Department
for Business
Innovation & Skills

The Case for Public Support of Innovation

Annex A

Contribution to the UK case study for the OECD TIP System Innovation project

technopolis [group]

Produced by Technopolis Ltd for the Department for Business, Innovation and Skills (BIS). This study was co-funded by the Technology Strategy Board (TSB).

As an addition to *The Case for Public Support of Innovation*, Technopolis were commissioned to gather evidence on assisted living. This is to feed into a case study by BIS for the OECD TIP System Innovation project. This document is an input and it is not the full case study. Additionally, this annex is entirely independent from the main report.

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Executive Summary

The UK like many advanced economies has an ageing population and there is no doubt that this demographic change will impact on both society and the economy. Internationally, governments are aware of this and the challenges that it may pose and many have committed to moving forward with policy related interventions which can be linked back to an evolutionary perspective, with countries are varying stages of development, or transition from a situation where this demographic change has been registered politically but with no meaningful response to the unfolding social and economic dislocation to a situation where older people are living longer, independently and remain fully engaged in society. Such interventions or policy responses include reducing pension benefits, reducing healthcare costs, extending working life, increasing pension fund savings, strengthening poverty floors, increasing fertility rates and increasing migration. Within this broad picture, innovation in services and technologies is seen a as a necessary additional response with markets not expected to respond sufficiently and mechanisms such as the Assisted Living Innovation Platform (ALIP) are in evidence in several countries.

ALIP is one example of a type of innovation-support measure launched by the Technology Strategy Board in the mid-2000s, which adopts an innovation systems perspective as its basic intervention logic. The Innovation Platforms extend the Board's portfolio of support measures beyond the classic supply-side instruments like the Smart scheme or collaborative R&D programme, and provide a more open and flexible response to the dynamic conditions that characterise areas of profound social change and thereby provide an altogether more powerful means by which to catalyse innovation, at both component and system levels.

In the process of reviewing the UK's ALIP this case study has attempted to characterise system transitions within the context of an ageing population which is moving from a situation where the majority of elderly residents are cared for in hospital or in residential/nursing care to one where the majority of residents are able to live independently for longer with the reduced need for medical intervention. The characterisation of this transition has indicated three clear stages; embryonic, middle and advanced which reflects the proportion of the total population aged 65+, the level of political acknowledgement of the societal challenge posed by an ageing population, policy responses by individual policy areas, the piloting of new policies and services and the change attitudes and social values to an ageing population.

In exploring this transition, this case study considers both the drivers of the transition as well as the bottlenecks and barriers faced to help understand where the UK is positioned within this systems transition. In relation to the drivers of the UK transition, this case study demonstrates that demographic change is largely responsible for this transition but that this is accompanied by other drivers such as unsustainable health and social care costs of an ageing population, an increased expectation of older citizens to enjoy life and to live independently as well as technical change in which a technology savvy population expects technology to play an increasingly important role in their lives. In contrast the bottlenecks and barriers faced by the system in transition include the traditional independent operation of health and social care systems, a focus on activity rather than outcomes, health and social care professionals wary of changing practices, uncertainty over the business case for assisted living technology among institutional customers and a high cost of current private products and services in a relatively small consumer market.

There has been substantial policy activity in the UK to address the ageing population and the associated unsustainable health and social care costs faced. At the international level this has come in the form of the Madrid International Plan for Ageing 2002, which focuses on three priority areas namely older persons and development, advancing health and well-being into old age and ensuring and enabling supportive environments as well as the Ambient Assisted Living Joint Programme. At the national level the UK by the development and publishing of a number of White Papers detailing support for innovation in the form of the Preventative Technologies Grant followed by the launch by ALIP by the TSB and the launch of the Whole Systems Demonstrator project. Further to this the UK is undergoing a series of health and social care reforms, which seek to integrate services, which is particularly important for the development and deployment of assisted living technologies.

This case study then goes onto to discuss the role of these policy measures and the evidence from the WSD is discussed here alongside the result of the smaller pilot telecare project in Kent and the results of a similar study conducted by the Veterans Association in the USA. With these results in mind the case study then goes on to discuss a number of key policy challenges still to be addressed for the UK to continue in it's transition to a society where older people continue to live independently which are considered in the context of institutional incentives, integrated health and social care, affordability and the health divide and public procurement and lead markets.

This document concludes by providing a suite of policy interventions, policy objectives and measures that can stand together as a toolkit for the UK government in organising its response to the challenge of an ageing population going forward.

1. Introduction

1.1 This paper

The paper has been written to support BIS in its preparation of a case study of innovation support in the UK, for the OECD. It has been developed primarily through desk research, complemented by stakeholder interviews and using the OECD case study template to structure data collection and presentation of the results.

The focus of the OECD case study is on *a socio-techno-economic system in transition* and BIS has elected to focus on the UK's ageing population and its transition from a situation where a majority of the country's elderly citizens are cared for in hospital or residential homes to one where the majority is able to live independently for longer and with reduced medical intervention. This will be achieved in part through technological and social innovation, making possible a move towards assisted living in one's own home and earlier preventative advice / support and the related need / opportunity for government to catalyse / accelerate efforts to develop assisted living technologies.

The central importance of innovation to this social transformation is widely acknowledge and prompts a focus on the Technology Strategy Board's Assisted Living Innovation Platform (ALIP), while recognising that the innovation platform is only *one* policy response that the UK government has put in place to facilitate the transition. We describe several other important wider policy measures to promote innovation in assisted living, however analysis of these broader (non-innovation) policies, on for example pension reform, have been left for BIS to elaborate separately.

We have also sought to characterise the stage of transition within the system in the UK, first in terms of the societal and policy response to an ageing population and secondly in terms of the stage of development of assisted-living technologies.

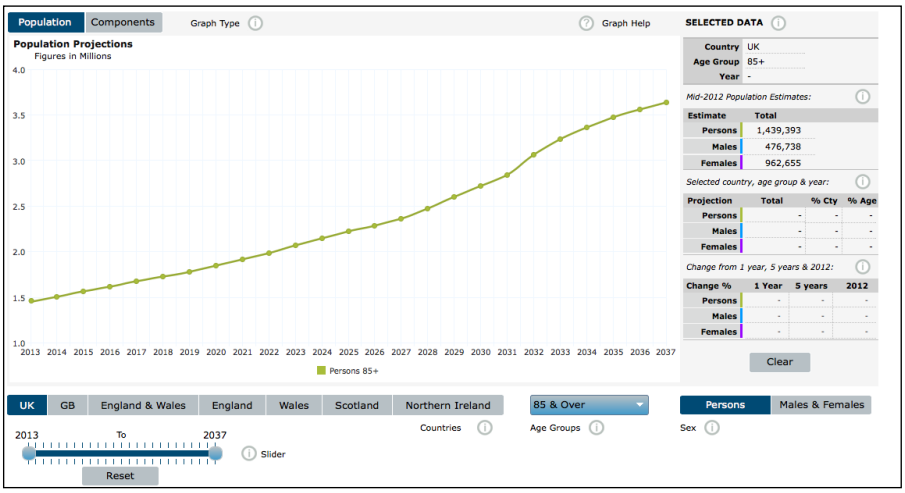
There is nothing ground-breaking about the methodology employed here, which amounts to a process of deductive reasoning, working top-down from a broad spectrum of macro information about population demographics, government policy and innovation support, among other things, towards a more specific conclusion about the state of play of assisted living in the UK. We have used primary and secondary sources to consider a series of intermediate ideas or hypotheses along the way, in order to inform our reflections / judgement as regards the stage of development reached, whether that is the importance of wider framework conditions (like pension reform or tax breaks) as a catalyst for change or more immediate drivers and barriers, such as the receptiveness of older people to the innovations in question or the compatibility of such developments with the public institutions the must interface with.

There are a number of important challenges, in methodological terms, which may be common to investigations of systems in transition. The first challenge is conceptual, wherein the majority of written evidence and oral contributions adopts a rather narrow focus, dealing with a specific action or programme, and offering only a very limited or cautious view as to the state of play of the so-called system. The idea of assisted living is still rather novel and contributors were not always comfortable drawing out the logical connections between their specific activities and the more general or systemic developments regarding the transition (maturation) of the technology and its impact on an independence of the UK's elderly population. Additionally, when studying systems in transition, there are likely to be numerous data limitations – patchy, inconsistent, contentious – and all of these classic challenges revealed themselves here. In this case, the subject proved to be rather controversial and complicated our consultation process, requiring above average efforts to gather the necessary range of opinions and uncharacteristically slow / low responses. Our pragmatic solution has been to search out as many secondary data as we can find, from multiple sources, and look for convergence amongst those data, and ultimately offer quite cautious conclusions and recommendations. It was beyond the scope of this particular exercise to look more systematically at the robustness / limitations of the individual data sources used in our analysis or indeed to systematically document what data exists and what data are missing (the known and the unknown, so to speak).

1.2 An ageing population

An ageing population is a big issue for all advanced economies. People are living longer, which is changing the balance in the overall population between those of working age and those over retirement age. Key figures also concern the increasing the number of people over 85: the ONS National Population Projections 2012 (November 2013) predicts that the number of people over 85 in the UK will more than double in the next 20 years, from 1.4 million today to 3.1 million in 2032.

Figure 1 – UK Population Projections



Source – Office for National Statistics[1]

At its simplest, this kind of demographic change alters the 'dependency ratio' between younger and older citizens, wherein the working population pays taxes in part at least to cover the social costs of the non-working (retired) members of the population. An ageing population places increasing pressure on any society, a challenge that is revealed across much of the OECD with an evident worsening in the Old Age Support (OAS) ratio (the number of people of working age relative to the number of retirement age). In the UK, that ratio is forecast to worsen over the coming 20 years, from 3.21 (2012) to 2.76 (2032).

The change in the UK ratio would be more striking had it not been for various government initiated pension reforms, with for example, the 2011 Pensions Act equalising the State Pension age for men and women by 2018 and also announcing that the retirement age for both will with rise from 65 to 66 by 2020. Immigration has also proved to be an important bulwark, with economic migrants mostly comprising people of working age, many of who will leave the country when they are older, returning to their homes and families.

It's not all about the OAS dependency ratio, however. Increasing numbers of elderly people are frail and suffering from various chronic illnesses and in need of almost continuous healthcare provision or residential care. Healthcare expenses are rising rapidly, in part because of this changing composition in demand: this segment of the population accounts for a disproportionate share of the costs borne by the health service overall.

1.3 Rationale for government intervention

The UK government, and many other governments around the world, have concluded that the impact of an ageing population on healthcare and other social systems is unsustainable, and that retirement age and pension reform is an insufficient response and that the challenge requires action on a broader front. This involves more than economics, with a strong political impetus to ensure that

[1] "Interactive Graph - National Population Projections 2012-Based" http://www.ons.gov.uk/ons/interactive/ppu-2012-v2/index.html

older people remain engaged socially and can live dignified lives and contribute socially to the greatest possible extent.

The ageing population is a demographic change that affects millions of people directly, and will affect the great majority of the UK population indirectly through taxation of one kind or another and possibly through qualified access to health care provision, making it a public good issue.

Governments have a natural role to play in the provision of universal health and social care, for everyone, including older people. It is widely accepted that markets do a poor job of achieving socially desirable and economically efficient levels of health and social care provision for all, which explains the predominance of national health and social care systems throughout the world.

The public good argument has its corollary in arguments about the case for public support for innovation in the health and social care sectors, where the scale and complexity of public provision (and its regulated nature) makes it difficult for any individual actor – public or private – to implement major reforms. And reform is needed.

Healthcare systems are already stretched to the limit with The Nuffield Trust estimating that under the current healthcare system arrangements, the NHS in England will see a funding shortfall of £54 billion by 2021/22[2] if NHS funding remains constant in real terms, if no productivity gains are made and if trends continue in current hospital utilisation by people with chronic conditions (accounting for 70% of total health and social care spending in 2010)[3]. Without change, the health service will need to ration its provision through more determined selection / triage as to what can be treated and how and also by generally lengthening waiting times to reduce overall rates of throughput. Rationing and extending delivery must have a negative impact on the services health outcomes (KPIs), all things being equal. Presumably such external pressure will increase the risk of system failures too, in some degree at least.

The market cannot be expected to respond quickly or robustly to these broad societal trends, even if it can address the issues in some degree through various innovations in nutrition, self-diagnosis or medical devices.

Moreover, there is likely to be a substantial proportion of the total population of frail elderly that will not have the means to take advantage of new commercial products and services and will still look to the health service. If the pensions crisis continues to worsen, a substantial and a growing proportion of older people will not be financially secure and health issues may spiral as poverty in old age becomes a reality for increasing numbers of individuals. The government may also need to raise taxes across the board in order to cope with a smaller working population and larger and frailer retired population.

The ALIP is one of several important anticipatory responses to this demographic change, seeking to promote wide-ranging innovation as a means by which to reduce the need for medical intervention while also allowing the elderly and frail to live with more dignity and autonomy. ALIP's social objectives are expected to deliver economic benefits too, through a reduction in the burden on the healthcare services and through increased commercial opportunities for the innovators.

1.4 An international debate

The ageing population is not just a UK issue; it is affecting societies throughout Europe and around the globe. There are numerous parallel initiatives in Europe and further afield. Notably the European Commission identified Active and Healthy Ageing as one of Europe's five grand (societal) challenges, and has launched various research and coordination platforms to detail the issues, agree action plans, define research roadmaps, and so on.

[2] Nuffield Trust. (2012). A decade of austerity? The funding pressures facing the NHS from 2010/11 to 2021/22.

[3] Department of Health, Improving the Health and Well-Being of People with Long Term Conditions: World Class Services for People with Long Term Conditions – Information Tool for Commissioners, 2010

The European Innovation Partnership[4] on Active and Healthy Ageing is a similar kind of initiative to ALIP, working at the European level. It is based on an innovation platform or partnership that is designed to bring together stakeholders from across the system to address systemic weakness in the related European research and innovation system (notably, under-investment, conditions which are not sufficiently innovation-friendly, and fragmentation and duplication).

The AHA partnership has three goals

- Enabling EU citizens to lead healthy, active and independent lives, while ageing
- Improving the sustainability and efficiency of social and health care systems
- Boosting and improving the competitiveness of the markets for innovative products and services, responding to the ageing challenge, thus creating new opportunities for businesses

This will be realised in the three areas of prevention and health promotion, care and cure, and active and independent living of elderly people. The overarching target of this partnership will be to increase the average healthy lifespan by two years by 2020. The AHA Partnership aims to achieve this by bringing together key stakeholders (end users, public authorities, industry); all actors in the innovation cycle, from research to adoption (adaptation), along with those engaged in standardisation and regulation. The partnership provides these actors with a forum in which they can cooperate, united around a common vision that values older people and their contribution to society, identify and overcome potential innovations barriers and mobilise instruments.

The World Health Organisation (WHO) has been championing the issue of active ageing for even longer.[5]

> *… population ageing will … present both challenges and opportunities. If we do not adapt, it is likely to strain pension and social security systems, increase demand for acute and primary health care, require a larger and better trained health workforce and increase the need for long term care, particularly in dealing with dementia.*
>
> *The societies that adapt to this changing demographic can reap a sizeable "longevity dividend", and will have a competitive advantage over those that do not.*
>
> *But this will not come easily. We first need to change the way we think and the way we do business. We need to discard our stereotypes of what it is to be old. We need to consider the interaction of ageing with other global trends such as technological change, globalization and urbanisation. We need to "reinvent" ageing. Above all, we need to be innovative and not simply try to reinvent the past.*
>
> *Dr Margaret Chan, Director-General of the World Health Organisation (WHO) in a foreword to a recent book on the implications of global ageing*[6]

The subject has been a topic of debate at Davos, with Joseph Jimenez, Chief Executive Officer of Novartis, presenting his thoughts on the subject to the World Economic Forum's Annual Meeting in Davos-Klosters (January 2014). Indeed, the World Economic Forum has set up a Global Agenda Council on Ageing (2012-2014),[7] which is working on developing guidelines for age-friendly businesses, an index of ageing preparedness and preparatory discussions to ensure that population dynamics are included within the next set of UN development goals.

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[4] About the European Innovation Partnership on Active and Healthy Ageing http://ec.europa.eu/research/innovation-union/index_en.cfm?section=active-healthy-ageing&pg=about

[5] WHO definition of active ageing: the process of optimising opportunities for health, participation and security in order to enhance quality of life as people age. Active ageing applies to both individuals and groups. It allows people to realise their potential for physical, social and mental well-being throughout their lives and to participate in society according to their needs, desires and capacities, while providing them with adequate protection, security and care when they require assistance (WHO 2002).

[6] John R. Beard, Simon Biggs, David E. Bloom, Linda P. Fried, Paul Hogan, Alexandre Kalache, and S. Jay Olshansky, eds., Global Population Ageing: Peril or Promise, Geneva: World Economic Forum, 2011.

[7] http://www.weforum.org/content/global-agenda-council-ageing-2012-2014

To help provide a comprehensive assessment of the progress that countries are making in preparing for global ageing, a Global Ageing Preparedness (GAP) Index has been developed which aims to capture the full impact of the demographic transformation through until 2040. The Index consists of two sub-indices, the 'fiscal sustainability index' and the 'income adequacy index'.

The GAP Index looks at projections of public old age benefit spending (including both pensions and health) and the fiscal room that different countries have to accommodate their growing ageing populations, by raising taxes, cutting spending or borrowing. From the perspective of adequacy, the GAP Index tracks trends in living standards of the elderly relative to the non-elderly in each country based on projections that take into consideration the impacts of changes in public benefit programmes, private pension provision, and labour-force participation rates as well as including indicators that measure the robustness of safety nets and family-support networks. The results of the GAP Index are provided in the form of a strategy guide below, which shows the potential pay-off of seven key fiscal strategies according to the GAP Index between different countries. Reducing healthcare costs is a significant priority for the UK (receiving 2 out of 3 possible stars).

Figure 2 – GAP Index Reform Strategy Guide

	[1] Reduce public pension benefits	[2] Reduce health-care cost growth	[3] Extend work lives	[4] Increase funded pension savings	[5] Strengthen poverty floors	[6] Increase fertility rates	[7] Increase immigration
Australia	★	★★	★		★★	★	
Brazil	★★★	★	★	★★		★	★
Canada	★	★★	★			★★	★
Chile	★		★	★	★	★	★
China	★		★★	★★	★★★	★★	★
France	★★★	★★★	★★★	★★★		★	★
Germany	★★★	★★	★★	★★		★★★	★★★
India			★★	★★	★★		
Italy	★★★	★★	★★★	★★	★	★★★	★★
Japan	★★★	★★		★★	★★	★★★	★★★
Korea	★	★		★★★	★★★	★★★	★★★
Mexico				★★	★★★		★
Netherlands	★★	★★★	★★			★★	★★
Poland	★★★		★★	★★		★★★	★★
Russia	★		★★	★★	★	★★★	★
Spain	★★★	★★	★★★	★★★	★★	★★★	★★
Sweden	★★	★★	★	★		★	
Switzerland	★	★★	★		★	★★★	★
UK	★	★★	★★	★	★	★	
US	★	★★★		★	★★		
High-priority	7	3	3	3	3	8	3

	[1] Reduce public pension benefits	[2] Reduce health-care cost growth	[3] Extend work lives	[4] Increase funded pension savings	[5] Strengthen poverty floors	[6] Increase fertility rates	[7] Increase immigration
Reform guide key:	No star = not a priority		★= low priority		★★= significant priority		★★★= high priority

Source: The Global Aging Preparedness Index[8]

The choice of countries is perhaps not idea for our purpose here, inasmuch as it presents countries with radically different baseline conditions – social and economic – and that in turn must affect the potential for further policy intervention. So, the weighting of priorities must in part reflect the nature and extent of the problem nationally as well as pre-existing interventions. So, there is a widespread prioritisation of policies to 'increase fertility rates,' which is arguably less appropriate in a geographically small and densely populated country like the UK. The focus on healthcare is also clearly more of a priority where there are large and costly healthcare systems or where there is a groundswell of public opinion regarding the need for reform and increased equity (i.e. 'Obamacare' in the US). Notwithstanding these reservations, the table does underline the diversity of policy responses and underlying situations, and the different stages of transition. It is also a useful guide in the context of the next section where stages of system transition will be discussed in more detail. Those countries shaded orange will be discussed further here.

2. Characterising system transition stages

When considering systems innovations, which is fundamentally about the transition of entire systems, it is first important to define each of the stages of transition.

This will help us to determine what stage of transition the UK is currently in as we move from a situation where a majority of the country's elderly citizens are cared for in hospital or residential homes to one where the majority is able to live independently for longer and with reduced medical intervention, through assisted living in one's own home and earlier preventative advice / support. Each of these stages is defined in the table below:

Figure 3 – System Transition Stages

Stage	Definition
Embryonic	• People of retirement age constitute more than 15% of the population • Politicians have acknowledged the issue of active ageing in their mandate • There exists a national policy on active ageing
Middle	• All of the above • Plus: • Individual policy areas have developed policy responses, strategies and action plans • Widespread pilot initiatives have been launched • Evidence of achievements is being used to inform the modernisation and reform of public institutions
Advanced	• All of the above • Plus: • Headline statistics show the proportion of older people living longer at home is XXX

[8] "The Global Ageing Preparedness Index" https://csis.org/files/publication/101014_GlobalAgingIndex_DL_Jackson_LR.pdf

	• The proportion of the overall national health budget spent on the treatment of older patients is reducing • Social values / attitudes are changing towards older people with a greater proportion of the post-retirement population still economically active in some degree

The stage of transition in the UK is ahead of that of many other European countries, despite the fact that an ageing population is an issue faced by many EU economies and the population of those aged 65+ years is expected to rise from 87.5 million in 2010 to 156.2 million in the EU27 by 2060[9].

A country that may be considered in at an earlier stage of transition than the UK is that of Sweden. According to the GAP Index strategy for Sweden there is a significant priority placed on reducing healthcare costs, however, unlike the UK there is no specific policy in relation to assisted living technologies, or more specifically, to telecare. In Sweden, where the population aged 65+ accounts for 18% of the total in 2010 and set to rise to 26% by 2060[10] each municipality sets their own policy in relation to care and this is where, if at all, telecare may feature. There are a few small-scale trials across the country and the Health Institution is working on telecare services for elderly and disabled people. Hence, there is considerable variation across the country and subsequently Sweden is in very the very early stages of a transition to independent living for its older adults for as long as possible. In contrast, in the UK, there are numerous research projects and pilot schemes experimenting with new service designs and assistive technologies.

In the UK in 2010 the population aged 65+ accounted for 17% of the total population and by 2060 this is expected to rise to 25%. The challenges of an ageing population in particular relation to impacts on the health and social care economies are a current focus for national policy. This comes in the form of White Papers, the funding of the Whole Systems Demonstrator project, funding of a number of smaller telehealth and telecare pilot schemes as well the establishment of the Assisted Living Innovation Platform in conjunction with the TSB. The results of the WSD and smaller pilot projects have been reported and subsequently an initiative to enable telehealth and telecare services to reach 3 million people nationwide has been launched.

However, despite the relative advances made in assisted living technologies in the UK, the US has seen even greater advances in telehealth services with the Department of Veteran Affairs now providing telehealth (including telecare) to half a million veterans[11]. (Interestingly, the USA according to the GAP Index strategy, has a high priority for reducing healthcare costs and maybe this suggests that being at a later stage in the transition means that the priority for reducing healthcare costs rises). Telehealth services were piloted as early as 1977, but came to the fore in the late nineties when the Veterans Health Administration (VHA) rolled out its first telehealth program called Care Coordination/HomeTelehealth (CCHT) between 2003 and 2007. The purpose of this program was to coordinate the care of veteran patients with chronic conditions and avoid unnecessary admittance to long-term institutional care. The initial results of this study showed a 25% reduction in bed care days for the 17,025 strong cohort and a 19% reduction in hospital admissions with an average cost of $1,600 per patient per annum, which is significantly less than other non-institutional care programs and nursing home care[12].

[9] European Commission, & Economic Policy Committee. (2011). The 2012 Ageing Report: Underlying Assumptions and Projection Methodologies.

[10] European Commission, & Economic Policy Committee. (2011). The 2012 Ageing Report: Underlying Assumptions and Projection Methodologies.

[11] Ken Terry, "Why The Private Sector Lags VA In Telehealth," Infomation Week http://www.informationweek.com/government/leadership/why-the-private-sector-lags-va-in-telehealth/d/d-id/1111027

[12] Lancaster AE Darkins A, Ryan P, Kobb R, Foster L, Edmonson E, Wakefield B, "Care Coordination/Home Telehealth: The Systematic Implementation of Health Informatics, Home Telehealth, and Disease Management to Support the Care of Veteran Patients with Chronic Conditions," Telemed J E Health, 14 (2008), 1118–26.

In addition to considering the stage of transition of the overall socio-economic system, we also looked at the state of play with assisted living technology, using a taxonomy devised by The OECD, which draws on the classic innovation / diffusion model described by Everett Rogers:[13]

- Gestation: there is need for support for the technology/product/change in question because it is not commercially viable
- Breakthrough: the technology/product becomes commercially viably, but still niche
- Take-off: exponential growth as the commercially viable product begins seizing market share
- Stabilisation: the technology/product model has shifted to the mainstream

On balance, we would contend that the technology – in the UK – at least is hovering somewhere between the gestation and breakthrough stages, with certain applications already in the market place but still niche due to cost and user issues, while more extensive variants continue to need substantial public support through pilot demonstrations and subsidies of one kind or another.

3. Transition mechanisms and bottlenecks

3.1 Transition mechanisms (drivers)

The UK system is currently undergoing a transition from one in which the majority of its elderly residents need care in hospital or in residential homes to one where they are able to live independently for longer, with a reduced need for external institutional care, through the development of assisted living technologies.

The transition arises as a result of a combination of factors. The first is that the UK has an ageing population with the proportion of the population aged 65+ in 2010 estimated to be 17% and set to rise to 25% by 2060[14]. Further to this, it is also estimated that at least 75% of those over the age of 75 years are living with chronic conditions requiring health and/or social care intervention. Hence the cost to the NHS and social care services is unsustainable and without further investment or major reform is likely to experience enormous shortfalls in the not so distant future.

In addition to the impact of an ageing population on the health service and public finances, there is a broader social phenomenon in play where many older citizens have more time and more disposable income than their younger counterparts and constitute an increasingly important market segment from many industries (the 'silver pound'). They are more than consumers of course. Baby boomers have higher expectations than older people from previous generations: they expect to remain active citizens, to enjoy life and live independently in their home for as long as possible[15]. This group is technology savvy and expects technology to play an increasingly important role in their lives, which is a strong driver for the development of assisted learning technologies in the transition of the system. However, a recent YouGov poll by CarersUK in 2013[16] showed that at present fewer than 1 in 3 people use technology to support their health and social care, despite more than 7 out 10 of the population using technology in other areas of their lives such banking, paying bills, shopping and communication suggesting huge potential for using technology to support caring for older and disabled people.

These policy mechanisms come in the form of a number of national initiatives, which have developed in part as a result of the Madrid International Ageing Plan 2002, as well as in response to the problems associated with an ageing population which gained attention following the UK's first

[13] Everett M Rogers, (1962), Diffusion of Innovations, Glencoe: Free Press

[14] European Commission and Economic Policy Committee (2012), The 2012 Ageing Report: Underlying Assumptions and Projection Methodologies

[15] House of Lords (2013), Ready for Ageing? http://www.publications.parliament.uk/pa/ld201213/ldselect/ldpublic/140/140.pdf

[16] Carers UK (2013), Potential for Change: Transforming public awareness and demand for health and care technology http://www.carersuk.org/media/k2/attachments/Potential_For_Change___Carers_UK.pdf

foresight exercises in the late 1990s. In addition to these policy mechanisms, which are discussed in more detail in the next section, the NHS is also currently undergoing a process of reform to address the current lack of integration of health and social care services which is vital to helping people to live independently for longer. Each of these policy mechanisms will be described in more detail in the next section.

Finally, pharmaceutical companies grappling with generics competition and falling numbers of new blockbuster drugs have a commercial interest in exploring ways to ensure patients are adhering to medication programmes. They can use automated reminders, refills, and related services to differentiate themselves in the marketplace and ensure long-term customers. They can use the same technology to improve monitoring of clinical trials and gain insights into the ongoing use of medications. However, these developments may find favour with younger patients first.

3.2 Bottlenecks and barriers

However, despite the various policy mechanisms in place and the provision of funding, the transition of the system still faces a number of bottlenecks, which may hinder progress.

The first point to highlight is the limited data available regarding the cost-effectiveness of a move to assisted living and telecare, the cost for which has been falling but remains non-trivial when deploying the technology at scale, which may be unaffordable particularly in the context of the current financial climate with cuts to many areas of public finance.

Further to this, many Clinical Commissioning Groups (CCGs)[17] have felt that there is a lack of robust evidence on the cost-effectiveness of telehealth innovation in the UK and so many CCGs have felt the need to prove their own business case for telecare and telehealth in order to adopt the technology rather than accept findings from elsewhere, which will inevitably slow the diffusion and in some case may inhibit the uptake of technology[18]. This is not surprising following the ambiguous results of the WSD following initially promising early headline results. However, a systematic review in 2007 showed 8,666 papers reporting the outcomes of remote care trials with the authors estimating over 12,000 papers in total[19], which will have been significantly added to in the past seven years demonstrating a significant evidence base.

In addition to this the NHS is also undergoing a series of changes through its reform process, which includes the integration of health and social care services. This has involved the establishment of CCGs, to which spending decisions have been devolved. Hence, charging individual CCGs, (almost twice in number to the PCTs to which they have replaced), with the commissioning of telecare and wider telehealth services may increase the level of organisational fragmentation providing a significant challenge for suppliers. However, it is hoped that this change to CCGs, which are GP led, may increase opportunities for them to play a more active role in providing end-to-end services[20].

Secondly, there are the implications for healthcare professionals and organisations in adjusting to new ways of working when adopting technology supported care. Replacing face-to face contact with technology-supported care can be a significant issue for both healthcare professionals and patients because it challenges their existing expectations about health and social care delivery. However, anecdotal data from patients overall shows strong support for the technology and the promise of future technology with personalisation programmes such as resource-allocation systems, self-directed support and personal budgets as measures that may help to reinforce this.

Thirdly, the small / fledgling consumer market may also create a potential bottleneck. Certain telehealth and telecare units may be rejected by some older people on the basis of stigmatisation, wearability and problems with visual displays. Further to this, affordability of telecare products may be a constraint for those on low incomes depending on the funding mechanisms put in place by local authorities. However, the lack of a consumer-driven market in the UK has enabled the NHS, which is

[17] formerly Primary Care Trusts (PCTs)

[18] M Clark N Goodwin, Sustaining Innovation in Telehealth and Telecare: WSDAN Briefing Paper, 2010.

[19] Barlow et al (2011), Scaling up remote care in the UK. Lessons from a decade of policy intervention

[20] HaCIRIC (2012), Developing the capacity of the remote care industry to supply Britain's future needs

both the payer and the provider of healthcare, greater freedom to undertake trials with unproven financial benefit[21].

There are also challenges relating to the organisation of health and social care, with business models that reward activity rather than outcomes, at which point, any technology or service innovation that reduces hospital admissions will ultimately reduce income for the PCT in question. While they may be beneficial for the system overall, it is not especially attractive for the individual trust, in the short term at least. Moreover, ALIP and the AHA Partnership both emphasise integrated care models as a route to improved service quality and health outcomes, but both recognise the challenge of bringing different services closer together into a more holistic offer / package, in light of their highly evolved and specific systems and procedures. Integration and reform are arguably the two biggest challenges.

Lastly, the lack of common standards and interoperability of devices is also a potential barrier to the diffusion of the technology. At present industry lacks the incentive to develop the software to enable interoperability and currently no single player has all the capabilities to provide an integrated remote care service and so partnerships will be necessary to bring solutions to market[22] and for the scaling up of telecare services into mainstream health and social care services.

4. Related Policy Agendas and Measures

4.1 UK policy on ageing

There are a number of policy measures that have been put in place in the UK to address the ageing population and the associated unsustainable healthcare costs faced by the NHS. These measures have received significant funding, estimated at approximately £260 million since 2006[23].

At the international level this has come in the form of the Madrid International Plan for Ageing 2002, which set out 10 commitments agreed by governments to bring about the changes needed to address the challenges and opportunities of an ageing society by focusing on three priority areas:

1. Older persons and development – this refers to the participation of older persons in development and the sharing of its benefits. More specifically, a lack of access to technology that promotes independence and other socio-economic changes can marginalize older persons from mainstream development and so take away their purposeful economic and social roles and thereby weaken traditional sources of support.
2. Advancing health and well-being into old age – this refers to good health being a valuable asset, not only to the individual but also in terms of being vital for economic growth and the development of societies. Older persons are fully entitled to have access to preventative and curative care. Full access for older persons to healthcare includes disease prevention, which involves the recognition that health promotion and disease prevention activities throughout life need to focus on the maintenance of independence, the prevention and delay of treatment as well as improving the quality of life of older persons with disabilities.
3. Ensuring and enabling supportive environments – this refers to commitments to strengthen policies to create inclusive, cohesive societies for all. Whatever the circumstances of older persons, all are entitled to live in an environment that enhances their capabilities. Some will require a higher level of physical support and care whereas the majority of people are willing and capable of continuing to be active and productive. Policies are required that empower older persons and support the contributions they are able to make to society. It also requires policies that simultaneously strengthen both lifelong development and independence and

[21] "Health Check: The Rise of Telecare in Europe - The Network: Cisco's Technology News Site" http://newsroom.cisco.com/feature-content?type=webcontent&articleId=1156618

[22] HaCIRIC (2012), Developing the capacity of the remote care industry to supply Britain's future needs

[23] Comprising £80 million for the Preventative Technologies Grant, £31 million for the Whole Systems Demonstrator Programme in England, £9 million for the Telecare Capital Grant programme in Wales, £8 million for the Telecare Development Fund in Scotland, £46 million in Northern Ireland's telecare investment programme, £37.3 million for DALLAS and £46 million for ALIP and its associated projects (Barlow et al 2011).

that support social institutions based on principles of reciprocity and inter-dependence. Governments will play a central role here.

In 2008 the Ambient Assisted Living Joint Programme (AAL JP) [24], a European Union Initiative co-funded by EU Members and Associated States and the European Commission, was established to help create a better quality of life for older adults and to strengthen the industrial opportunities in Europe though the use of information and communication technologies. It carries out its mandate through the funding of across-national projects (at least three countries involved) with the participation of small and medium enterprises (SME), research bodies and users and stakeholders organizations. The aim of AAL JP was to foster the emergence of ICT-based products, services and systems for ageing well at home, in the community and at work in order to increase the quality of life, autonomy, participation in society, skills and employability of older adults and reduce the costs of health and social care. This programme has been extended to run until 2020 to continue applied and close to the market research for ageing well with ICT and during its extension will seek to support industry, particularly SMEs to bring digital innovative products, services and solutions for ageing well to the European market. It is thought that alignment with the European Innovation Partnership on Active Healthy Ageing (EIP AHA) could further boost the deployment of AAL solutions at the European level. At the national level, the UK is partner in 75 projects, which receive support in the form of co-funding from the AAL JP.

At the national level, the UK has responded to the Madrid International Plan for Ageing by delivering a 'Healthy Ageing' programme which formed part of a strong theme in the National Service Framework in addition to a number of initiatives to improve long-term care services for older people, in particular community-based services that are needed to overcome the mismatch between the home based services that are usually desired and the residential care services that are in fact supplied[25].

The National Service Framework for Older People (introduced in 2001 and updated in 2006, set out clear quality requirements for care, based on the best available evidence of what treatments and services work most effectively for patients) is healthy ageing. This framework highlights the importance of health promotion activities that are of specific benefit to older people in response of the desire of older people to live independent lives for as long as possible. This framework suggests that increased physical activity, improved diet and nutrition and immunisation and management of influenza are key in healthy ageing. The delivery of a 'Healthy Ageing' programme, as detailed in the Department of Health's Next Steps in Implementing the NSF for Older People, published in 2006, was the vehicle for of the older people's component of the delivery of the 2004 White Paper, Choosing Health, and was also a key component in the delivery of the cross-government strategy for older people as described in 'Opportunity Age', a strategy document published in 2005 setting out government approaches to the ageing workforce, the promotion of active ageing and developing services which promote independence and well-being.

The importance of this theme is still evident in the Department of Health's most recent White Paper 'Caring for Our Future: Reforming Care and Support' which highlights the continuing need to

> *'keep people active, promote physical and mental health and wellbeing, and strengthen local connections… and that failure to support people at an early stage means that people are needlessly admitted to hospital because they have had an accident or crisis and lose their independence.'*

In 2005 the Department of Health report 'Building Telecare in England'[26] detailed the Preventative Technology Grant, announced earlier in 2004, which was designed to increase the number of people able to benefit from telecare services and so enable thousands of older people to live independently, in control and with their dignity for longer. More specifically, the PTG was intended to initiate a change in the design and delivery of health, social care and housing services and prevention strategies with the main aim of enhancing and maintaining the well-being and independence of

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[24] European Commission, "Ambient Assisted Living Joint Programme", 2012.

[25] Assisted Living Innovation Platform: Medelec Cambridge. www.medelec.co.uk/Presentations/11.00_GrahamWorsley_TechnologyStrategyBoard.pdf

26 Department of Health. (2005). Building Telecare in England.

individuals. This was too be achieved by pumping, priming and changing the incorporation of telecare in the delivery of mainstream services[27]. The grant was made available between 2006-2008 and was centrally funded, providing grants totalling £80 million to local authorities in England to invest in telecare applications with the expectation that telecare delivery will help to increase quality of life and independence and be most effective when being implemented as an integrated service.

The 2006 White Paper, 'Our health, Our Care, Our Say'[28], placed renewed emphasis on providing care closer to home in a review of community services, suggesting this was necessary in order to be more responsive to patients' needs and to prevent ill health by promoting healthy lifestyles. Following this, the Technology Strategy Board launched the Assisted Living Innovation Platform (ALIP) in 2007, with co-funding from: the Department of Health's National Institute for Health Research, the Engineering and Physical Science Research Council (EPSRC) and the Economic and Social Research Council (ESRC), totalling £60million. ALIP was created to demonstrate the feasibility of new technology and new business / social models working together at scale.

4.1.1 Innovation Platforms

The basic idea of an Innovation Platform was developed by the Technology Strategy Board as part of a desire to use a larger number of government "levers" to encourage and support innovative activity by UK companies. The Collaborative Research & Development competitions run under the preceding Technology Programme (funded by DTI and overseen by the Board, but before the foundation of the new agency) awarded grants to support the development of technologies in areas deemed to have significant potential, however technology suppliers dominated the calls for proposals, and projects tended to be more technology push than market pull, with limited engagement of end users or other forms of market need. What the Board realised was that Government had programmes to address the various societal problems from both perspectives, push and pull, and that the demand-side policies, made up of procurement, regulation, standards and even fiscal measures, often had an important influence on whether a future market would materialise and what it would look like. If businesses could be made aware of how that particular market would evolve over the next 3-7 years, they could develop new products and services to answer the challenge being addressed. The other Government department would still own the challenge and make decisions on how it was answered, but the Technology Strategy Board would support UK businesses in their quest to provide the answer. To do this the Technology Strategy Board had to work closely with the "owner" Government department to understand the detail of their vision and the route they intended to take to achieve it. They then had to identify and engage with those businesses that could help with these intentions.

This kind of cross-departmental interaction can identify areas where the goals are difficult to achieve, but it can also identify those areas where the vision could already be achieved – sometimes by technology already available in another sector of activity.

The Technology Strategy Board launched two "pilot" Innovation Platforms in the first instance, "Intelligent Transport Systems and Services" and "Network Security".

The new concept addressed a couple of issues. Firstly, that innovation is often frustrated by challenges on the supply and demand sides and indeed in the connectedness of the two, which is to say it is rarely a single market failure that can be addressed quickly and easily, but rather multiple problems across a system often with strong feedback loops. In that sense, classic R&D grants awarded to technology firms (supply side) may not have the level of user orientation or market engagement necessary to identify appropriate or affordable solutions. There are many other challenges that may have to be overcome in order for a technological advance to be taken to market and amount to a significant innovation, which may relate to the configuration and authority of public institutions or the risk and reward (incentives) created by the existing regulatory set up.

27 European Commission, "ICT and Ageing - European Study on Users, Markets and Technologies" http://www.ict-ageing.eu/?page_id=1617

28 Department of Health (2006), Our Health, Our Care, Our Say: a New Direction for Community Services

4.1.2 Assisted Living Innovation Platform

The ALIP[29] delivers a wide-ranging programme (see table below for summary), which seeks to enable the ageing population and those with long-term health conditions to live with greater independence. This is particularly important in light of the fact that people are living longer, which is primarily attributed to healthcare and technology advances made over the last 50 years. However, as the number of economically active people contributing to the financing of health social care falls, today's healthcare models look to be unsustainable, creating a major cause for concern for health and social care services in the UK. Investment in this programme looks to address the challenge of assisted living in an attempt to contribute towards addressing this problem with a medium term goal of demonstrating the feasibility of new technology and new business and social models working together to deliver aspirational services at scale[30].

Figure 4 – Summary of ALIP Programmes

ALIP Programme	Programme Partner(s)	Years Run	Projects	TSB/ALIP investment	Total Programme Cost
Home Based Systems and User Centred Design	NIHR, EPSRC, ESRC	2008-11	9	£6.3 million	£14.3 million
Smart Care Distributed Environment	NIHR, EPSRC	2009-12	7	£6.3 million	£16.2 million
Economic and Business Modules and Social Behavioural Studies	NIHR, ESRC	2010-14	8	£8.8 million	£12.2 million
Independence Matters	Design Council	2011	7	£2 million	£2 million

It is important to note that ALIP does not cover mechanical technology for disability, orthopaedics, robotics, home improvements, e.g. chairlifts, or wheelchairs

Source: Technology Strategy Board[31]

The TSB also launched a large-scale programme called Delivering Assisted Living Lifestyles at Scale (DALLAS) at a cost of £37.3 million in 2011, which invests in four communities to improve the lives of 169,000 people by 2015. The aim is to demonstrate how independent living technologies, services and systems can be used to promote wellbeing, and provide integrated top quality health and care, enabling people to live independently for longer.

The latest project launched is that of the '3millionlives' campaign. The 3millionlives (3ML) campaign was launched in 2012 following the results of the world's largest randomised control trial of telehealth and telecare called the 'Whole Systems Demonstrator Programme', launched in 2008. The early indications of this programme showed that if used correctly, telehealth can deliver a 15% reduction in A&E visits, a 20% reduction in emergency admissions, a 14% reduction in elective admissions, a 14% reduction in bed days and an 8% reduction in tariff costs. The most striking result was the demonstration of a 45% reduction in mortality rates[32]. In response to these positive results the government launched the 3millionlives campaign based on the idea that there are at least 3 million people in the UK with long-term health conditions and/or social care needs that could potentially benefit from the use of telehealth and telecare services.

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[29] Log frame for ALIP in Appendix 2.

[30] Technology Strategy Board, "Assisted Living Innovation Platform" https://connect.innovateuk.org/web/assisted-living-innovation-platform-alip/who-we-are

[31] Assisted Living Innovation Platform: Medelec Cambridge. http://www.medelec.co.uk/Presentations/11.00_GrahamWorsley_TechnologyStrategyBoard.pdf

[32] "Whole Systems Demonstrator Programme: Headline Findings - December 2011" https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/215264/dh_131689.pdf

4.1.3 Health and Social Care Reform

Further to the initiatives detailed here and as already briefly mentioned, the NHS is currently undergoing a process of reform. The Health and Social Care Act 2012 was brought in to safeguard the future of the NHS following the recognition of the same set of factors that are driving the development of assisted living technologies: the NHS is facing rising demand and treatment costs as the population ages and long-term conditions become more common. There is also need for improvement in some areas where the NHS falls behind other European countries and, despite the NHS budget being protected by government, the NHS is facing the tightest settlements ever, which is likely to be unaffordable in the future due to the exacerbated demand of an ageing population. The provisions of the HSC Act 2012 draw on the evidence and experience of 20 years of NHS reform and are designed to address these challenges by making the NHS more responsive, efficient and accountable, in part by the increased integration of health and social care services.

The integration of health and social care is important for many reasons but particularly for the development of assisted living technologies and important for the transition of the system to one where people are able to live independently for longer. In the past, significant issues have existed around the functional specialisation and distinctness of public services, such as health and social care where older people (and the taxpayer) may be served best by integrated services, where the historical separation between the services has created particular working approaches/technical systems that are not easily connected due to certain incompatibilities (DALLAS). 'Caring for our Future' seeks to address this problem with a number of key actions[33], including investment of £100 million in 2013/14 and £200 million in 2014/15 in joint funding between the NHS and social care to facilitate the move to better integrated care and support.

4.1.4 Healthcare reform and innovation

As part of the Health and Social Care Act 2012, Clinical Commissioning Groups (CCGs) have been established to replace primary care trusts (PCTs). CCGs are clinically-led groups and have been set up to organise the delivery of NHS services including elective hospital care, rehabilitation care, urgent and emergency care, most community health services and mental health and learning disability services.

Further to this, CCGs have been charged with leading innovation using the Commission for Quality and Innovation (CQUIN) payment framework to incentivise providers with examples of innovative working including but not limited to: prevention and early intervention, using national tools and databases to support understanding of clinical variation, support local innovation through pathway development with provider organisations, 'dynamic care' an agile response to changes in patient flow and remote visibility thereof and sharing of best practice[34]. The reason for this charge, has been the acknowledgement that whilst the NHS is recognised as a world leader in invention, the diffusion of these innovations within the NHS has often been slow and in some cases failed[35]and so a strategic approach to innovation was put forward in the UK Strategy for Health Innovation and Life Sciences, to be included in NHS reforms, following a review by the NHS Chief Executive of the adoption and diffusion of innovations across the NHS, published in 2011.

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[33]Department of Health. (2012). Caring for our future: reforming care and support. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/136422/White-Paper-Caring-for-our-future-reforming-care-and-support-PDF-1580K.pdf

[34] CISCO 2013, ICT at the Heart of NHS Reform Cisco Network Architecture Blueprint (C-NABv2) for NHS Organisations, http://www.cisco.com/cisco/web/UK/public_sector/health_care/assets/cisco_ict_at_the_heart_of_nhs_reform-commissioning_annexe_apr_2013.pdf

[35]Innovation Health and Wealth: Acceleration Adoption and Diffusion in the NHS (2011) http://webarchive.nationalarchives.gov.uk/20130107105354/http:/www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_134597.pdf

5. Role of policy and policy measures

5.1 Analysis of the role of policy measures

We have discussed the issue faced by many advanced economies of an ageing population and unsustainable healthcare costs associated with living longer and a high prevalence in this population of long-term chronic conditions. High healthcare costs are associated with hospital admissions and the need for residential/nursing care. In combination with the desires of older people, helping individuals to live independently to reduce these costs has become high on the agenda. The approach adopted in the UK has been to encourage the development of assisted living technologies, which offer an array of social and economic benefits. This has taken several forms, most notably:

- The continued development of assisted living technologies / systems
- The implementation of assisted living solutions
- The expansion and development of the telecare industry across the value chain

Notably, this has also led to the beginning of the integration of health and social care services in the UK to provide older people (clients) with a more holistic form of assistance / service provision, albeit there are many and various 'interoperability' problems between the two services, which exist at all levels, culture, procedures, data and technology. This is a significant barrier to the successful diffusion and uptake of assisted living technologies.

In short, there is a pressing need for innovation within most if not all of the elements of the UK 'system' that older people must navigate, whether that is technological innovation associated with personal devices or home automation through to non-technological innovation in public services and the emergence of a consumer market for assisted living solutions.[36] The Technology Strategy Board and the DoH (and various EU programmes) have chosen to work with a classic logframe methodology in order to determine the spectrum of challenges (problems) that must be addressed and to determine their 'to do' list of specific objectives. Appendix B presents a provisional logframe – built up from various existing programmes – in an attempt to capture and schematise the full range of challenges that need to be worked on, along with an indication of the kinds of inputs and outputs that we believe BIS and other stakeholders will need to deliver.

As we have seen, there are a number of policies at the national level that have initiated the transition from a situation where the majority of elderly people are cared for in hospitals or residential homes to one where they are able to live independently in their own homes for longer. Thus, national policy on ageing has been successful in raising awareness about the issues across the public estate, with evidence of related strategies and action plans in most areas of policy, from healthcare to innovation.

The impacts of these policy mechanisms are difficult to assess, as yet there are no national-level data providing information, for instance on the proportion of older people living independently (rather than in long term residential care or hospitals) or the proportion of older people that access health and social care services at home or within their immediate community. Further to this there are limited data available about the impacts thus far of the various policy measures discussed that are already in place. There are however, evaluations of individual pilot schemes such as DALLAS and the PTGs (conducted at the local level) that indicate a demand for new services and have shown the potential for innovation within this broad area and suggest that assisted living programmes, broadly conceived, are able to deliver improvements in system efficiency and also reduce the number and length of hospital admissions.

[36] Geoff Mulgan and Charlie Leadbeater have written on this phenomenon of 'systemic innovation,' wherein a social problem like obesity, unemployment or an ageing population (often but not always social challenges) is best tackled through a systemic understanding and action on pressure points throughout the system, looking for change or innovation in the constituent parts of that system. See, Systems Innovation, Geoff Mulgan and Charlie Leadbeater, January 2013, NESTA Discussion Paper

5.2 ALIP achievements

ALIP (and other pilot initiatives) have demonstrated a demand for new services and have shown the potential for innovation within this broad area. They have also revealed a number of important barriers that will continue to hamper the development and diffusion of these innovative services.

Figure 5 – Overview of DALLAS initiatives

Community	Overview of Activities
Year Zero	Individuals linked through products and services aimed at supporting them in managing their own health. Products and services developed with other businesses to be launched through the community.
Mi Liverpool	Support increased access to independent living technologies on the open retail market to increase levels of independence and self-care in Liverpool.
Living it Up	Using the community as a platform, living it up seeks to establish a trusted marketplace for independent living products that will match individuals with products and services that may be of benefit to them. Community activists will assess potential needs and the provision of advice is through centres, net TV, telephone line and installation support
i-Focus	Activity focuses on 'interoperability' both within the UK independent market and DALLAS itself.

Source: adapted from Technology Strategy Board[37]

Although there has been no external evaluation of ALIP, there is an evaluation in hand looking at the economic and business benefits of one of ALIP's major projects (DALLAS). The University of Glasgow has been commissioned to conduct a continuous evaluation of the DALLAS project to capture the early evidence of the benefits to individual clients as well as the system overall (report not yet available). Although DALLAS is ongoing, the evaluation will consider how the independent living market has developed over the past five years as well as providing data about the current market, which will be used in subsequent phases to enable more robust conclusions to be drawn about the impact of DALLAS (net impact).

DALLAS is establishing communities all over the UK and seeking to engage with a total 169,000 people by 2015. The aim is to demonstrate how independent living technologies, services and systems can be used to promote wellbeing, and provide integrated top quality health and care, enabling people to live independently for longer. Within DALLAS, four communities have been established; Year Zero, Mi Liverpool, Living it Up and i-Focus (summarised in Figure 5).

Our interviews report that the first-round evaluation identified a number of market failures, which confirm the DALLAS programme rationale and intervention logic, including the lack of awareness and trust in products, systems, services available and interoperability which are significant barriers to the growth of the independent living sector, reiterated by interview respondents. Further to this, additional themes were also identified, including barriers to market entry for SMEs who struggle to secure statutory provision contracts, which has been suggested to stifle innovation and is thought to occur within smaller organisations; a lack of finance for producers of technology in invest money in the development and marketing of products for the retail market; financial barriers to the consumer whereby the cost of technologies is not affordable.[38]

If these barriers continue to be worked on through the action of communities, sector experts and industry representatives, then the sector is likely to grow. There are several activities in progress to try and overcome these barriers which include marketing campaigns and engagement to target the lack of awareness of target individuals and their needs directly as well as a focus on interoperability being considering across all community activities which encompasses products, services and information flow, current coordination failures will be addressed to prevent further failure in market growth. From the financial perspective, the need for culture changes in current procurement processes by involving NHS partners is also needed, with the aim that this will open the door to smaller companies. However, whether this is going to be possible is unclear at this stage. In a similar

[37] Final Report: Dallas baseline economic evaluation (2013) https://connect.innovateuk.org/documents/3301954/3710069/REVISED%20FINAL%20report%20for%20publication%20-%20TSB%20dallas%20evaluation.pdf

[38] Final Report: Dallas baseline economic evaluation (2013) https://connect.innovateuk.org/documents/3301954/3710069/REVISED%20FINAL%20report%20for%20publication%20-%20TSB%20dallas%20evaluation.pdf

context, financial investment made through DALLAS benefits consortium, but whether this will encourage wider UK investment remains to be seen.

Although attempts are being made to address these barriers, more needs to be done in order to facilitate innovation and accelerate the rate of transition in the system to arrive at the point where one might reasonably characterise the UK as being at an advanced stage.

5.3 Whole System Demonstrator (WSD) achievements

The early findings of the WSD in the UK suggest a 45% reduction in mortality rates, a 15% reduction in A&E visits, a 20% reduction in emergency admissions, a 14% reduction in elective admissions, a 14% reduction in bed days and an 8% reduction in tariff costs as a direct result of telecare[39]. With these initial headline results, Paul Burstow, Minister of State for Care Services at the time suggesting that this could lead to savings of £1.2 billion for the NHS[40].

However, further analysis of the WSD trial in a series of journal articles and referred to in a recent report by the King's Fund[41] found ambiguous evidence in relation to hospital admissions[42] and no real benefits in terms of cost-effectiveness[43] or quality of life[44]. With these results in mind, the evidence is very mixed. However, while these journal articles raise some tough questions, there are various other studies from the UK and the US that strongly suggest that new technology can transform both the economics and outcomes of health and social care to a meaningful degree and we see widespread interest and investment in pilots and full-scale systems in the UK, US and the rest of Europe as a result.

In the UK, in addition to the WSD, smaller telehealth pilot schemes have been run and more specifically the 'Kent TeleHealth Evaluative Development Pilot'. The overall aim of this pilot was to monitor and manage the health of participants, increasing participants stability thus decreasing hospital bed days of care; decreasing presentation to A&E and to increase the participant's awareness and management of their own condition; exploiting the emerging technology of telehealth and to look for benefits for patients, carers and the health and social care sector[45].

This pilot was rolled out to 250 patients with long-term chronic conditions[46] (LTCs) and demonstrated that telehealth technology has the potential to promote an individual's long-term well-being and independence as well as improving individual's and their carers quality of life. The data showed that the use of telehealth technology was associated with fewer hospital admissions (A&E visits and bed days of care) along with high patient and carer satisfaction as well as the general and physical health of patients increased during the trial period and that used in a targeted way it can also improve the working lives of staff, is more cost effective and can be seen as another way of supporting effective clinical management in its broadest sense. The study concluded that the use of telehealth technology has the potential to produce a key and irreversible shift in how healthcare is delivered and

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39 "Whole Systems Demonstrator Programme: Headline Findings - December 2011" https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/215264/dh_131689.pdf

40 http://www.careindustrynews.co.uk/2012/03/nhs-can-save-1-2bn-from-technology/

41 The King's Fund (2014), Making and health and social care systems fit for an ageing population http://www.kingsfund.org.uk/sites/files/kf/field/field_publication_file/making-health-care-systems-fit-ageing-population-oliver-foot-humphries-mar14.pdf

42 Steventon A, Bardsley M, Billings J, Dixon J, Doll H, Hirani S, Cartwright M, Rixon L, Knapp M, Henderson C, Rogers A, Fitzpatrick R, Hendy J, Newman S (2012). 'Effect of telehealth on use of secondary care and mortality: findings from the Whole System Demonstrator cluster randomised trial'. British Medical Journal, vol 344, e3874.

43 Henderson C, Beecham J, Knapp M (2013). 'The costs of telecare and telehealth' in Unit Costs of Health & Social Care 2013, pp. 26–32. Canterbury: Personal Social Services Research Unit, University of Kent. Available at: www.pssru.ac.uk/project-pages/unit-costs/2013/index. php?file=henderson-beecham-knapp

44 Cartwright M, Hirani S, Rixon L, Beynon M, Doll H, Bower P, Bardsley M, Steventon A, Knapp M, Henderson C, Rogers A, Sanders C, Fitzpatrick R, Barlow J, Newman S (2013). 'Effect of telehealth on quality of life and psychological outcomes over 12 months (Whole Systems Demonstrator telehealth questionnaire study): nested study of patient reported outcomes in a pragmatic, cluster randomised controlled trial'. *British Medical Journal*, vol 346, f653.

45https://shareweb.kent.gov.uk/Documents/adult-Social-Services/professionals-and-projects/WSD/Telehealth%20Full%20Report%20FINAL_Layout%201.pdf

46 LTC's included Chronic Obstructive Pulmonary Disease (COPD), Coronary Heart Disease (CHD) and Diabetes Mellitus

that future investment decisions will be influenced by findings from this and other studies that point the way to different management of LTCs against the backdrop of challenging economic circumstances[47].

Recent studies in the US suggest that telehealth is increasingly widely used.

> *Overall, Adler-Milstein and coauthors found that 42 percent of US hospitals had adopted telehealth by late 2012, with significant variation across the country: Alaska was the highest with 75 percent, and Rhode Island had minimal adoption.*
>
> *Market forces and individual hospital features also influence telehealth adoption rates. Factors that positively influence adoption rates include serving as a teaching hospital, being part of a larger system, having greater technological capacity, and higher rurality. Factors negatively affecting adoption include high population density, being for-profit, and operating in a less competitive market.*
>
> *http://content.healthaffairs.org/content/33/2/207.abstract*

More specifically, the VA has run a large-scale telehealth including telehealth programme, worthy of mention in the light of the WSD results. Their analysis of 17, 025 patients from the CCHT program demonstrated a 25% reduction in the number of bed days of care, 19% reduction in the number of hospital admissions with the cost of CCHT $1,600 per patient per year compared with $13,121 per year for VHA's home-based primary care and $77,745 per year for private nursing home care. Although healthcare provision is different between the two countries, the reduction in the number of bed days of care and the reduction in hospital admissions are encouraging. These results may be of particular interest in light of the findings from the WSD[48].

In addition to the results from the WSD, results have been made available from the use of PTGs, which have been carried out at the local level according to the award of the grants. Councils awarded these grants are required to report through the CSCI Delivery and Improvement Statement, on the numbers of additional older people benefiting from telehealth since the introduction of the grant, several councils have published local evaluation reports. One such example is that of Norfolk, which was awarded £542,000 in 2006/7 and a further £913,000 in 2007/8. The evaluation of the programme in Norfolk provided evidence that technology can delay entry to hospital and residential nursing care with avoided costs estimated at £1.34 million and £4.24 million respectively, over the course of the evaluation period[49].

Promising early findings from the WSD followed by conflicting results from later studies have not hampered political commitment for making assisted living technologies mainstream with Norman Lamb, current Care and Support Minister, pledging £3.8billion for the integration of health and social care services as part of NHS reforms with investment already underway.

6. Future Policy Perspectives

There are a number of key policy challenges still to be addressed in order for the UK to progress further or complete it's transition to a society where older people do continue to live independently for very much longer, live healthier lives and participate to the fullest extent in their local communities. The most significant challenge will be moving from a system where telecare is being piloted on a relatively small scale to a system where telecare technologies become mainstream in health and social care services across the UK, which the launch of '3millionlives' (3ML) will help

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[47] https://shareweb.kent.gov.uk/Documents/adult-Social-Services/professionals-and-projects/WSD/Telehealth%20Full%20Report%20FINAL_Layout%201.pdf

[48] Darkins A, Ryan P, Kobb R, Foster L, Edmonson E, Wakefield B, L. A. (2008). Care Coordination/Home Telehealth: the systematic implementation of health informatics, home telehealth, and disease management to support the care of veteran patients with chronic conditions. Telemed J E Health, 14(10), 1118–26.

[49] Preventative Technology Grant: Report by the Director of Adult Social Services (Norfolk). http://www.norfolk.gov.uk/consumption/groups/public/documents/committee_report/asocserv130306item11pdf.pdf

support. In moving towards telecare technologies becoming mainstream and so enable older people to live independently for longer, the future policy perspectives can be considered in the context of:

- Institutional incentives
- Integrated health and social care
- Affordability and the health divide
- Public procurement and lead markets

6.1 Institutional Incentives

As mentioned earlier, CCGs have been charged with leading innovation in the NHS. This is one of a number of responsibilities of CCGs and they are also responsible for organising the delivery of NHS services including elective hospital care, rehabilitation care, urgent and emergency care, most community health services and mental health and learning disability services. Hence, with the aim of CCGs to also deliver improvements in cost effective health and social care and that because being so closely associated with patients, they are in the best position to determine how this can be carried out most appropriately and hence drive the diffusion of new innovations.

Thus, the success of telecare and other telehealth applications is going to be reliant on the support they receive from CCGs. The early findings from the WSD suggest that telecare can reduce acute hospital interventions and so telecare and other telehealth applications may be important tools for CCGs in providing cost-effective services whilst adhering to the desire of older people to live independently for as long as possible. However, more robust data in support of assisted living technologies in order to strengthen the business case for making assisted living technologies mainstream within a CCG, which previously PCTs were reluctant to do as a direct result.

There is almost certainly room for further research into business models and financing of healthcare, which is perhaps a topic for an ALIP study (ESRC supports the platform and work on health economics more generally). There is a deal of work going on around private provision and marketisation, however, there may also be benefits in looking more closely at / experimenting with risk-sharing models that link payment to health outcomes achieved through treatment. A pharmaceutical company would agree to refund the payer the cost of a drug if a patient doesn't respond to treatment. For example, Novartis has used risk-sharing programmes in markets like Germany, where the company partnered with two leading national payers on pricing for Aclasta, an osteoporosis treatment. Under the agreement, if a patient suffered a fracture, it signified a failure of the drug, and Novartis agreed to pay back the cost of the drug to the payer.

6.2 Integrated health and social care

The successful integration of health and social care services within the NHS is going to be of a key importance to factor in the diffusion of assisted living technologies. The integration of these services for older and disabled people is supported by £3.8bn in funds in the form of the Better Care Fund, which is not additional money, but; money pooled from existing health and social care services for redeployment with the aim of transferring services from secondary to primary care where possible.

With a focus on bringing together health and social care services and focusing on reducing admittance to secondary care and residential/nursing home costs there is a significant opportunity for assisted living technologies.

In addition to the social benefits of enabling older people to live independently for longer and the potential associated cost savings, there is also significant economic opportunity for the telecare industry. In 2010 the estimated spend on telecare in the UK was £106million. At this point the introduction of assisted living technologies was still at a relatively early stage in the transition, as it still is now. Thus, as the transition of the system progresses and telecare technologies gain momentum and head towards becoming a mainstream technology for helping older people to remain independent for longer then the size of the telecare industry has the opportunity to grow, tracking growth in the ageing population globally. However, there are clearly risks, inasmuch as other countries are sponsoring similar innovation support schemes and their national business community will be seeking to establish an international comparative advantage in competition with their competitors overseas, in the hope of dominating local and global markets.

6.3 Affordability and the health divide

Affordability of assisted living technologies is important both to the NHS as a whole, as well as to the consumer market. In the context of the consumer market, problems with affordability will provide constraints to those on lower incomes, inhibiting the diffusion of the technology. Inevitably, wider diffusion of the technology leads to lower costs. Thus the public sector will be an important lead market allowing suppliers to realise economies of scale earlier and deliver improving price performance. This is particularly important if assisted living technologies are to become more affordable to the mainstream consumer market.

Average life expectancy is continuing to increase across the UK, however it is important to remember that there are substantial differences in mortality rates and life expectancy within the overall population, by gender, geography and socio-economic group. This also has an effect on NHS spending. The result of such health inequalities was estimated by the Marmot Review to have an annual cost of £36-£40billion in relation to lost taxes, welfare payments and additional NHS costs[50]. Therefore reducing these inequalities may help to reduce healthcare spending, particularly as chronic long-term conditions may in some instances be associated with health inequalities, a strong theme in the Marmot Review.

6.4 Public procurement and lead markets

The UK ought to be well placed to take a lead in telecare and telehealth nationally and internationally, inasmuch as it has run more pilots than most – the WSD was one of the largest RCTs ever carried out – and 3ML will continue to build that experience and evidence base.

The UK has a strong academic research base in this area, and the government has supported several important national research programmes, perhaps most notably the ESRC-sponsored Growing Older Programme and the New Dynamics of Ageing (NDA) programme. There are also EU programmes where UK academics have been quite prominent, including the European Research Area in Ageing programmes (1 and 2, which ran between 2004 and 2012).

The UK also has the public institutions with the scale and financial resources to take a lead in the early implementation of these services and also drive the development of new products and services through both pre-commercial procurement (PCP) and public procurement of innovative solutions (PPI). The Technology Strategy Board hosts the UK's SBRI team, and is building up substantial experience in pre-commercial procurement (a risk sharing model, where a public sector client or clients will co-finance research to develop and implement novel solutions in order to improve their efficiency or service quality; the innovator is then free to sell those novel products or services to other clients, with the provenance of major public sector sales. The TSB and DoH also have the capacity to support multi-client investments in novel / newly developed products or services, where prices are likely to be higher than existing solutions for equivalent functionality / quality.

Public procurement will be controlled by CCGs going forward, which replace PCTs, and are therefore going to introduce a new dynamic and layer of uncertainty. They are however mandated to pursue innovation and system reform in order to improve quality and healthcare outcomes while also bearing down on costs; they have the right mandate, however, there will no doubt be a fresh round of calls for robust evidence and more demonstrations in order to give these new / smaller bodies the confidence to adopt and spend money on the technology.

Market research data suggest that the UK has one of the largest markets for telehealth in Europe, so as long as the public sector can move beyond simply piloting telehealth services to rolling out these services, there ought to be substantial commercial opportunities. That growth will be addressed by global businesses too, and the UK's open markets and tight management of public procurement, will mean that current UK-resident businesses will have only the smallest of home market advantages.

UK resident businesses are performing strongly in export markets already and as a group they ought to be well placed to capitalise on growing markets internationally. The extent to which those markets are entirely open is point of concern, as institutional customers will dominate them for the

[50] Fair Society, Healthy Lives: The Marmot Review (2014) http://www.instituteofhealthequity.org/Content/FileManager/pdf/fairsocietyhealthylives.pdf

foreseeable future. Notwithstanding this small concern, there are lots of market research reports predicting quite dramatic growth in global telehealth markets, including

- Worldwide revenue for telehealth devices and services is expected to reach $4.5 billion in 2018, up from $440.6 million in 2013, based on data from an IHS report entitled "World Market for Telehealth – 2014 Edition." http://www.fiercehealthit.com/press-releases/global-telehealth-market-set-expand-tenfold-2018
- Figures from an earlier market study, by Frost and Sullivan, show that UK-resident businesses accounted for more than 25% of the total European telehealth market, some way in front of Germany with 21%. Deloitte predict the EU telecare market will more than double between 2010 and 2015, increasing from €170M to more than €350M. Research firm InMedica predicts a 600% increase in the size of the US market in the five years, 2012 to 2017, from 230,000 users currently to more than 1.3 million in 2017[51]

6.5 Future mechanisms

The demographic trend in the UK and much of the rest of Europe is predicted to continue into the foreseeable future and with this will come continued pressure on our healthcare services. Therefore we can expect to see growing interest in strategies to help relieve this pressure with innovations such as assisted living technologies which not only help to ease the pressure on healthcare services but also help to fulfil older peoples social desires to remain as independent for as long as possible.

However, widespread market and system failures remain in evidence and there remains a prima facie case for the UK government to continue to support developments in the space, in pursuit of the social and economic goals we have described repeatedly above. Put simply, the system will not transition / evolve to a more advanced / socially progressive state, without continuing government intervention over the medium term at least. The pressure to modernise public services, improving functionality, service quality and efficiency is also going to continue.

The role of the government's research and innovation policy has been less significant in the past, however, there is a sense that it is building momentum. Numerous new pilot initiatives, with improving engagement of the key governmental and delivery bodies, which ought to demonstrate the value and feasibility of these approaches. Commercial opportunities – market forces – will be important forces for change too, with a small number of businesses actively looking to develop the markets addressing the silver pound.

There remain several important barriers, however, which can be expected to retard progress and slow down the transition, which leads us to conclude that BIS and the UK government (e.g. DoH) more generally needs to be championing further work. We have also taken the view that the investment by the European Commission and other EU MS does not take away the need for a policy response – and public investment – at the national level, as the EU platforms are largely supportive of peer learning and do not have the authority (or scale) to cause national agencies to respond to these challenges in a socially meaningful way. We suggest there is potential value in BIS and the Technology Strategy Board pursuing various actions, along the following lines:

- Continue to support the various national coordination and demonstration programmes focusing on the development of assisted living and telehealth solutions for older people (e.g. ALIP / 3ML)
- Look to expand ALIP's ability to invest in studies / coordination activity to address a number of remaining bottlenecks, including novel financial models (getting the incentives right) and the development of clinical standards for telehealth products and services
- Explore the potential for the TSB and DoH to work with CCGs on the development of a series of SBRI and PPI competitions relating to telehealth, to create lead markets
- Consider the feasibility / appetite for creating a cross-departmental coordination group, like the UK clinical research collaboration or the low carbon innovation coordination group, to bring together health and social care providers, government departments, regulators, telehealth

[51] http://healthworkscollective.com/indy-kavelaars/141866/true-value-telehealth

suppliers and civil society organisations to accelerate the rate at which health and social care services are integrated

- Consider the mechanisms available to connect UK plc into development projects and pilots internationally, whether that is in the EU through the Active and Healthy Ageing Innovation Partnership (or Ambient Assisted Living Joint Programme) or the US via the creation of bilateral pilot projects or FCO / UKTI specialists marketing UK capabilities.[52] These parallel programmes may provide access to additional public support and other investment (financial gearing) as well as access to strategic partners, supply chains and prospective customers

ALIP has built strong partnerships among both private and public sector actors, and from our interviews and desk research, it appears to be gathering momentum still. There has been no formal evaluation at this point in time, however, so there is no firm view as to the nature and extent of its contributions to date; the DALLAS evaluation will help with this gap in the evidence base, but perhaps not sufficiently, if this is to be the national flagship innovation support measure for assisted living. ALIP might also benefit from a clearer or 'SMARTer' statement of its objectives, which would help steer future investment / activities and help provide a reference for subsequent evaluations and effectiveness reviews. On the input side, it would be good to understand more about the rationale for shape of the portfolio and the scale of investment directed to defined market segments and target groups. On the output side, it would be helpful to come up with a list of realistic goals that can be associated with concrete performance targets and timeframes. This kind of discipline would, in turn, help to reveal the importance of a series of external risk factors, which are likely to impede progress (e.g. financial incentive systems within the relevant public services, integration and fragmentation in health and social care). The improvement dimensions are clear enough, but the targets will need to be worked on by the community, we recap here for clarity

- to extend the time people can live in their preferred environment, by increasing their autonomy, self-confidence and mobility
- to support maintaining health and functional capability of the elderly individuals
- to promote a better and healthier lifestyle for older people / elderly individuals at risk
- to improve the level of social engagement of older people and the maintenance of their social networks
- to support carers, families and care organisations
- to increase the efficiency and productivity of health and social care provision for older citizens

This proposed suite of policy interventions, policy objectives and measures can together stand as a kind of action plan or toolkit for the UK government in organising its response to the challenge of an ageing population going forward.

[52] The UK has been less actively involved in the governance of the major European coordination groups however, including for example, the European Innovation Partnership on Active and Healthy Ageing or the Ambient Assisted Living Joint Programme. UK industrialists and researchers are involved more at a project level, however, which will support strategic partnerships and facilitate access to markets outside the UK. There may however be some merit in the Technology Strategy Board (the UK representative on the AHA general assembly) revisiting the case for a more prominent role in various working groups and other agenda setting activities (Peter Saraga, ex head of R&D at Philips UK is chair of the Advisory Group).

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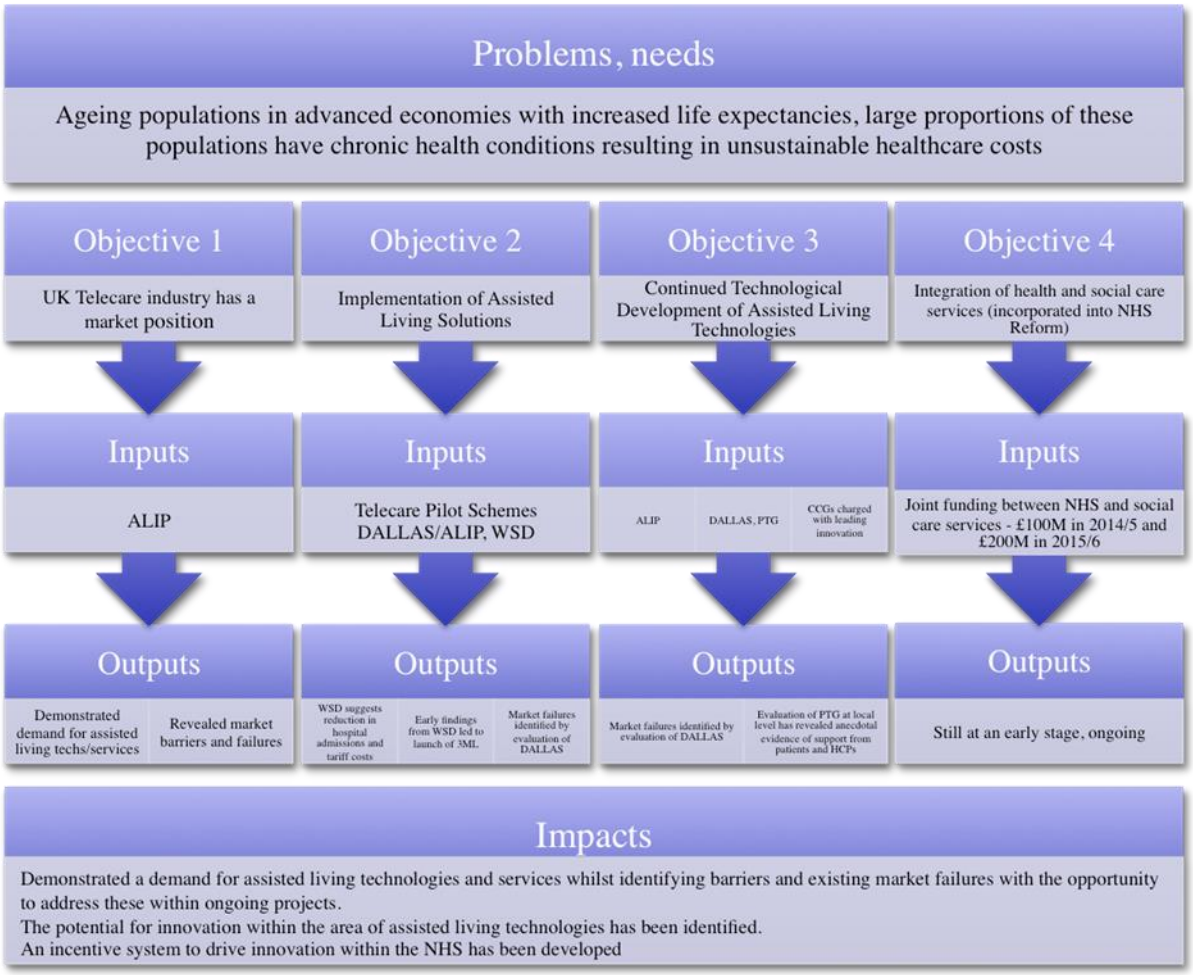
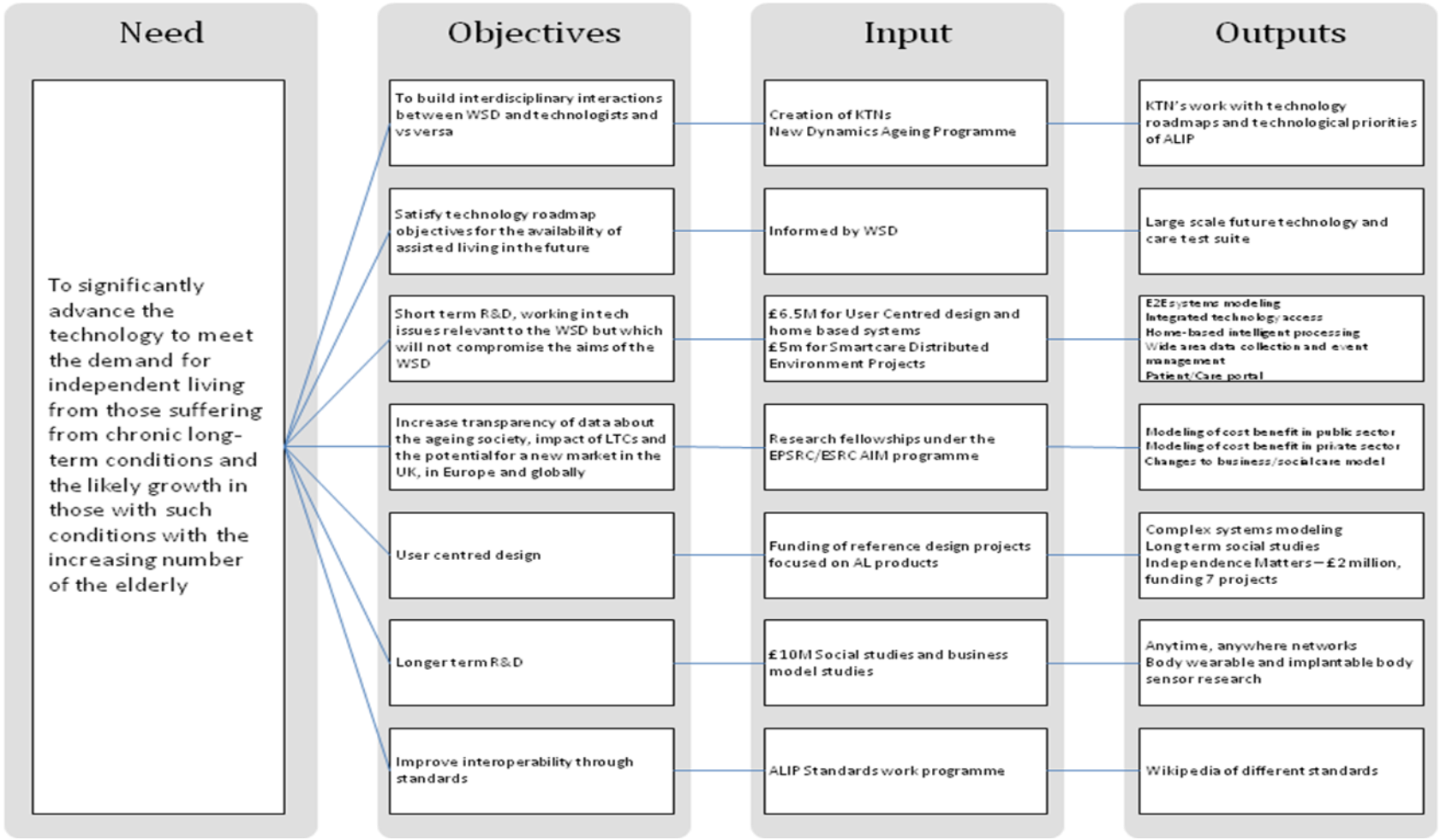
Appendix B Intervention logics

B.1 - Provisional log frame for public support for active and healthy ageing



Source: Technopolis 2014

B.2 Appendix 2 – Provisional log Frame for the Assisted Living Innovation Platform



Detail derived from the TSB ALIP Implementation Plan 2007

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