delivery to the users. The out-of-pocket expenses paid by end-users are limited as far as possible. This kind of agreement is especially useful for those countries, such as France, where private organisations can contribute to the care of older people.

- Regional public authorities remained responsible for service accessibility and delivery, allowing public and private care and technical organisations to develop particular services and skills and then provide and maintain them.

5.3   Engage stakeholders to build confidence and trust

The different cases show that engaging different stakeholders in the provision of the service could contribute to the success of the business model used for a technology-enabled service. The commitment of different stakeholders brought in people with complementary skills, who worked together towards a shared objective though they may have had different interests (quality of life, development of a market, etc.), building knowledge, confidence and trust in the service.

The case studies showed that **the stakeholders who usually participate in public long-term care service provision were:**

- Public authorities at different levels (according to their competences) and in different areas (authority responsible for health, for social affairs, or a specific public authority responsible for long-term care).

- Care providers responsible for providing care to older adults. These providers could be the same public bodies (if care was delivered through the public health and social care services), not-for-profit organisations receiving public funding to deliver such service, and/or for-profit organisations (if a private company was delivering care services).

- Technical providers in charge of providing, installing and maintaining the devices.

- Research institutes that evaluate the use and impact of the technology-enabled service.

- European, national, regional or local organisations that funded the evaluation, creation or implementation of the service.

- Public training bodies in charge of training professionals, who installed, maintained and used the service, and universities that trained health and social care practitioners to use technologies.
- Older people and their informal carers and their representative organisations, who were involved as primary stakeholders in all stages of the design, implementation and evaluation of the service

Operationally, these stakeholders, led by the public authorities under a policy framework, were engaged in the design and provision of the service in different and complementary manners. They could be formally involved as part of a partnership or they could be more informally involved. The following examples from the cross-case analysis **shed some light on how stakeholders were engaged in the service**:

- A **care provider** was involved through a Public Service Delegation contract in *Advanced Telecare*. In France, public service delegation («délégation de service public (DSP) ») is the set of contracts under which a legal entity by public law entrusts the management of a public service for which it is responsible to a public or private operator whose remuneration is substantially related to the results of operating the service. This is a concept of French law. The General Council of the Department subcontracts a private care provider to deliver a service, in partnership with it, under a public service delegation contract.

- **Technical providers** came to a private agreement with the care provider in the Public Service Delegation contract in *Advanced Telecare.*

- **Research centres**. Universities were involved, for example in the cases of *Action* and *TELBIL,* in impact evaluation as part of research projects funded by competitive and non-competitive programmes. Hubs or living labs functioned as informal organisations/associations that provided key intellectual resources to projects such as *Advanced Telecare*. This was, in fact, part of the preparatory work for settling the Public Service Delegation contract.

- **Professionals** such as artisans and practitioners (health professionals, social care and assistance professionals, and other support services practitioners) were largely involved through:
  - General agreements or contracts for their training:
    - In *Advanced Telecare*, these agreements/contracts were signed between home care associations, public training associations, networks of artisans and the General Council. Home care professionals were informed and trained through an awareness raising campaign, which clarified and explained the changes in order to overcome their reluctance to use and recommend the service. These professionals and the rest of professionals involved in the service delivery chain (artisans, staff making referrals at the General Council of the Department, and staff from the care provider) also took part in a training plan containing information about the objectives and content of the service.
    - In *TELBIL*, health care professionals, doctors and nurses were also trained under an informal agreement by the project researchers and the technical provider and shown how to use the service.
  - A telecare learning network (now a virtual network) was set up by the government to provide an information sharing and networking opportunity for home care professionals.
  - Like-minded professionals then helped to raise awareness and convince their own colleagues, in their own working environments. They also served as local telecare experts and "champions".

- **Local authorities** formed partnerships with local housing associations, voluntary associations, private providers of health care technologies and health care organisations. In Scotland, these partnerships were led by the local authorities and were funded under a policy framework to deliver telecare.

- **Policy-makers** participated in *TDP* through a national government campaign to enable them to better understand the system and benefits of telecare.

- **Older people and informal carers** received training from *TELBIL*, *TDP* and *Action*. *TELBIL* used the same training programme based on demonstration that was used for health care professionals. *Action* included this training as a specific module of the service, and local partnerships in *TDP* trained older people and their informal carers in the use of telecare. *Action* also consulted older people and informal carers from the initial design stage of the service through to its implementation, in order to account for their needs in building the new service.

5.4 Use a well-established entry point for the new service

We observed that in two of the four cases, the introduction and access to a new service was made through an existing well-established service. An entry point of this kind helped to keep the service affordable and at the same time improve it. Using a mainstream technology also maximised reliability and accessibility for end users, as the literature has also pointed out (Georgantzi et al., 2014).

We looked at how two examples use a well-established entry point for the new service:

- *Advanced Telecare* service used the telealarm, a well-accepted service by the older population and their carers at local level, as an entry point to the new service.

- In the case of *TELBIL*, the service was provided as part of standard public primary health care in the public primary care centres, and was accessible and free for the whole population. It was also provided through the existing primary care doctor as an alternative to the standard support they were receiving for chronic conditions. Thus, patients with multiple pathologies were cared for in a familiar structure, which was compatible with existing clinical practice and did not require any special authorisation or new structure.

Operationally, we could also see how these two initiatives managed the change, concretely:

- In *Advanced Telecare*, when people contacted their local public services to be informed about the telealarm, they were also informed about the new and improved service, which was available at a similar price to the original telealarm service. Moreover, as explained in Section 5.3., home care professionals were trained to recommend the service to the users, and electric installations were adapted to the current electric norms.

- *TELBIL* employed a project manager to coordinate the provision of the service and professionals were trained in the new service so that they could offer it to their patients.

5.5 Share experiences

Of the services studied, the ones that managed to scale-up in some way had in common informal procedures for collaboration within their locality and with other localities and regions, which allowed them to transfer know-how between their services. The success of the service, rather than a region/locality's desire to implement a similar scheme, seemed to be what raised demand in other regions. We can see that:

- *Advanced Telecare* has been implemented in two other Departments of the Limousin Region (Corrèze and Haute Vienne), and in other French Regions in the Loir et Cher Department (Centre Region).
- *TELBIL* participated in a project co-funded by the European Commission's ICT Policy Support Programme. It was designed to exploit and further deploy innovative telemedicine services, which had been implemented and trialled in 15 European regions.

Operationally, we found that two strategies were used to replicate and scale-up services:

- Exchanges and collaborations among policy-makers and technical officers in the region, with the localities or regions concerned. These exchanges and collaborations were mostly:

- o Focused on giving support to the definition of the economic and organisational models followed by the region/locality to implement the services and identifiying the barriers faced and possible facilitators.
  - o Made through face-to-face or phone meetings, or speeches.
  - o Carried out by a small group of main and representative stakeholders
- Participation in development and innovation projects, such as those funded or promoted by European Commission programmes (see Sections 6.2 and 6.4 for more information).

5.6   Be alert to the challenges of interoperability

The cross-case analysis showed that the four cases faced some problems of interoperability between the devices and software they were using in the technology-enabled service. The typical problems faced were related to:

- Old electric installations that were not compatible with new devices,
- Cross-border communications among countries,
- Use of different devices that were not compatible.

Operationally, some of the cases were able to resolve the problems of interoperability, while others were not. In *Advanced Telecare*, the electrical installations were adapted to new electricity norms. The cost of materials and labour were covered by local government funding and professional support. However, the most important lesson was learnt in the case of *TDP*. Here, it was realised that standards and procurement procedures should be more harmonised or standardised for successful and sustainable mainstreaming of reliable telecare service delivery. This would allow interoperability barriers to be anticipated. The design of integration profiles for one single-use case could be a possible solution[8] (Eichelberg, 2014; Eichelberg and Rölker-Denker, 2014).

---

[8]   See Annex 3 for more information on integration profiles.

6. The role of the European Union in implementing the policy lessons in Member States

In this section, as part of the final objective of this research, we would like to give some recommendations about how the European Union could help the Member States to use these policy lessons to implement technology-enabled services that help older people live independently at home.

We have identified different actions where the European Union could contribute by:

* disseminating the policy lessons among different organisations and committees.
* facilitating mutual learning among Member States through the exchange of good practices
* developing policy frameworks and initiatives for use by the Member States when implementing the services
* providing funding for the creation, design, and implementation of these technology-based services.

6.1 Dissemination

The EU can disseminate these policy lessons by:

* Translating this report into the languages of the European Union.
* Informing relevant policy committees composed of Member States, European organisations representative of stakeholders, European Commission institutions. We list some of them below:
  o DG EMPL
  o DG CNECT- H2: Digital Social Platforms
  o DG ENTR- E4: Key Enabling Technologies and Digital Economy
  o DG REGIO – DGA2.H: Competence Centre Inclusive Growth, Urban and Territorial Development
  o DG SANCO – O2: Innovation for Health and Consumers
  o DG ECFIN
  o Economic Policy Committee: Working Group on Ageing Populations and Sustainability: provides a quantitative assessment of public finances and economic consequences of ageing populations in the EU Member States.
  o Social Protection Committee (SPC) is an EU advisory policy committee for Employment and Social Affairs Ministers in the Employment and Social Affairs Council (EPSCO), which monitors social conditions in the EU and the development of social protection policies in member countries, and promotes discussion and coordination of policy approaches among national governments and the Commission.
  o The European Foundation for the Improvement of Living and Working Conditions (Eurofound) is a tripartite European Union Agency, whose role is to provide knowledge in the area of social and work-related policies.
  o AGE Platform Europe is a European network of more than 150 organisations of and for people aged 50+, representing directly over 40 million older people in Europe. It focuses on a wide range of policy areas that impact on older and retired people.
  o EUROCARERS (European Association working for Carers): aims to advance the issue of informal care at both national and EU levels.
  o European Disability Forum (EDF) is an independent Non-Governmental Organisation that represents the interests of 80 million Europeans with disabilities.
  o The European Platform for Rehabilitation (EPR) is a network of leading European providers of rehabilitation services to people with disabilities and other disadvantaged groups.

- A network of independent experts on social inclusion assists the European Commission in monitoring and evaluating poverty and social exclusion and the relevant policies in 34 European countries: the 28 EU Member States and six non-EU countries (the Former Yugoslav Republic of Macedonia, Iceland, Liechtenstein, Norway, Serbia, and Turkey).
- The Strategic Policy Forum for Digital Entrepreneurship advises the Commission on policy issues and actions to foster digital entrepreneurship and promotes the development of the digital entrepreneurship policies by Member States at national and regional level.

- Disseminating these policy lessons in conferences such as:
  - The Annual Convention of the European Platform against Poverty and Social Exclusion, organised by DG EMPL.
  - Peer Reviews in social protection and social inclusion foster open discussion and mutual learning. Each Peer Review meeting is hosted by one country which presents a selected good practice (e.g. a programme, policy reform, institutional arrangement). These Reviews are attended by experts from the European Commission, peer countries and relevant stakeholders who provide feedback.
  - Ambient Assisted Living (AAL) Forum is the annual platform for the growing European AAL community to meet and discuss topics, relevant to improving the AAL Joint Programme[9] and the adoption of AAL solutions in the market. It is an initiative of the AAL Joint Programme.
  - Events organised as part of EU-funded projects or of the regular activities of a wide range of European-wide organisations.

6.2 Mutual learning

The EU can facilitate the mutual learning of innovative and proactive approaches to the use of technology to help older people to live independently through the exchange of good practices, see examples below in Table 2.

---

[9] Renamed for the period 2014-2020 as Active Assisted Living Research and Development Programme

Table 2: Programmes to support the implementation of the policy lessons through mutual learning

Name of the programme	DG	Aim for the policy lesson implementation	Link
European Innovation Partnership on Active and Healthy Ageing	DG CNECT DG SANCO	To highlight good practices in the area of long-term care for older people and support the scaling up of these innovative approaches to new regions and more users to ensure the wider dissemination of best practices.	http://ec.europa.eu/research/innovation-union/index_en.cfm?section=active-healthy-ageing
Smart Specialisation Platform (S3 platform)	DG CNECT JRC-IPTS (DG EAC) DG REGIO	The S3 Platform, with DG CONNECT and DG REGIO, are supporting national and regional policy makers to successfully develop and implement ICT-based innovation in their research and innovation strategy and related operational programmes for EU cohesion policy. A specific toolbox for ehealth is available, which provides documents and links to guiding material for regions. This toolbox develops digital growth strategies, and provides information about upcoming events for the exchange of learning.	http://s3platform.jrc.ec.europa.eu/digital-agenda
Knowledge and Innovation Communities (KIC) for innovation for healthy living and active ageing	EIT (European Institute on Innovation and Technology)	A KIC on innovation for healthy living and active ageing has been just created[10], with the following aims: - closely co-operate with the pilot European Innovation Partnership (EIP) on Active and Healthy Ageing. - create complementarity between education and training key actors, - provide a structured network of practitioners to identify framework conditions and best practice on policy, regulatory or standardisation issues which could have an impact on the sector.	http://eit.europa.eu/interact/bookshelf/sia-factsheet-innovation-healthy-living-and-active-ageing-and-raw-materials

---

[10] See announcement at http://eit.europa.eu/newsroom/eit-selects-new-strategic-partnerships-milestone-europe-areas-health-and-raw-materials

6.3 European policy

The European Commission has also developed policy frameworks and initiatives that can support the Member States in the implementation of these policy lessons. Some of the main initiatives are in Table 3.

Table 3: Programmes to support the implementation of the policy lessons through European policy

DG	Name of the programme	Aim for the policy lesson implementation	Link
DG EMPL	Social Investment Package for Growth and Cohesion	Policies designed to strengthen people's skills and capacities and support them to participate fully in employment and social life. Key policy areas include education, quality childcare, healthcare, training, job-search assistance and rehabilitation.	http://ec.europa.eu/social/main.jsp?catId=1044
DG CONNECT	eHealth Action Plan 2012-2020	An Action Plan to address barriers to the full use of digital solutions in Europe's healthcare systems. The goal is to improve healthcare for the benefit of patients, give patients more control of their care and bring	https://ec.europa.eu/digital-agenda/en/news/putting-patients-driving-seat-digital-future-healthcare
	Digital Silver Economy	To promote the market and products of technologies for older people	https://ec.europa.eu/digital-agenda/en/news/growing-silver-economy-europe
DG ENTR	Entrepreneurship 2020 Action Plan – Digital Entrepreneurship	To foster the knowledge base on the state of play and evolution of Digital Entrepreneurship in Europe.	http://ec.europa.eu/enterprise/sectors/ict/digital-enterpreneurship/index_en.htm http://ec.europa.eu/enterprise/dem/monitor
Joint Programming Initiative "More Years, Better Lives – the Challenges and Opportunities of Demographic Change"	Member States, supported by the European Commission	To enhance coordination and collaboration between European and national research programmes related to demographic change.	http://www.jp-demographic.eu/front-page?set_language=en
DG CNECT and DG ENTR	The European Multi Stakeholder Platform (MSP) on ICT standardisation	Advise on matters related to the implementation of ICT standardisation policies	http://ec.europa.eu/digital-agenda/en/european-multi-stakeholder-platform-ict-standardisation

6.4 Funding

Policy lessons obtained have shown that European public funding can support the creation, design, and implementation of these technology-based services. For example, the Framework Programme funded the creation and testing of *Action*, and the European Regional Development Fund facilitated the implementation of *Advanced Telecare* in the region.

Currently, the following European Commission funding programmes are available (see Table 4 below):

Table 4: Programmes to support the implementation of the policy lessons through funding

Name of the action	DG	Aim for the policy lesson implementation	Link
Horizon 2020 – Health, Demographic Change and Wellbeing	DG RTD	For research and innovation: • to keep older people active and independent for longer and • to support the development of new, safer and more effective interventions, and • to contribute to the sustainability of health and care system	http://ec.europa.eu/programmes/horizon2020/en/h2020-section/health-demographic-change-and-wellbeing
Active Assisted Living Research and Development Programme	Member States, supported by the European Commission	For applied research on innovative ICT-enhanced services for ageing well, to support market-oriented research and SMEs.	http://www.aal-europe.eu/
European Structural & Investment Funds:	DG REGIO	The ESI Funds will support the implementation of relevant Country Specific Recommendations and of national reform programmes.	http://ec.europa.eu/contracts_grants/funds_en.htm
European Social Fund	DG REGIO	20% of the ESF in each Member States to promote social inclusion and confront poverty The ESF can scale up successful social policies tested in both the public and private sectors to mainstream policies.	http://ec.europa.eu/esf/home.jsp
European Regional Development Fund	DG REGIO	The ERDF has identified the need to promote innovation and the development of SMEs, such linked to an ageing population, care and health, prioritising investment in health and social infrastructure.	http://ec.europa.eu/regional_policy/thefunds/regional/index_en.cfm
Programme for Employment and Social Innovation (EaSI) – Progress	DG EMPL	Support Member States efforts in the design and implementation of employment and social reforms at European, national as well as regional and local levels by means of policy coordination, the identification, analysis and sharing of best practices.	http://ec.europa.eu/social/main.jsp?langId=en&catId=89&newsId=1093
Cosme EU programme for the Competitiveness of Enterprises and Small and Medium-sized Enterprises (SMEs)	DG ENTR	Contain specific provisions to financially support social policy innovation	http://ec.europa.eu/enterprise/initiatives/cosme/index_en.htm
Health Programme 2014-2010	DG SANCO	The Programme would fund grants and public procurement contracts for public or private bodies, national authorities, European NGOs and international organisations. It would help EU countries to find cost-effective solutions to the challenges they face and to make their health systems more responsive and sustainable.	http://ec.europa.eu/health/programme/policy/2014-2020/index_en.htm

EU resources can also be complemented by resources from, for instance, the World Bank, the Council of Europe Development Bank and the European Investment Bank group.

References

Benatar, D., Bondmass, M., Chitelman, J. and B. Avitall (2003) Outcomes of Chronic Heart Failure, Archive of Internal Medicine, 163, 347-352.

Billings, J.; Carretero, S.; Kagialaris, G.; Mastroyiannakis, T. and Meriläinen-Porras, S. (2013). The role of information technology in LTC for older people. In Leichsenring, K., Billings, J. And Nies, H. (eds): Long-term care in Europe – Improving policy and practice. Palgrave Macmillan. http://www.palgrave.com/products/title.aspx?pid=601806

Breazeal, C.L. (2003). Sociable machines: Expressive social exchange between humans and robots. PhD thesis, MIT, 2000. T. W. Fong, I. Nourbakhsh, and K. Dautenhahn. A survey of socially interactive robots. Robotics and Autonomous Systems, 42:143–166.

Cabrera, M. and Ozcivelek, R. (2009). ICT for independent living services. In Cabrera, M. and Ozcivelek, R.: Information and communication technologies for active ageing: opportunities and challenges for the European Union. The European Community and IOP Press

Carretero, S. (2015). Mapping of effective technology-based services for independent living for older people at home. Seville: Joint Research Centre, Institute for Prospective Technological Studies, JRC Scientific and Technical Reports Series, http://publications.jrc.ec.europa.eu/repository/handle/JRC91622

Carretero, S. and Kucsera, C. (2015). Report on case studies of the technologies for independent living for older people. Sevilla: Joint Research Centre, Institute for Prospective Technological Studies, JRC Scientific and Technical Reports Series

Carretero, S.; Stewart, J.; Centeno, C (2015). Information and communication technologies for informal carers and paid assistants– benefits from micro-, meso-, and macro levels. European Journal of Ageing, DOI 10.1007/s10433-015-0333-4

COCIR (2011) COCIR E-Health Toolkit for an accelerated deployment and better use of eHealth, Brussels, COCIR, http://www.cocir.org/uploads/documents/eHealth%20Toolkit%20LINK2.pdf

Dar, O., Riley, J., Chapman, C., Dubrey, S.W., Morris, S., Rosen, S.D., Roughton, M. and M.R. Cowie (2009) A randomized trial of home telemonitoring in a typical elderly heart failure population in North West London: results of the Home-HF study, European Journal of Heart Failure, 11, 319-325.

Dries, J.; Hüsing, T.; Kubitschke, L. and Leys, M. (2006). ILS – The Future of Independent Living Services in the EU. Final report. Available at http://is.jrc.ec.europa.eu/pages/EAP/documents/ILSfinaldraft.pdf

Empirica (2005). Inventory of ILS related policy, applications and contextual factors. Available at http://is.jrc.ec.europa.eu/pages/EAP/documents/WP2ILS.pdf

Empirica, WRC and European Commission (2010). ICT & Ageing. European Study on Users, Markets and Technologies. Final Report, http://www.ict-ageing.eu/

European Commission (2009). Telemedicine for the benefit of patients, healthcare systems and society. Commission Staff Working Paper, Brussels, EC, http://ec.europa.eu/information_society/activities/health/docs/policy/telemedicine/telemedecine-swp_sec-2009-943.pdf

European Parliament (2012) resolution of 20 November 2012 on Social Investment Pact – as aresponse to the crisis (2012/2003(INI)). Available at http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//NONSGML+TA+P7-TA-2012-0419+0+DOC+PDF+V0//EN

Gassner, K. and Conrad, M. (2010). ICT enabled independent living for elderly A status-quo analysis on products and the research landscape in the field of Ambient Assisted Living (AAL) in EU-27. Berlin: Institute for Innovation and Technology (iit) as part of VDI/VDE Innovation + Technik GmbH.

Available at http://www.vdivde-it.de/publications/studies/ict-enabled-independent-living-for-elderly.-a-status-quo-analysis-on-products-and-the-research-landscape-in-the-field-of-ambient-assisted-living-aal-in-eu-27

Hansen, S.T. (2011). Robot Games for Elderly. A case-based approach. PhD Thesis. Danish Technological Institute. Aalborg University

Laberg, T.; Aspelund, H.; Thygesen, H. (2005). Smart Home Technology. Planning and management in municipal services. Social-og helsedirecktoratet. 52p.

Lewin, D.; Adshead, S.; Glennon, B. and Williamson, B. (2010). Assisted living technologies for older and disabled people in 2030. A final report to Ofcom. London: Plum Consulting. Available at http://stakeholders.ofcom.org.uk/binaries/research/technology-research/Assisted.pdf

Malanowski, N.; Ozcivelek, R. (2008). Active Ageing and Independent Living Services: The Role of Information and Communication Technology. JRC-IPTS publication. Luxembourg: Office for Official Publications of the European Communities

Miles MB, Huberman A M (1994) Qualitative data analysis. 2d ed. London, Sage.

Polisena, J., Tran, K., Cimon, K., Hutton, B., McGill, S., Palmer, K. and R.E. Scott (2010) Home telemonitoring for congestive heart failure: a systematic review and meta-analysis, Journal of Telemedicine and Telecare, 16, 68-76.

SCAN Foundation (2010). Technologies to Help Older Adults Maintain Independence: Advancing Technology Adoption. Available at http://www.techandaging.org/briefingpaper.pdf

Social Protection Committee and European Commission (2014). Adequate social protection for long-term care needs in an ageing society. Luxembourg: Publications Office of the European Union. Available at http://ec.europa.eu/social/BlobServlet?docId=12808&langId=en

WHO (1998). A health telematics policy in support of WHO's Health-For-All strategy for global health development: report of the WHO group consultation on health telematics, 11–16 December, Geneva, 1997. Geneva, World Health Organization, 1998.

Wootton, R., Bahaadinbeigy, K. and D. Hailey (2011) Estimating travel reduction associated with the use of telemedicine by patients and health care professionals: proposal for quantitative synthesis in a systematic review, BMC Health Services Research, 11, 185.

Annex 1: Main variables for cross-analysis

1. Developing business cases and business models

This section highlights:
- Drivers for and impediments to the development of business cases and models,
- The roles of stakeholders in the business models,
- Impacts on quality of life.

This section is illustrated with examples based on the good practices selected in Deliverable 2.

2. Enabling factors and barriers to scaling up and market creation

This section addresses the main enabling factors and barriers to market creation and the development of the services needed to scale up solutions. It will focus on scaling-up strategies observed at local, regional and national levels.

3. Available technologies that help older adults to live independently

This section covers:
- Technologies available to help older adults to live at home independently, listing the diversity of existing solutions according to different levels of needs.
- Cost analysis of these technologies based on the case studies, to show that available, proven technology can be cheap and affordable for public care systems. This analysis could also mention more advanced/emerging technology where the price is not yet fixed.

4. Standards and interoperability of solutions

This section elaborates the following content:
- General context of standardisation and solutions developed to address interoperability problems, based on general literature and case studies.
- Discussion about establishing a European interoperable market.
- A focus on cross-border situations, both cross-regional and cross-national.

5. Impact evaluation

This section identifies the advantages and disadvantages of different kinds of evaluation that could be used to assess technological solutions across Member States and the requirements regarding methods.

6. Integration in the long-term care system

This section analyses facilitators and barriers to integration. Models will not be defined but factors related to success and barriers across models will be explained. In addition, the most relevant factors will be identified in each model, and illustrated with the most interesting examples in each country/practice.

7. Policy role in the implementation models

In this section, we describe the role of policy at local, regional, national and European levels for the different models. We illustrate what worked and what did not work in each model. We also considered the timeline for each policy intervention.

Annex 2: Cross-analysis of four case studies

Developing business cases and business models

Drivers for and impediments to their development

The case study analysis revealed some relevant factors for building a successful business case and model for technology-enabled services that help older people to live independently at home. The following factors can contribute to successful policy strategy:

- **A policy framework** that supports the creation, development and implementation of the service. These policies are generally concerned with maintaining the quality of life of older adults and covering the public cost associated with their care, using technology-enabled services:
  - *Advanced Telecare* and *TELBIL* were created and promoted by a regional policy:
    - *Advanced Telecare* was boosted by the Limousin Region's long-term care strategy to increase the independence and security of older people at home and contain the costs of public care, by reducing falls at home. Making telecare accessible to older people at home was endorsed by the French national health care strategy.
    - *TELBIL* was promoted by a policy of the Basque Regional Health Care Ministry, which identified telemedicine as one of the actions to combat chronic diseases.
  - *Action* was driven by European and Swedish policies for ageing at home, and the active inclusion of older adults and their carers through information and communication technologies.
  - *TDP* (UK) built a strong national policy framework and took the lead in the implementation of telecare in Scotland. It developed a long-term policy and ensured funding support to attain its objectives.
- **Public funding** to create, develop and start implementing the service in the long-term care system:
  - *Advanced Telecare* received funding of €5.7 million from European, national and regional funds for implementing the service in the Department for a period of 5 years.
  - For *TELBIL*, the region, supported by the Spanish government, funded the implementation and the evaluation of the service in the primary health care sector for a period of two years in two different projects. The equivalent of €143,165 was allocated for both projects.
  - In the case of *Action*, funding from the European Regional Development Funds was first allocated for research and development to create the service. Later, the Swedish government funded the development, testing and implementation of the service.
  - In the case of *TDP*, the public funding was already associated with a policy framework.
- **An economic model** to fund and implement the service was also a driver for the business case and model of *Advanced Telecare* and *TDP*:
  - The Creuse Department created a Public Service Delegation contract to provide *Advanced Telecare*, in order to be able to outsource service provision to a care provider, selected via public tender. The service for end-users is totally or partially funded by several public and private organisations with which the General Council of the Department has agreements. The Public Service Delegation allows the General Council to maintain responsibility for service entitlement and quality, and to retain ownership of the devices. The care provider is responsible for providing the service and for installation and repair of equipment.
  - For *TDP*, the government decided to develop a model of partnerships led by local councils and composed of complementary stakeholders (care and technical providers, etc.). Each partnership was selected and funded by the government, with full responsibility for providing care and annually providing data on outcomes, using economic, social and health indicators. Funding depended on these yearly reports. The government also supported the

development of physical infrastructure, established technology standards, and promoted R&D. It also carried out awareness activities for policy makers and professionals.

- **Data on the impact of the service** in relation to the policy priorities stated in the policy framework and prior service implementation. One of the main characteristics of these impact assessment evaluations is that they were commissioned and funded by regional governments to test their policies. Pilots and small studies provided a first indication of the benefits these services could bring to the population and the public care system. If these studies made a positive assessment of the potential benefits of a service, it would be implemented by the public care system in that region. This was the case in:

  o *Advanced telecare.* It achieved a reduced number of falls among older people at home and consequent reduced hospitalisation.

  o *TELBIL,* where it was found there was a reduction in the use of health care resources in a randomised control trial. In addition, the technology-enabled service was cheaper than standard care, with consequent savings for the health care system.

  o *Action,* which demonstrated in different quantitative and qualitative studies of a sample of around 400 older people and carers that the service contributed to older people's independence, the quality of life of carers, and quality of care. It also generated savings for the health care system. In fact, these data constituted the key factor for the Borås Municipality in deciding to include the service in the existing support services for older people.

  o *TDP.* Their impact assessment was done after implementation. However, they were convinced of telecare's potential, due to the results of previous initiatives in Scotland, such as those obtained through the telecare implementation scheme in West Lothian Council (Kelly et al., 2005).

- **Building the technology-enabled service on existing, accessible and well-known public services**. This was a driver for the business case and model of *Advanced Telecare* and *TELBIL*:

  o In the case of *Advanced Telecare*, the service substitutes an existing technology-enabled telealarm service that was well-accepted locally by the older population and their carers. When people ask for information about the telealarm service, they are informed of a new and improved service, available at a price similar to the old telealarm service.

  o In the case of *TELBIL*, the service was provided inside the public primary care centres, and was accessible and free for all. It was available through the regular primary care doctor as an optional service to the regular care they were already receiving for their chronic conditions. Thus, the service managed to deal with patients with multiple pathologies within the existing structure. It was compatible with standard clinical practice and did not require special authorization or a new structure to care for them.

- A **pool of complementary stakeholders** participating from the beginning in the creation, development and implementation of the service. This is especially relevant in the case of *Advanced Telecare* because every stakeholder participates and feels motivated to ensure that the model works. These stakeholders are complementary in the sense that all of them contribute their own competences, under the leadership of the regional government:

  o The General Council leads on policy and management of the service.

  o A care provider is in charge of providing the care and the related activities (maintaining the devices, raising awareness).

  o A technical provider is subcontracted by the care provider to ensure the technical skills needed for the effective functioning of the service are in place.

  o Training organisations also participate to ensure appropriate implementation of the training strategy. The active participation of the stakeholders is underpinned by a strong training

strategy involving all actors and led by the General Council of the Creuse Department. The training covers the needs of all staff involved: e.g. artisans, installers, staff of the General Council and home care staff. In addition, a portfolio of training focused on a university degree on home automation has been developed and a demonstration centre has been established.

We have also identified, nevertheless, some **barriers/impediments** to the development of the business case and model, specifically:

- The **financial sustainability of the service** has been identified in *Advanced Telecare*, *TELBIL* and *Action* as one of the major barriers to further development of the service. For example *Advanced Telecare* mentioned the need for co-funders for the service. As a part of a strategy to sustain service provision, the General Council of the Creuse Department has signed agreements with private and public organisations to support this co-funding. In the cases of *TELBIL* and *Action*, however, public funding ceased and with it the provision of the service.

- **Professionals' reluctance** to use and implement the service was seen in *Advanced Telecare*. This reluctance was mainly linked to fears the new service would replace their skills and jobs. The General Council developed an awareness plan targeted at home care professionals prior to implementing the service, to help them appreciate the benefits of the service for them and for service users. This plan also helped them to recommend the service to older people, converting this barrier into a driver of success for the business case and model.

  TDP also used an awareness strategy in the form of a national governmental campaign during the implementation of the telecare service, targeting politicians and care professionals. The aim was to enable politicians to better understand the system and benefits of telecare, and to raise awareness among professionals and convince them of the advantages.

- **Technical problems** can affect the technical feasibility of the equipment and limit the development of the business case and model, as in the case of *TELBIL*. The technical problems were mainly to do with data transmission and reception, and they were resolved by putting in a technician from the technical provider and a service project coordinator.

Roles of stakeholders in the business models

As mentioned in the previous sub-section, active participation by complementary stakeholders was identified as important for the success of the business models in four cases. Each stakeholder in these four cases had a specific role that ensured that the necessary complementary competences were available to implement the service within the public care system.

In the case of *Advanced Telecare*, a wide range of public and private actors participated in the implementation of the service, with the General Council of the Creuse Department holding overall responsibility, and drawing up the agreements for this:

- The Public Service Delegation contract, whereby the General Council outsourced the provision of *Advanced Telecare* to a service care provider called SIRMAD. This public service delegation contract was awarded to SIRMAD through a public tender. The care provider is responsible for providing the service, and for installations, removals, and repair; for invoicing users monthly; and for assessing and prescribing the service. SIRMAD is part of the Fondation Caisse Génerale pour la Solidarité, a public organisation that was one of the funders of the pilot evaluation project.

- A technical provider, Legrand, also plays a role in this Public Service Delegation arrangement through SIRMAD, providing the technology and helping the General Council to train home education stakeholders.

- A network of artisans deploys and maintains the installation of equipment and adapts the electrical installation. This network was previously trained by public training organisations and the Chamber of Artisans, specifically CNISAM, a body working specifically with artisans for health and personal autonomy.

- A living lab (Autonom lab) carried out the pilot evaluation of the service.

In the case of *TELBIL*, three stakeholders were important for the business model:
- The technical provider (Saludnova – a private company), in charge of providing the equipment, training, and equipment maintenance and repair.
- The regional government (Basque Health Care Department) played an active role in setting a policy strategy focused on technology for health care and health policy to face the challenge of chronicity in the region. It also provided funding to test the effectiveness of the service.
- This funding to test effectiveness was provided by the Spanish national health care Ministry.

In the case of *Action*, the main stakeholders of the service are:
- The Borås Municipality which was the first to implement the service.
- The private company, ACTION CARING, set up to implement the service, offers the service to the municipality and installs the equipment, trains the staff, and follows-up the service. A technical provider is in charge of technical issues.

Older people and their carers using the service were involved in all stages of its design.

For *TDP*, the main stakeholders involved are from the Scottish Government which was responsible for establishing the telecare policy plan. It also established various public organizations and public-private partnerships:
- a public organisation, the Joint Improvement Team (JIT) was created to represent the government in telecare
- the Scottish Centre for Health and Telecare was set up to develop and integrate telecare and telehealth into the public system.
- local partnerships are in charge of developing, providing and monitoring telecare at the local level
- a further local public entity, Scotland Excel, another stakeholder in the business model, oversees procurement, and aims to increase the role of private technology providers in local partnerships, support procurements and enhance interoperability.

Impacts on quality of life

As mentioned in the first subsection of this chapter, the four cases had an impact on their policy objectives. They improved the quality of life of older adults and generated savings for public health and social care systems:

- A pilot evaluation of *Advanced Telecare* showed that this technology-enabled service has an impact on the quality of life of older adults. Specifically, this study (ESOPPE) of 194 older adults found that *Advanced Telecare* reduced the number of falls at home and hospitalisations due to falls (compared to those who did not have the equipment installed in their homes); the number of people using the service who were depressed was also lower than the number of those who did not use it.
- *TELBIL* has demonstrated that it is feasible to improve the quality of life of older people and their informal carers. To assess effects on patients, Martín-Lesende et al. (2013a) carried out an analysis of the quality of life of 58 patients with heart failure and chronic lung disease in a randomised control trial. Patients were recruited, and randomly assigned to treatment (receiving telemonitoring) and control (receiving usual care) groups over 12 months. The results showed that the telemonitored patients were significantly more likely to perceive better quality of life than those receiving usual care, after 12 months of treatment. However, the authors did not find significant differences between the groups in their quality of life related to health or in functional health over this period. Similar results were subsequently found in another study, the TELBIL-A study (Orruño et al., in press). The authors evaluated the burden of informal carers in a

randomised control trial, and found that, although a high percentage did not feel burdened (84%), those who cared for telemonitored chronic patients were statistically more likely to report reduced burden after 12 months compared with carers of patients receiving usual care.

- *Action* helped to increase the social inclusion of frail older people and their carers who are usually excluded from the benefits of information and communication technology (ICT) (Magnusson et al. 1999). Both the family carers and the older person they cared for felt less isolated as they developed informal support networks with other participating (user) families in similar situations (Magnusson et al. 2002). The majority of users reported that the service helped them to improve their everyday quality of life: a specific study of 34 family carers recruited from two municipalities in West Sweden found their perceived quality of life increased through using the *Action* service (Magnusson et al. 2005).

- For *TDP*, the benefits of the service were revealed by quarterly reports submitted over the five year period by Scottish local care partnerships (Beale et al., 2009; Chianti et al., 2011; Newhaven Research, 2011; Cenderello et al., 2013). Service users reported a significant improvement in their quality of life: 60.5% of users felt that their current quality of life was either "a bit better" or "much better" than before they had their equipment.

Enabling factors and barriers to scaling-up and market creation

Policy leadership and willingness of the regional government to create and implement the service was the main **enabling factor for the market creation and the development of the service** in the public care system. This willingness and leadership creates a supportive and suitable environment that motivates investment in the service. For example:

- The Creuse Department was the main supporter and prescriber of *Advanced Telecare*, leading the creation and implementation of the project. It took responsibility for creating a policy framework and an economic model for its implementation, and for bringing the stakeholders together to launch a large-scale deployment. For example, the General Council was responsible for meeting all the involved stakeholders, and for getting them involved in and committed to its implementation. The promoter reported that being a small department enabled the General Council to bring the relevant stakeholders together more easily, as the number of people to meet was smaller and they frequently wore different "hats" (i.e. represented different organisations). The General Council also developed a specific awareness programme for care professionals, whose reluctance had previously been identified, which turned them into advocates for the service.

- In the specific case of *TELBIL*, the policy leadership and funding (first by OSTEBA and later by Kronikgune) of the Basque Regional Health Care Department entitled a group of primary health care professionals to implement and test the service, and to be freed of other regular care responsibilities.

- The *TDP* policy placed telecare on the political agenda in 2006, refocusing care for older adults. It aimed to change how care for older adults is organised moving towards integrated care, prevention and care at home with solutions such as telecare. In this policy, the government commissioned specific governmental bodies such as the Joint Improvement Team to be involved in the overview and quality assurance of telecare. This political agenda included strategic actions such as an awareness plan for politicians and health care staff. In 2010, the government renewed its strategic policy to give a stronger emphasis to telecare (such as Care for Older People and Telecare: Health Care Quality Strategy for NHS Scotland" and "Reshaping Care for Older People: a Programme for Change 2011-2021"). In 2012, it sought to stabilize the market with a new plan called "National Telehealth and Telecare Delivery Plan for Scotland to 2015".

- A lack of adequate policy support from local politicians has been identified by *Action* as one of the main barriers to market creation and scaling up of this service. Promoters of the service have found that some local politicians seemed to embrace the idea of implementing an

innovative solution in care of the older people, but were not determined or powerful enough to break the status quo in local caring provision in the longer term.

We also found one of the **main barriers to market creation** to be the economic viability of the service model to make the service sustainable for all users. Some cases found solutions to this barrier (*Advanced Telecare*), while others cut the service (*TELBIL* and *Action*). For example:

- *Advanced Telecare* had difficulty in establishing an economic model capable of producing an accessible offer for larger numbers of people which would be economically viable. Its economic model is based on a Public Service Delegation contract, and agreements with private and public organisations to cover part of the cost of the service to users. This strategy allows the General Council to offer the service at a similar price to the previous telealarm service, and to reach a high number of people in need.

- *TELBIL* and *Action* stopped delivering the service due to lack of funding. In the case of Action, the municipalities could not support the service with their own funds, and could not maintain it once the national funding ceased. Thus *Action* could not develop an economic model that created a market and scaled-up the service. Although, there were many local implementations, these were small-scale, around 20 users, which was insufficient to create the critical mass of users needed. A competitor, GAPET, entered the market offering a cheaper and alternative solution that was chosen over Action by the municipalities. Another competitor of *Action* is Tunstall Nordic, which offers standard telehealth and telecare solution packages.

Finally, regarding **scaling-up strategies observed beyond local, regional and national levels**, *Advanced Telecare* and *Action* have scaled-up the service over the region and the country, respectively. While *Advanced Telecare* has managed to replicate the service, *Action* has not, because both the strategies and the aim of the scale-up are different. Specifically:

- *Advanced Telecare* was implemented in two other Departments of the Limousin Region (Corrèze and Haute-Vienne), and in the Loir-et Cher Department (Centre Region). This scale-up was initiated and carried out by the General Councils of the respective Departments (not the Creuse Department). The strategy used for this replication was based on exchanges and collaborations among policy makers and technical officers of the Creuse General Council with the relevant General Council of these Departments. The Creuse General Council also helped them to define the economic and organisational models needed and informed them of the facilitators and barriers. These cooperations are conducted via face-to-face or phone meetings, or presentations. As the case representative commented, implementation in bigger departments could be a barrier to replicability of the service as it requires a bigger effort and bringing together a higher number of stakeholders.

- For *Action*, it was not possible to scale-up the service around the country because of the existence of different factors related to (Magnusson and Hanson, 2012; Hanson and Magnusson, 2014):
  - The organizational complexity of the municipality: it was difficult to integrate the service into the delivery chain, as stand-alone services; there were no funds which municipalities to apply for; and they did not have enough budget themselves.
  - There were some challenges in relation to local care staff. There were some reluctance among care staff, in the sense that some of whom (in particular care assessors) believed only human interventions can be successful. There was also a relatively high level of turnover of senior care managers, which can be a problem when trained and dedicated *Action* champions leave. It was hard to replace them and this set the service back (there were instances where the replacement manager did not want to continue and the service was ultimately terminated).
  - Sound and convincing evidence of impact and efficiency (particularly financial) was lacking.
  - There was a need for sound business / financial plans and models.

- There was a need for a more favourable policy context, at all levels (local, regional, national).
- It was hard to build up a critical mass of users.

- For **TELBIL**, researchers are trying to replicate the service outside the Basque Region, participating in European projects. They are involved in a project funded by the European Commission's ICT Policy Support Programme: United4Health (UNIversal solutions in TElemedicine Deployment for European HEALTH care) which aims to exploit and further deploy innovative telemedicine services implemented and trialed in 15 European regions. The case representative's team has also advised on the implementation of the telemonitoring service based on their experience in other Spanish localities, such as Sevilla (Andalucian Region) and Valencia (Valencian Region).

Available technologies that help older adults to live independently

In the four cases studied, the technologies used (both devices and communication technologies) were simple and commonly available on the market. We list below the different technologies:

- Telecare devices:
  - Bracelet
  - Pendant
  - Telecare hub unit
  - Transmitter (speaker and a microphone)
- Sensors:
  - Gas sensor
  - Smoke sensor
  - Temperature sensor
  - Bluetooth wireless sensors to measure blood pressure, heart frequency and oxygen saturation
  - Fall sensor
  - Flood sensor
  - Bed/chair occupancy sensor
  - Enuresis sensor
  - Movement monitors and detector
  - Epilepsy monitors
  - Movement detector
  - Carbon monoxide monitors
- Alarms:
  - Smoke alarm
  - Automated reminders
  - Video door entry alerts
  - Electric window/door openers
- Communication and liaison systems:
  - Radio
  - GPRS
  - Broadband connection
  - Virtual Private Network
  - Electric network

- o Switched Telephone Network
- LED or automation of existing lighting with motion detection
- Smart phone personal digital assistant, equipped with:
  - o windows mobile operating system
  - o Tactile screen
  - o Manual input of temperature, heart frequency, clinical situation questionnaire and changes, and recording of intake and compliance with medication and diet
- Software:
  - o Windows mobile operating system
  - o A software to interpret the data and communicate the sensors
  - o Antivirus with firewall
  - o Action application
  - o Web manager
- Computer with:
  - o Screen
  - o Keyboard
  - o Mouse
  - o Videophone
  - o Microphone

These technologies addressed older adults' different daily living needs and also monitored their health conditions.

In general, the investment of public authorities in these technologies is not high, for example:

- In the case of *Advanced Telecare*, the total cost of the technology is 890 € per unit or 963 € per unit depending on the light path. It included:
  - o Transmitter + bracelet/pendant = 140 €/unit
  - o Gas sensor = 132 €/unit
  - o Smoke sensor = 66 €/unit
  - o Temperature sensor = 98 €/unit
  - o Solenoid valve = 58 €/unit
  - o Remote control shut off valve = 45 €/unit
  - o Light path: 424 or 351 €/unit
- The *TELBIL* equipment cost 782€.   It included the Smart phone personal digital assistant and some sensors. There was also a cost associated with the registration and maintenance of the private technical provider, see below:
  - o Registration of the organisation: €1,500
  - o Registration of the devices: 85 €/patient
  - o Registration of the web end-users: 25 €/professional
- *Action* costs 145 €/month/user. This cost includes:
  - o Computer+webcamera+loudspeaker+antivirus programme: 45 €/month/user
  - o Action application: 100 €/month/user

Standards and interoperability of solutions

As stated in the 2012 report of the German Commission for Electrical, Electronic and Information Technologies of DIN and VDE (DKE):

- Interoperability refers to the ability of two or more systems to work together to perform a task by communicating via their interfaces (DKE, 2012).
- The concept of interoperability can be broken down into several levels, as described for example in ETSI ETR 130:1994 (DKE, 2012):
  - Protocol interoperability is the ability of a remote system to exchange data packages via the basic communication system.
  - Service interoperability (or syntax interoperability) is the ability of a remote system to offer a sub-set of a remote service according to a functional specification.
  - Application interoperability (or semantic interoperability) is the ability of a remote system to warrant consistent implementation of syntax and semantics of the exchanged data.
  - Interoperability for the user applies when the user can exchange information using the remote system.
- A standardization of functions and interfaces simplifies the comparison of products or components before purchase, combinability during installation, exchangeability during maintenance, and retrofitting during extension of a system.
- The primary beneficiaries of this flexibility are the users at the end of the value chain, since a better comparability and exchangeability of components leads to more choice, more competition and, consequently lower prices. Vendors also benefit from interoperability since they can flexibly combine their products and components with components from third parties to offer functionality not available in their own product range (Eichelberg and Rölker-Denker, 2014).
- The "usual" approach to achieving interoperability for all parties involved is to reach consensus about the interfaces between systems and system components at different levels. These refer to both "hardware" interfaces between sensors, actors, and IT components and "software" interfaces between software components (services). Consensus is usually codified into standards (both legal and industry standards.).
- Standards and specifications are developed on various levels (national, European, international) in different organizations.

  The major international standardization organizations involved in full consensus-based standardization are (DKE, 2012):
  - ISO (International Organization for Standardization)
  - IEC (International Electrotechnical Commission)
  - ITU-T (International Telecommunication Union)

  The corresponding standardization organizations on a European level are:
  - CEN (European Committee for Standardization)
  - CENELEC (European Committee for Electrotechnical Standardization),
  - ETSI (European Telecommunications Standards Institute)

  Further standardization organizations also exist, frequently only on a national or regional level. For example, the "Integrating the Healthcare Enterprise" (IHE) is an international organization made up of various national organizations, that stipulates requirements and gives a detailed description of how existing specifications are to be applied in the healthcare sector (DKE, 2012).
- Standards applicable to technology-enabled services to help older adults live independently at home already exist, covering all kinds of communication protocols. For example, a repository created by the AALIANCE2 project references more than 400 standards of relevance for the Ambient Assisted Living sector[11] (Eichelberg and Rölker-Denker, 2014).

---

[11] http://nero.offis.de/projects/aaliance2/start

- The existence of multiple standards makes it difficult to choose one for a particular use. As pointed out by DKE (2012), given the diversity of topics and standards relevant to technology-based services to help older adults live independently, cross-vendor interoperability of systems and components will only be feasible if it is possible to identify "typical" systems applications and to standardize the corresponding components, interfaces and data formats etc. These typical use scenarios are similar to the case-centred integration profiles already employed by medical technology to improve interoperability.

- The following organizations have developed integration profiles (for different industry sectors), although not all of them actually call their specifications "integration profiles" (Eichelberg and Rölker-Denker, 2014):

  o The Integrating the Healthcare Enterprise (IHE) initiative (www.ihe.net) has, since 1998, developed and published about 100 integration profiles as part its "technical frameworks", mainly focused on the integration of IT systems within hospitals. There are also some profiles which address the exchange of health information between health professionals or between patient and health professional.

  o The Continua Health Alliance (www.continuaalliance.org) publishes the Continua Design Guidelines.

  o The Healthcare Information Technology Standards Panel (HITSP, www.hitsp.org) is a US-specific initiative that aims to harmonize and integrate standards to meet clinical and business needs for sharing information among organizations and systems in the healthcare sector. HITSP publishes a comprehensive set of specifications that are freely available and, on a technical level, mostly based on the work done by IHE and Continua.

  o The Digital Living Network Alliance (DLNA, www.dlna.org) develops interoperability profiles for multimedia applications, based on Universal Plug and Play (UPnP), and offers a certification programme for compliant products.

  o In the eHealth sector, the epSOS project (http://www.epsos.eu/) and the Antilope project (www.antilope-project.eu) have both adopted this approach.

  o The "VDE application guide[12]" (which essentially is a national pre-standard) looks at the method for describing integration profiles in the ambient assisted living (AAL) sector.

When we reviewed the cases studied, the main barriers to interoperability found were:

- The electricity supply in some older people's homes was unsuitable for use with the telecare equipment supplied. The solution was to adapt the electricity supply, supported by local government funding and professional support.

- The roaming service, like the GPRS mobile data service, does not allow older people to send information when they are outside the country.

- In *TDP* care provision depended on partnerships spread across the country where each used a different kind of device, raising interoperability problems. A lesson learned was that standards and procurement procedures should be more harmonised or standardised for successful and sustainable mainstreaming of reliable telecare service delivery.

Impact evaluation

All four cases assessed the impact of their technology-enabled services to see whether they had achieved their policy objectives. Advanced Telecare and *TELBIL* both used experimental studies in which they compared a small number of users and non-users of the technology-enabled service. They used baseline and outcome variables over 12 months of use, standardized instruments and bespoke questionnaires.

---

[12] https://www.vde-verlag.de/standards/0700848/vde-ar-e-2757-6-1-anwendungsregel-2014-09.html

- *Advanced Telecare* carried out a prospective cohort study, comparing 194 older adults, some of whom were exposed and others not exposed to one year of the service. The study evaluated variables measured at baseline and follow-up, as well as outcomes variable at follow-up.

  The variables evaluated at base line and follow-up were:

  - Socio-demographic data,
  - Medical history of previous falls, comorbidities and medication,
  - Functional autonomy status,
  - Frailty status,
  - Cognitive status,
  - Nutrition status,
  - Depression status,
  - Arterial hypertension,
  - Existing illnesses, visual and hearing impairment, incontinence and orthostatic hypotension.

  Outcome variables evaluated at follow-up were:

  - Incidence rates of falls at home over 12 months,
  - Hospitalizations after falls at home,
  - Acceptability.

  Some variables such as functional autonomy, frailty, cognitive status, nutrition and depression were evaluated using standardized instruments, while the other variables were assessed using medical records and open questions designed by the research team.

- *TELBIL* carried out two experimental studies. One was a pilot study using a randomized control trial, composed of a sample of 58 in-home patients, randomly allocated to intervention and control groups, with a 12 month follow-up (evaluations at 3, 6 and 12 months). The second was a pre-post evaluation study over 12 months, using a convenience sample of 28 patients from the previous pilot study.

  The variables evaluated at base line and follow-up and the instruments used are summarized in the table below:

	Study 1	Study 2	Instrument
Variables evaluated at base line			
Socio-demographic data			Questionnaire
Clinical data	Diagnosis of heart failure and chronic lung disease	Main pathologies	Hospital records
	Requirements of home oxygen therapy		Question
	Comorbidity	Pluripathologies	Standardized instrument
	Regular medication	Number and list of regular medication	Medical records
	Treatment adherence		Questionnaire
	Functional status	Functional status	Standardized instrument
	Health outcomes		Standardized instrument
		Quality of life (standardised)	Standardized instrument
Burden of informal carers	Burden of informal carers		Standardized instrument
Use of health care resources	Number of hospital admissions		Records
	Use of other health care resources		Records
Outcomes measures (12 months):	**Use of health care resources:**		
	Number of hospital admissions in 12 months	Number of hospital admissions	Questionnaire
	Duration of hospital stay	Hospital stay length	Questionnaire
	Number of hospital admissions due to exacerbations	Number visit to emergency	Questionnaire
	Level of use of health resources		Questionnaire
	Cost-effectiveness analysis expressed in QUALY		Calculated from other variables (duration of hospital stay, use of emergency services, purchase and maintenance of telemonitoring devices, number of consultations and time of the health care personnel and dedicated to service, and the health related quality of life
	Record of clinical data:		
	Mortality rate		Clinical records
	Health related quality of life	Quality of life related to health	Standardized instrument
	Clinical efficacy		Questionnaire
	Functional status	Functional status	Standardized instrument
Burden of informal carers	Burden of informal carers		Standardized instrument
Evaluation of the service	Degree of acceptance and satisfaction of patients and health professionals (standardised)	Patient and relatives, and professionals satisfaction	Questionnaire
	Technical performance and compliance with the telemonitoring system		Questionnaire
	The reliability and performance of telemonitoring system		Questionnaire
Reasons of losses of patients			Questionnaire

Patients were asked for their informed consent, and the hospital's Scientific Research Ethics Committee approved the study.

Action, by contrast, did several evaluation studies using mainly interviews and focus groups to assess the impact of the service on quality of life, and the cost of and satisfaction with the service. In *TDP*, impact assessment data came from quarterly returns from the local partnerships. In both cases, and particularly in *TDP*, the sample used was large. Specifically:

- *Action* carried out 3 studies:

The first selected a sample of 1,838 older people and family carers who had been using Action in their homes for 3-4 months. Researchers evaluated the impact of the service on the autonomy, independence and quality of life of the users and their family carers, plus the costs associated with the service, using interviews and a focus group.

In the other two studies, the sample was much smaller. One was carried out with 3-4 carer/care recipient dyads who had been using Action in their homes for 3-12 months, and were recruited in 2 Swedish municipalities. The evaluation interviewed focus groups and assistant nurses in order to analyse the costs and the benefits of using Action for older people, their families and staff involved and in general to evaluate the service.

The second study was a pilot intervention, with a multi-method evaluation at 12 months. Individual structured interviews were carried out and standardized instruments were used. The sample consisted of 19 non-randomly assigned older spousal carers. The research evaluated:

– Socio-demographic data of spousal carers,

– ICT use,

– Knowledge about chronic disease and caring,

– Social network,

– Social support,

– Burden of care,

– Mental health,

– Carers' experience of the intervention.

- In the case of *TDP*, data were collected through evaluation of the 29,117 users of telecare of the 32 partnerships via quarterly returns, postal questionnaires for service users and informal carers, and 5 case studies:

Quarterly returns (submission of information by partnerships) evaluated:

– Reduction in emergency admissions to hospital (identified by JIT),

– Reduction in delayed discharges from hospital (identified JIT),

– Reduction in care home admissions (identified by JIT),

– Duration of each admission or delayed discharge avoided based on local records,

– Financial savings from avoided admissions and discharges (applying unit costs to health care home admissions),

– Local outcomes and efficiencies,

– Demographic details,

– Telecare equipment process.

Questionnaires evaluated (at the end of the evaluation period: from 2006 to 2008 and from 2006 to 2011):

– Users' perceptions of the impact of telecare on their health and quality of life,

– Change in the pressure on informal carers.

Case studies: 5 partnerships were invited to participate. Site visits allowed the researchers to carry out face-to-face interviews with a range of local managers and operational staff. They also met some service users and their carers, and saw local facilities for demonstrating relevant equipment):

– Assessment on how the funding was used to help people,

– Feedback on local experiences of developing and implementing telecare services.

Though the impact assessments in all the cases aimed to identify the benefits of the services as regards quality of life and the generation of savings for the public care system, the main **weakness** in assessing technology-enabled solutions across Europe was that generally there was

no common methodology for conducting evaluations. The sample, research method, variables evaluated and instruments, data collection methods were different. Other weaknesses arose from the samples that called into question the representativeness of the results. For example, some studies used non-randomized sample selection (*TELBIL*, *Action*) and small samples (*Advanced Telecare*, *TELBIL*, *Action*) which could offer a quick response to policy questions on impact, but were biased in the sense that individuals participating in the research were selected for convenience and were not representative of the population. The findings should therefore be interpreted with caution.

The **strengths** of these impact evaluations were that all used multidisciplinary assessment with different variables to measure specific indicators or policy objectives. Moreover, most also used standardized instruments to evaluate these variables, providing feasibility and validity and potential comparability of the results. The procedure for data collection followed by *TDP* was a strength: most evaluation was shared among the local partnerships, and the evaluation data provided was guaranteed as the government only funded partnerships which submitted evaluation information. This ensured data were collected from a large number of service users, and that data on the achievement of policy objectives was available.

Integration in the long-term care system

Facilitators for the integration of the service in the long-term care system are different for each initiative. We were able, however, to find common patterns among some of them. One of the main facilitators was the **availability of a policy framework** that supported development of the service as a regular service:

- In the case of *Advanced Telecare*, the General Council of the Creuse Department launched a Public Service Delegation in which they outsourced care provision to a care provider with competences in care and the technical equipment. The General Council left ownership and entitlement to the service in the portfolio of the departmental care system. This allowed the General Council to maintain its responsibility for quality of service provision. Moreover, the existence of a prior telealarm service helped with integrating the service, as it was easier to offer Advanced Telecare to older people who were already interested in a telealarm service.

- *TELBIL* was delivered by the regular primary care services of the public health care system, and the service was free for the end-users.

- In *TDP*, the policy framework developed by the Scottish Government to expand the telecare service in Scotland enabled the integration of the service. The Scottish Government led the development of the service, issuing a call for participation of appropriate stakeholders, and creating policy tools to facilitate the integration of the service in all the Scottish localities as a standard public care service. The Scottish government also involved key organisations in local health and housing and also social care partnerships, in integrating telecare into the day-to-day local service options. It made a toolkit available that supported the change management process, and the development of storage and tracking systems to ensure effective management of telecare equipment. It also provided a procurement framework for the supply of telecare, bringing in private technology providers to help address interoperability issues and offer flexibility in the choice of equipment. As in the case of Advanced Telecare, the existence of established community alarm services helped integrate telecare into the standard system of provision.

- The lack of a favourable policy framework and a well-defined roll-out plan for the municipalities was mentioned by Action as the main barrier to integration of the service in the public care system.

Another relevant facilitator was the **training and education of the main stakeholders** involved in the provision of the service:

- *Advanced Telecare* implemented an awareness plan for home care professionals before launching the service, ensuring their acceptance and willingness to integrate it as a standard service.
- *TELBIL* also trained the health care professionals, to make them competent in the new service and offer it to their patients as an improved service in the existing health care system.
- *Action* supported municipalities through a training and education plan, allowing the municipality to have in place a care ecosystem without creating a new one. Nevertheless, they did not manage to design an awareness plan that addressed the reluctance of professionals about the use and benefits of the service (as in *Advanced Telecare*).

Barriers found to integration of the service in the public care system were:

- *Advanced Telecare* and *TDP* experienced interoperability problems. In the case of *TDP* the electrical installation was not adapted to their equipment. The General Council overcame *Advanced Telecare*'s problem with an agreement with artisans and additional funding from the General Council. *Advanced Telecare* also has ongoing problems with the phone network (Orange) when there are failures in the network. So far, it has not been possible for the General Council to resolve these.
- For *TELBIL* and ACTION, an important barrier was the irregular funding, as the regional and local government did not include the service in its public health care system budgets as a standard service.

Policy role in the implementation models

In three of the four cases studied (*Advanced Telecare*, *Action*, *TDP*), **local governments** are in charge of implementing the service in the local care system, although the model is different in each:

- For *Advanced Telecare*, the main role of the department was to create, implement and scale-up the service, providing it with financial support and integrating it into the social services. It also created a rural excellence hub on home automation and health to boost the sector. The provision of the service relies on an economic model through a Public Service Delegation agreement that ensures the service is deployed and reaches an appropriate number of people in need. As main implementer of the service, they were also in charge of the impact evaluation of the service.
- In *Action*, the municipality was in charge of developing, promoting and providing the service with the support of Action Caring. The municipality of Borås mainstreamed the service, and paid the private company to provide the service, as far as national funding allowed.
- For *TDP*, local governments were asked to apply for telecare funds, in partnership with other stakeholders. Local governments were the initiators of the partnerships and became the main providers of telecare. Local partnerships also raised awareness of telecare among the general public, and trained staff working with users (mostly at the beginning).

Regional governments were more in charge of setting-up the strategy and providing the funding, mostly in the case of *TELBIL* and *TDP*, although the support of the regional policy was also relevant for Advanced Telecare:

- *Advanced telecare* was started in 2009 as part of the Limousin Region's long-term care strategy to reduce falls at home of older adult and the cost associated with these. The Limousin Region also provided funding equal to €600,000 through the "Contrat de Projets Etat-région 2007-2013 – Volet Handicap et Dépendance".
- *TELBIL*'s service was provided within the public national health care system. It relied on regional policies to create a service for health technology assessment in the region (as part of the health care regional ministry), and a strategy to deal with chronic conditions. The region also provided

funding for the impact evaluation study – a pilot undertaken by the Basque country's health care department.

- *TDP*'s programme was initiated by the Scottish Government to address population ageing. It funded the extension of telecare solutions and the number of people to be helped in the area. This regional programme was designed to obtain a return on social investment in terms of savings on the care systems and to boost the business side of telecare. Regional government also set up a governmental body – the Joint Improvement Team (JIT) – to supervise the programme and assure its quality. The JIT was created to give support, guidance and advice to the local partnerships.

Moreover, the regional government also undertook awareness-raising mainly among policy-makers and professionals. They published different policy documents and brochures on various topics, such as:

- *Reshaping Care for Older People: A Programme For Change 2011 – 2021*, address to the special needs of older adults, and highlights telecare as an everyday part of their care.

- *Scotland's National Dementia Strategy* highlighted the importance and opportunities that telecare services can offer for older people living with dementia at their home environment,

- *Scotland's Digital Future. A Strategy for Scotland* featured the telecare as a strategic area of public service delivery, with the commitment of government to telecare

The role of National and European policy is mostly to co-fund the service:

- *Advanced Telecare* received funding of €150,000 from the French Government, from the "Fond National d'Aménagement et de Développement du Territoire". Service implementation was also funded by the European Regional Development Fund.

- *TELBIL* was co-funded by the Spanish Ministry of Health, Social Services and Equality, through the Regional Ministry of Health of the Basque Country.

- *Action* received national funds from the municipalities which they in turn had received from the Swedish Government. Action was also funded by European Commission's Framework Programme (for its creation and development).

The limited availability of funding has affected the development of good policy, in some cases rendering the service unsustainable.

In general, policy has played a role in different stages of the services, but has been important from the start in setting up the service and in developing and maintaining it:

- In *Advanced Telecare*, policy affected the creation, implementation and scale-up of the service.

- In *TELBIL*, policy played a role prior to the launch of the service, promoting and supporting its development, and in setting policy goals and providing funding.

- In *Action*, policy played a part from the outset, with funding from the European and national level, and later local level to mainstream the service in the municipality.

- For *TDP*, policy was important from the start, in setting-up a framework for telecare. Training was initially carried out by the partnerships but in 2010, the Government took over responsibility for it.

Annex 3: Integration profiles

Integration profiles are designed for one single-use case: they describe the use case (application scenario) from a user perspective, identify the systems/components needed to implement or support the use case, and then enumerate the communication interfaces between the systems and components. The standards (and options, if needed) to be used for each interface are defined. From an implementer's perspective, integration profiles can be seen as design guidelines or standards-based "cook books" describing how to implement a certain use case in a way that ensures interoperability from a user perspective (Eichelberg and Rölker-Denker, 2014).

Integration profiles are developed as follows (Eichelberg, 2014):

- Analyze the use case.
- Identify the systems and system components involved (everything that could be implemented as a separate product). These components are called 'actors'.
- Describe interactions between systems and components. These are called 'transactions'.
- Select standards for each transaction, clarify ambiguities in the standard where "plug and play" interoperability needs to be achieved.
- Result: A "cookbook" (implementation guideline) for a modular architecture for a certain use case.
- Additional benefit: transactions can often be re-used for multiple use cases.

Integration profiles should include the following well-defined structure:

- Rationale and storyboard: What is this all about?
- Actors and transactions: components and interactions.
- Profile options: mandatory and optional features, alternatives.
- High-level process and data flow: how do the actors interact?
- Ethical and legal considerations.
- Transaction definitions: the "ugly technical details".

A detailed example can be found here:

http://www.cip-reaal.eu/fileadmin/content/press/MACSI_2014_S3.1_01_Eichelberg.pdf

JRC Mission

As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new methods, tools and standards, and sharing its know-how with the Member States, the scientific community and international partners.

Serving society
Stimulating innovation
Supporting legislation

Publications Office