ASSISTIVE HEALTH TECHNOLOGIES FOR INDEPENDENT LIVING

A pilot research project to test the findings from *Making Interdisciplinary Research Work—Achieving a Sustainable Australia*

AUSTRALIAN ACADEMY OF THE HUMANITIES

AUSTRALIAN ACADEMY OF SCIENCE

ACADEMY OF THE SOCIAL SCIENCES IN AUSTRALIA

AUSTRALIAN ACADEMY OF TECHNOLOGICAL SCIENCES AND ENGINEERING

ACOLA

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A pilot research project to test the findings from *Making Interdisciplinary Research Work—Achieving a Sustainable Australia*

Prepared by the Australian Academy of Technological Sciences and Engineering on behalf of the Australian Council of Learned Academies

ACOLA is the interface of the four Learned Academies:
Australian Academy of the Humanities
Australian Academy of Science
Academy of the Social Sciences in Australia
Australian Academy of Technological Sciences and Engineering

ACOLA
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Established in 1971, replacing its parent body the Social Science Research Council of Australia, itself founded in 1942, the academy is an independent, interdisciplinary body of elected Fellows. The Fellows are elected by their peers for their distinguished achievements and exceptional contributions made to the social sciences across 18 disciplines.

It is an autonomous, non-governmental organisation, devoted to the advancement of knowledge and research in the various social sciences.

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By providing a forum that brings together great minds, broad perspectives and knowledge, ACOLA is the nexus for true interdisciplinary cooperation to develop integrated problem solving and cutting edge thinking on key issues for the benefit of Australia.

ACOLA receives Australian Government funding from the Australian Research Council and the Department of Education.
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FOREWORD
PROGRAM SUMMARY
MAKING INTERDISCIPLINARY RESEARCH WORK

More and more research is aimed at tackling the grand challenges of society and addressing complex problems that do not fall within the traditional academic disciplines. The need for an interdisciplinary approach to these complex issues continues to increase. The growing demand for interdisciplinary research is seen in every field and the need to understand how best to approach this does not diminish.

With a view to better understanding the complexities involved in working across the academic disciplines, the Australian Council of Learned Academies (ACOLA) undertook a project *Making Interdisciplinary Research Work—Achieving a Sustainable Australia*, funded by an ARC Learned Academies Special Projects (LASP) grant in 2010.

This program was designed to address two outstanding problems, one a key issue in research management, the other a national challenge. The first was improving the application of interdisciplinary research to the broad, problem-based research agendas of today and tomorrow. The other issue—addressed as a test case for the methodological work conducted in the first part of the program—was how to use this understanding to find effective ways of approaching the array of challenges confronting Australia. This marked the beginning of a journey that has proved to be more complex than had been initially envisaged.

The project outcomes began in 2011 with a report by Professor Gabriele Bammer of The Australian National University. The report, *Strengthening Interdisciplinary Research—what it is, what it does, how it does it and how it is supported* (ACOLA 2012) examined the status quo in the field of interdisciplinary research in Australia. It made a number of key findings and presented a set of recommendations.

The second phase of the project led to a report, *The Character of Interdisciplinary Research: Examined through a sample of socio-environmental research projects* (ACOLA 2013), prepared by Professor Michael Webber of the University of Melbourne. That report presented further findings and made it possible for ACOLA to develop a tentative evaluation framework for interdisciplinary research, drawn from both reports.

In 2013, ACOLA recognised that it would be useful to test the tentative evaluation framework through the development of a stand-alone research project that could be monitored and evaluated. The Academy of Technological Sciences and Engineering (ATSE) was commissioned to carry out a research project titled *Assistive Health Technologies for Independent Living: A Pilot Study*. The Expert Working Group was asked to apply the findings and evaluation framework to the *Pilot Study* with the usefulness and appropriateness of that framework monitored over the ten-month life of the project.

Generally the framework was shown to be sound and helpful. The outcome of the evaluation did however reinforce the complexity of managing interdisciplinary research. The breadth of activities undertaken that can be categorised as interdisciplinary is such that at best only general principles can be applied and frequently only some of these will be applicable to any particular project.

There is an increasing interest internationally in improving how interdisciplinary research is initiated, funded, performed and its results promulgated; the ACOLA study results are consistent with what has been established elsewhere. It is clear that nobody has the full answer to the many challenges which exist and although the work here represents a significant advance in understanding of what can be done to improve performance, much more needs to be done.

ACOLA welcomes feedback on this study, particularly from practitioners in the field who have experienced the challenge of 'making interdisciplinary research work'.

Peter Laver AM FTSE
Chair, Steering Committee

All reports are available on the ACOLA website at www.acola.org.au

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PREAMBLE

Assistive health technologies have the potential to improve health outcomes and quality of life, reduce healthcare costs and offer solutions for independent living, particularly for the aged and people with disability.

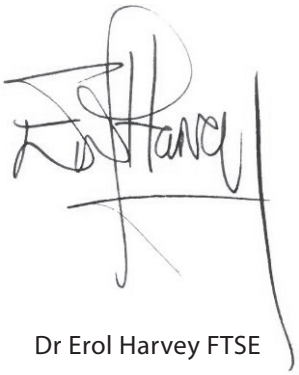
Despite the benefits provided by these health technologies, the deployment and use in Australia is limited. The aim of this project was to explore the question: *"Can the participation of experts from a range of disciplines in a user-centred network improve the adoption of assistive technologies to enable healthy and fulfilling independent living for people who are aged and people with disability?"*

This project identified several barriers and success factors that are critical to enhancing the uptake of health technologies and the development of innovative models of healthcare delivery based on these technologies. This report stresses the importance of bringing together experts from a wide range of disciplines in a user-centred network for health technologies. The interest to drive forward this agenda is strengthening, and this report puts forward compelling evidence for the support and establishment of such user-centred networks.

A key finding is that an increasing number of interdisciplinary players are moving into the healthcare sector, and that there is a likely need for an even greater range of disciplines in the future. Many of these players would be considered non-traditional, such as consumer electronics, large and small retailers, software developers, telecommunications companies, mutual/membership organisations and the like and thus important in bringing new business models to the sector. Their activity will be disruptive. We consider that a user-centred network of experts will enhance the probability of Australia taking a leadership role in this change.

This report highlights several important factors that can assist policy makers and providers to encourage greater uptake of health technologies and the development of future innovations.

The contributions, commitment and expertise of the project Expert Working Group members are gratefully acknowledged.



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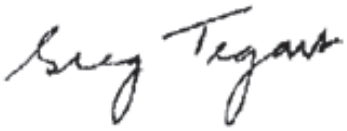


Professor Greg Tegart AM FTSE

Co-Chair, Expert Working Group

AIMS

This project aimed to explore the following question:

> Can the participation of experts from a range of disciplines in a user-centred network improve the adoption of assistive technologies to enable healthy and fulfilling independent living for people who are aged and people with disability?

METHODOLOGY

ATSE established and supported an Expert Working Group (EWG) to carry out the project. The EWG identified people to be interviewed and various online information sources to be visited, developed the questions for the semi-structured interviews, and identified people to be invited to the round-table discussion. Iterations of the resultant findings were circulated until satisfaction was reached among the EWG members.

The methodology for development of the report involved the semi-structured interviews, site visits, thematic analysis of interview transcripts, a round-table discussion with 21 participants drawn from a variety of fields, and a review of the existing literature. Case studies were used to showcase current efforts to trial and/or introduce assistive health technologies into models of care for aged people and people with disability.

EXECUTIVE SUMMARY

The mounting challenge of low population growth and increasing ageing in Australia is expected to place increasing pressure on the maintenance of healthcare standards in the face of rising costs. There is growing concern about the financial sustainability of a healthcare system in which care delivery occurs in a hospital-centric setting and is subject to capacity constraints and workforce shortages. Chronic illness and aged care accounted for over 70 per cent of Australia's $140 billion expenditure on healthcare in 2011–12.

Aged people use healthcare services more often and more intensively than younger people, a high proportion of lifetime costs being incurred towards the end of life. In Australia there are more than 3.2 million people aged over 65 years, and this is projected to rise to 5.8 million in 2031. Longer lifetimes and larger numbers of older people as a proportion of the population will see more people diagnosed with chronic conditions such as diabetes and cancer that require constant monitoring.

The development and deployment of new assistive and medical technologies can improve quality of life, facilitate healthy independent living and limit healthcare costs by providing innovative, cost-effective solutions. These are based on interdisciplinary approaches combining nanotechnology, biotechnology, information and communications technologies and cognitive science. Smart technologies such as these can enable older people to continue to live in their own homes for longer, control their treatments and medications better, identify the onset of symptoms before they need to seek emergency hospital treatment, and maintain close connections with family and society.

Such technologies are also applicable to people with disability. About 4.3 million Australians live with severe and profound disability, and for a significant proportion of them the disability is such that they are unable to live alone safely. Together with the increased number of people of all ages with disability arising from disease and accidents, this has

major impacts on the healthcare system and on healthcare costs.

The main target populations for application of smart technologies are people living alone with chronic health conditions, people with disability, people at high risk of falls, people living with dementia, people living in regional and remote locations, carers, and family members. There is a wide variety of technology-based products that can enable independent living when coupled with modern communication systems. Further, technology has the potential to allow for greater social engagement, which has been shown to be an essential feature of healthy ageing.

Linking sensors and alarms to a response centre allows for increased security at home, and linking diagnostic devices to medical experts enables better management of chronic conditions and early detection of situations where treatment or assistance is required. A self-management approach can be expanded beyond the home by the use of smart phones with attached devices for measurement of critical health parameters.

Individuals today have much higher expectations of healthcare providers than ever before. The media, call centres and the internet give people 24-hour access to expert consultation and information on which to base choices. Individuals attach a high level of importance to the evaluation and consumption of healthcare services, and the means to support them should be available.

Despite evidence of successful application overseas and several successful examples in Australia, the healthcare industry and governments in Australia have been slow to make use of these technologies. This is not surprising: such technologies are disruptive in that they challenge current methods of working, power structures and cost reimbursement systems in the healthcare professions and can create conflicts of interest between stakeholders.

The interviews, consultations and the round-table discussion held for this project provided a wealth of information and opinions on what barriers various interested parties encountered or perceived.

The main findings from the project highlight the importance of a number of factors for healthcare delivery based on the use of assistive technologies:

- A market focus is critical.
- Expert 'champions' are required.
- Long-term business models are crucial.
- New interdisciplinary players will be involved.

The project identified the following barriers to the widespread adoption and deployment of technologies that can enable innovative models of healthcare delivery and independent living for individuals:

- The integration of technology. The technology is widely available for use in Australia, but it is too hard to use, too hard to integrate, or simply does not suit the needs of end users.
- A lack of incentives and subsidies to encourage health practitioners to adopt new technological systems and approaches.
- A lack of sufficient funding to provide effective solutions and to evaluate results in trials that can be translated to other settings to provide evidence to policy makers and governments.

- A lack of leadership and competency to navigate through the 'silos'—state and federal governments, technology developers, health practitioners, care providers, policy makers and non-government organisations.
- The lack of champions to argue persuasively so as to influence the policy decisions of governments and major stakeholders.

Informed by studies of several outstanding Australian assistive technology projects, the project identified a number of factors that are essential for successful application of health technologies:

- Development and committed use of a long-term business plan.
- Using technology that is affordable and easy to access.
- Using technology that sits in the background of everyday living—where little or no action is required by users to gain the health benefits sought.
- Consultation with end users and their family, friends and carers about technology—forming and using an environment in which needs and wants can be voiced and heard.
- Having a strong workforce and team commitment—a champion and staff who have experience working with the aged and people with disability and who are technology literate.
- Using technology infrastructure that can operate and integrate a range of devices and systems, especially as technology evolves. It is essential to not be 'locked into' just one provider.

To overcome these barriers and exploit the success factors, it is vital to bring together experts from a wide range of disciplines in a user-centred network for health technologies. By putting users at the centre of all activity, such a network offers a unique mechanism to support high-quality independent living and promote the creation and adoption of innovative approaches to healthcare.

At present there are no formal networks of this kind in Australia. There are very limited mechanisms for bringing together stakeholders across a range of sectors to work on the development and deployment of smart technologies to deliver improvements in quality of life at a more economic cost. A model for the formation and operation of an Emerging Assistive and Medical Technologies Network, formerly proposed by the Academy of Technological Sciences and Engineering, is seen as a starting point for future development.

A new approach to healthcare is urgently needed. A clear, unified voice provided through a strong interdisciplinary network based on a sustainable business model can convey the information needed to inform government, industry and the community of the benefits to be gained from collaboration in the development and deployment of assistive technologies. It will also provide a platform for implementation of new policies and initiatives designed to help the aged and people with disability live as healthily and independently as possible.

KEY FINDINGS

The following are the primary findings arising from *Assistive Health Technologies for Independent Living*—a pilot study.

A market focus is critical

The expected impacts of ageing and disability in the population are well documented and assistive technologies are expected to help alleviate the associated demands. But evidence reveals current high levels of unmet need among the aged and people with disability and low adoption of assistive technologies, despite their expected value in timely and cost-effective healthcare delivery. There is not yet sufficient market demand, and widespread operational implementations are minimal. Demand drives sustainability. There is no competitive market in Australia to bring assistive technologies into the mainstream and to make them a preferred option in healthcare delivery. An independent body is needed to create an environment in which new and old players can seek to change policies in order to service isolated consumers, improve efficiencies, and reduce risks and costs. At present many groups are trying to do the same thing, and the lack of a real market is inhibiting progress. Creation of a market will need to come from individuals and organisations investing their own time and money; government is unlikely to invest, so industry investment is critical.

A user-centred network will offer end users direct access to technology and service providers, providing valuable definition of unmet user needs and rapid feedback about potential solutions. In this way the market starts to motivate the delivery of solutions, promoting the development of commercially sustainable solutions.

Expert 'champions' are required

The participation of enthusiastic and knowledgeable promoters who want to assist in improving the current status of healthcare delivery is critical. Well-respected champions who have skills in planning for sustainability and who can promote this agenda and bring together clinicians and organisations are required. A culture of innovation will see larger

health technology projects develop and lead to successful widespread adoption. Champions provide legitimacy and help bring clinicians and other groups together to build trust.

Champions and managers with leadership skills in organisations are also crucial for the diffusion of technology. Workflow difficulties pose a major barrier to technology uptake, and good management skills can help promote technology benefits and accelerate adoption.

A user-centred network will provide a vehicle for identification of such champions and offer them a voice that will be able to effect change among the interdisciplinary stakeholders.

A long-term business model is crucial

Achieving success calls for a business model that has a focus on the value the technology and innovations can bring and their ability to improve productivity, combining innovations that are cost-effective with improved health outcomes in the long term. This project highlighted the need for a business model that is adaptable and sustainable. Development and use of technology should align with the desired outcomes and the business strategy and be based on market need.

Few pilot programs of assistive technologies have moved to large-scale operational use. This raises the question of whether the technology is adequate to solve the problem arising. Defining the problem and how technology can assist is a vital step in developing or choosing the technology that will provide the desired outcomes, success and sustainability. There are many cases of the rapid adoption of innovations such as mobile phones and social media, but to date none of the assistive technologies comes anywhere near those experiences.

Innovation is about using knowledge and resources to create outcomes that are socially and economically valuable. A user-centred network will provide connections that will expand innovators' resources, facilitating the creation of new business models that will have an impact locally and internationally.

New interdisciplinary players will be involved

The healthcare market is changing, and external players are seeing the opportunity to break into the industry. The United States has seen deals with companies such as Costco, Nintendo, Samsung, FujiFilm and Apple. The new players moving into healthcare are interdisciplinary and contribute by leveraging diversification, expanding expertise range, and augmenting scale by providing the necessary capital.

Large-scale coordination requires incentives and support to connect the groups. Participation of all players—from small, medium and large firms, from diverse industries and involving a range of experience levels and entrepreneurship—is to be encouraged.

The EWG found there is a need to explore pathways to developing a market for health technologies that are based on healthcare service provision, rather than technology innovation alone: technology is secondary. As a consequence, there is potential for new players to move into this area and provide integrated solutions to delivering healthcare and offering assistive technologies as part of a suite of services. Collaboration and cooperation between interdisciplinary players, enabled and facilitated by a user-centred network, could accelerate this.

1

INTRODUCTION

Australia is not alone in having an ageing population and declining availability of middle-aged and younger people to provide economic and caring support. Europe, Japan, the United Kingdom and the United States all face the need to find innovative solutions to delivering effective and affordable healthcare over the ageing continuum. These countries are developing and deploying assistive, or so-called smart, technologies as possible answers.

In this context, assistive technologies are devices or systems that can provide assistance with everyday living. They range from simple devices such as motion sensors to devices developed using sophisticated technologies such as nanotechnology and advanced manufacturing (ATSE 2010). Assistive technologies can help the aged and people with disability live autonomously in their own homes for longer, manage their health and wellbeing, stay safe when performing tasks, and maintain close connections with family and society. Interestingly, although there have been great advances in medicine, diagnosis and treatment through technological innovation, the way in which healthcare is delivered has changed little. Health information technology is becoming integral to the practice of medicine, but current medical education and professional development curricula do not systematically prepare physicians (Graham-Jones, *et al*. 2012).

Information and communications technologies (ICT) can offer a two-way channel for delivery of health information. Telecare and telehealth services delivered at home via ICT have been demonstrated to deliver cost-effective, timely and improved access to quality care (Thaker, *et al*. 2013). Telecare relates to alarm systems and monitors that can be placed within the home to alert friends, family and medical practitioners when something of concern occurs. Telehealth uses ICT to support clinical healthcare and the management and delivery of services and has the potential to monitor the health status of individuals by recording vital statistics. Diagnosis can be delivered faster, potential drug interactions can be identified, and health records can be updated and accessed in real time and kept secure. This is particularly useful in regional and remote areas where patients have limited access to and

choice of services, when practitioners might need the expertise of specialists, and for those whose mobility is limited (CSIRO 2012; Jang-Jaccard, *et al*. 2014).

Self-management of health offers many potential benefits, such as significant improvements in health status, increased symptom control, reduced use of general practitioners, and fewer admissions to hospital (DoHA 2006). The Whole Systems Demonstrator project in the United Kingdom found a 15 per cent reduction in accident and emergency visits, a 20 per cent reduction in emergency admissions, a 14 per cent reduction in bed-days, and a 45 per cent reduction in mortality rates (Stevento, *et al*. 2012). Such savings would be welcomed by the state, territory and federal governments in Australia.

Although there are many examples of positive impacts arising from these technologies, it is necessary to develop and deploy technologies that are more accessible and are socially and culturally appropriate. This is, however, currently inhibited by a medical technology industry that is fragmented, with many entities creating new technologies in isolation (Hassan, *et al*. 2013). There are common elements in healthcare delivery for the ageing population and for people with disability. Many technologies could effectively be used in both aged care and disability support, as well as having a workforce capable to work in both sectors. Looking at both of these sectors together could lead to the development of efficient approaches to healthcare challenges.

In thinking about future developments in assistive technologies, project participants developed a vision for a healthcare system in Australia a decade or two from now (see Box 1). Some of the themes presented are developed further in the chapters that follow.

BOX 1
A VISION OF THE FUTURE

What *could* a healthcare system in Australia look like 10 to 20 years from now? And what changes would need to be made to get there?

Australia's healthcare system is complex and its future uncertain. Ideas for what an evolving healthcare system might look like and who would be involved emerged in this project from consultations with stakeholders and group discussions.

- The National Broadband Network will be in operation, and we will all be connected. We will rely on it for our services. We will make appointments to see a doctor and other healthcare services using an online system.
- There will be a strong, well-supported and independent Emerging Assistive and Medical Technologies Network that provides a link across all stakeholders.
- Change and disruption will come from consumers. New business models will be designed around their increasing demand for healthcare.
- Doctors will spend more time treating patients and less time doing repetitive paperwork.
- Consumers will be able to make better informed decisions on who they go to about their medical concerns. There will be greater online access in order to make these decisions.
- Only a small percentage of the population will be able to fund private services. The majority will continue to rely on assistance from the government.
- There will be a thriving and competitive market for heath technologies. Large electronics companies—such as Apple, Samsung and Philips—will provide integrated solutions for the health and wellness economy. They will offer devices that capture and analyse various health measures, store data in the cloud for ubiquitous access, and use the data to market health-related products and services.
- But they will not be the only important players. There will be opportunities for firms of all sizes and structures to be involved: the market environment will be flexible to allow for the involvement of new players. There are already a number of smaller groups that are trying to build relationships with service providers to deliver a private service.
- Geographical location for products and services will become less relevant. Consumers will make health-related purchases via the internet, informed by social media.

- Technology will be widely available. Consumers will be able to visit health and wellness stores and interactive websites to talk to health professionals about their needs and to seek advice and try-before-you-buy experiences.
- There will be greater equity of care in remote and regional areas because distance will no longer be a barrier to receiving fast, quality care.

What needs to change along the way?

- a full National Broadband Network roll-out; a fully functional, ubiquitous network. It can happen: the technology is there
- the development of new business models for promotion, sale and support of health and wellness goods and services that involve social media, online purchasing and localised support
- a thriving innovation system achieved by
  - building excitement, education, and promotion of the value of technology
  - funding and mechanisms for research translation
  - an easy-to-negotiate health regulatory system—for example, streamlined Therapeutic Goods Administration processes
  - creation and nurturing of an entrepreneurial culture where risks are taken and value is added. There is a need to move out of the 'comfort zone'
  - facilitated collaborations assisted by expert brokers—for example, innovation intermediaries
- services and technology embedded in an interoperable platform that integrates with lifestyles, rather than a plethora of intrusive stand-alone devices
- security and privacy measures for the safety of personal health data but still provision of access to public and private providers for health services and support. 'Big health data' will be available to commercial developers
- clarity of regulatory requirements for devices, monitors, health aids, and so on. The blurred boundary between regulated and unregulated diagnostic devices and therapeutic interventions requires clarity
- clarity about the limits to product liability and indemnity for goods and services offered
- clarity of payment schemes and the ability to cost-share between public and private funding sources
- the ability for users to make choices about where to apply for limited public funding support to suit their personal situation.

2

ASSISTIVE TECHNOLOGIES: THE BARRIERS AND OPPORTUNITIES

In Australia there have been numerous pilot tests and demonstrations of telehealth and telecare services and technologies, some of which have been evaluated and show considerable efficacy. But many innovations have not been implemented beyond pilot stage and have therefore failed to deliver the benefits expected of them (Celler & Lovell 2003). New technologies face a number of barriers to adoption. A lack of incentives, lack of education about the potential benefits, and limited data to prove cost effectiveness can impede uptake (Mattke, *et al*. 2010).One pathway to success is through applying and displaying the effectiveness of technologies across a variety of sites and systems.

Pilot studies of health technology and telehealth projects generally do demonstrate improvements in health outcomes, reduced hospitalisations and a higher quality of care. Australian studies show that the dominant focus of trials has been simply to demonstrate that a device or system works (NICTA 2010). The OECD has noted, however, that small initiatives will never achieve the benefits scale brings to a complex science project (OECD 2014).

If the lessons learnt from small initiatives are evaluated and applied to alternative sites and systems, this provides a model for translation and can minimise barriers associated with roll-out for wider adoption.

Barriers

Well over 500 studies in health information technologies make reference to barriers to use such as whether the technology fits seamlessly into normal daily routines, cost and access to technology, perceived benefits to the user, the level of trust in devices, and the level of use by clinicians and practitioners (Jimison, *et al*. 2008). Descriptions of most of the barriers noted in this report are brief and not thoroughly discussed. For further discussion, see *Smart Technologies for Healthy Longevity* (ATSE 2010). There are a number of categories of barriers, among them the following:

- economic
  - lack of well-designed and long-term sustainable business models
  - high cost and high risk

- lack of financial incentives and reimbursements

- policy
  - strict regulation
  - no streamlined processes and policies across state and federal health departments
  - lack of coherent evidence to inform decision making—by governments and end users
  - lack of acceptance and therefore the drive for deployment
- socio-cultural
  - personal feelings—about technology, privacy and security
  - high cost
  - lack of access to technology and education about using it
  - lack of knowledge about the benefits
  - an inability to voice opinions to the 'right' people
- scientific
  - lack of research and innovation translation
  - interoperability and usability of technology
  - trials not being coordinated to allow for comparison across sites and systems.

The EWG identified the following barriers to widespread adoption and deployment of health technologies that can facilitate innovative models of healthcare delivery and independent living for individuals:

- The integration of technology. The technology is widely available for use in Australia, but it is too hard to use, too hard to integrate, or simply does not meet the needs of the end users.
- A lack of incentives and subsidies to encourage health practitioners to adopt new technological systems and approaches.
- A lack of sufficient funding to provide effective solutions and to evaluate results in trials that can be translated to other settings to provide evidence to policy makers and governments.
- A lack of leadership and competency to navigate through the 'silos'—state and federal governments, technology developers, health practitioners, care providers, policy advisers and non-government organisations.
- The lack of a champion to argue effectively and forcefully so as to influence the policy decisions of governments and major stakeholders.

Technology

Although almost any medical device can be wirelessly enabled to assist with healthcare delivery in the home, how these devices are connected and monitored is less clear. In Australia some technologies are readily available, and there is an extensive knowledge and research base for future innovations. Australian telehealth trials generally use off-the-shelf technologies, whereas international trials usually use technology that has been custom-designed.

There are market opportunities for device manufacturers to develop technologies that can treat, cure or prevent disease. Technology developers require an understanding of the principles of disease and of the cultural and social context. Insufficient medical knowledge could hinder product creation. Developing a technology without fully understanding its potential application will almost certainly lead to market failure. Rigorous protocols can also hinder product introduction—for example, lengthy and costly processes for receiving approval from the Therapeutic Goods Administration. The number and levels of sophistication of technologies are increasing (Sorenson, *et al*. 2013). Often by the time an application is completed, the technology has evolved or alternatives have emerged: rapid change makes knowledge quickly obsolete, and this can be a deterrent for manufacturers.

Technologies that have the potential to assist in the treatment or prevention of disease or in the maintenance of health and wellbeing need to be affordable, but they also need to be readily accessible. If an individual decides they want a particular device, they need to know where to go to obtain it and how to install and operate it.

The benefits to be gained from some assistive technologies will be lost if the product is simply too hard for individuals to install or use.

The uptake of such technologies requires that users have the ability and desire to use the technologies, as well as access to the internet. In 2012–13, 83 per cent of Australians were users of the internet, with those in the 15–17 year age group accounting for the highest proportion of users (97 per cent) and those in the over 65 age group accounting for the lowest proportion (46 per cent) (ABS 2013b). In Australia internet use per 100 people is below that in Finland (91 per cent), New Zealand (90 per cent) and Canada (87 per cent) (World Bank 2013). Research into adoption, returns on investment, the realisation of benefits, and integration and interoperability will be needed to improve uptake in the future (Soar & Croll 2007).

Satisfying the needs and wants of the user

Self-identity and self-image are important. Technology can be a foreign concept for people who have not yet actively embraced it. For technology to be widely taken up, users must understand the potential benefits. They do not want to appear vulnerable or stand out from their peers by, for example, wearing some form of obtrusive technology. Devices that operate seamlessly in the background, allowing users to go about their day-to-day activities without disruption, will be more readily adopted and will alleviate some of the burden on support staff who might have to travel long distances to carry out simple monitoring procedures. This is especially important for rural and remote areas.

The delivery of care has changed in the past 20 years. People can now manage their own health as they age in their own homes using advanced technology. Technologies such as the internet, smart phones and social media can drive improvements in chronic care in Australia (Kavanagh 2010). Research suggests that people aged between 55 and 74 years are increasingly taking up new technologies and adapting to use of the internet, mobile telephones, tablets and gaming technologies (Zickuhr & Madden 2012).

Connected technologies can improve social interaction and play a role in maintaining physical and emotional health and cognitive function. Patients receiving care in the home express a higher level of satisfaction than patients receiving care in hospitals (Leff, *et al*. 2006).

Privacy

Sensors and monitors can be worn or placed in homes and connected to call centres and clinics. Expansive data can be generated and analysed to aid in detection and prevention of mishaps and to alert care responders. Among the benefits can be monitoring of chronic disease, faster emergency assistance, and detection of falls. The data generated can, however, pose a potential threat for an individual's security and privacy. Trust between all parties, in relation to the intended use and storage of and access to the data, is required. The privacy of an individual's data is a human right (Safran, *et al*. 2007.

Social media sites such as Facebook, Twitter, LinkedIn and Instagram are commonly used today. People are increasingly sharing information and are willing to publicly express their thoughts and feelings. It is likely that open data sharing will be increasingly used, and this might lead to the perceived risks diminishing over time as the digital age evolves.

Providing choice

Populations are not homogenous, so the healthcare offered needs to be diverse and suitable for meeting a range of needs. Many people with disability live in group homes or aged care facilities and, while some would argue that this is an improvement on the previous institutional arrangements, these environments still segregate people in a way that can inhibit social inclusion. More than 7000 young Australians are living in aged care facilities because the alternatives are very limited (Productivity Commission 2011). Such arrangements provide very little choice about living companions.

Social isolation affects people with disability and their families at a disproportionally

high rate. Some people with disability report that they are not happy with their living arrangements, and many want to live independently in the community but do not have the support needed to do so (DSS 2009; Cashin 2014). It is reasonable to argue that very few people living in group homes would choose to live in that way if they had a realistic alternative. More choice in living environments is needed, particularly for people who have lived in rural and remote areas and have had to leave their communities and move to urban areas. The Summer Foundation in Victoria and the collaborative efforts of the Medical Device Partnering Program at Flinders University are working towards new and innovative models for delivering independent living support for people with disability (see Boxes 2 and 3).

Dealing with rising consumer expectations

Australians today have much higher expectations of healthcare providers than previously. Advanced communication channels such as the media, call centres and the internet are now providing 24-hour access to services in the retail and financial sectors. The heightened consumer expectation that has resulted from this has flowed on to the healthcare sector, where a similar level of service is wanted. Until now, however, this expectation has been widely disregarded by healthcare providers. But the attitude is changing as more emphasis is being placed on consumers' views, and the consumer's perspective is becoming an increasingly important element in the evaluation of healthcare services. Consumers are seeking better value for money when it comes to their health and independence.

Involving General Practitioners

Encouraging the use of technology as the preferred mode of consultation with General Practitioners (GPs) will require subsidies and incentives to ensure that GPs gain an economic return from consultations and still have the capacity to deliver high-quality care.

Interviews for this project on assistive health technologies highlighted the need for greater GP involvement in the widespread use of health technologies, but they also revealed a lack of understanding of telehealth—how it works and what it could do—and a lack of interest in becoming involved. General Practitioners are crucial to the uptake and success of telehealth, and greater leadership from divisions of General Practice is needed.

There is a Medicare funding stream that has enabled GPs to use telehealth if they wish, and the Royal Australian College of General Practitioners has assisted in the creation of guidelines and standards for the delivery of care through this medium. Medicare also began providing rebates to patients for participating in real-time video consultations with medical specialists in July 2013.

Misalignment of incentives for the use of health technologies between players, as well as the lack of a reimbursement model, have proved a daunting barrier in the United States, where there is potential but still not a thriving market for technologies to enable independent living (Kayyali, *et al*. 2011). Reimbursement models are essential to the widespread adoption and use of home-based technologies for healthcare (Alwan & Nobel 2008).

Funding

For many Australians, being cared for at home would provide more practical, reliable and affordable access to healthcare, without the time and expense involved in travelling to major cities in the case of people in rural and remote areas. In the future, the provision of home healthcare is likely to be the only economically viable option (MTAA 2013). Consumers need to have choice and flexibility in relation to the provision of care and support at home. A range of technologies exist to support patients who wish to remain in their own homes, but users generally have limited ability to pay for current technologies, which are relatively expensive because of their small market.

Australia's current healthcare system is fragmented, and there are multiple barriers

BOX 2
INTEGRATED HOUSING AND SUPPORT DEMONSTRATION PROJECT, VICTORIA

In 2010 accommodation concerns for people with disability led to investment to develop purpose-built housing and accommodation. Residential Independence Trust was created, with Residential Independence Pty Ltd, or RIPL, acting as trustee to create opportunities for people with complex support needs to live as independently as possible in their own home.

Research studies along with consultations with people with disability, their families and carers reveal that the type of accommodation needed must take into account questions about choice and control, which are often lacking in an institutional environment. For a younger person with disability, moving into a nursing home or group setting should not be the default choice: there are opportunities here for innovative solutions to enable active participation in the community and offer individuals a real choice about where they live.

Facilitating choice for many young people requires substantial change and an increase in the number of supported housing options in Australia. A collaborative project with the Transport Accident Commission and Common Equity Housing Limited aims to provide evidence that could drive this change and demonstrate that people with disability can live independently with the assistance of smart technology. A longitudinal study is being conducted by the Institute for Safety Compensation and Recovery Research.

Six apartments purchased by disability housing providers the Transport Accident Commission and the Summer Foundation provide an appropriate housing option for people with disability in an otherwise conventional apartment complex. The aim is to show the positive impact that age-appropriate, well-designed and well-located housing can have on the lives of people with disability.

The Summer Foundation is developing the next generation of solutions and services, central to which is 'integrated housing'. In countries such as Canada integrated models of housing have been operating successfully for over 15 years. Three main outcomes are sought:

- reduced reliance on paid staff
- development and refinement of an innovative, flexible and cost-effective support model
- provision of individualised support based on the specific needs and preferences of each resident.

and complexities involved in gaining access to products and services. The inclusion in home care packages of medical technologies for home health will help create equitable access to care that allows individuals to be treated in their home environment.

This project explored the barriers to moving from pilot programs to mainstream deployment and uptake. A pilot is designed to answer a research question, and if the program answers it the pilot is considered completed. The aims for pilot programs and ongoing sustainable programs differ, as discussed in Chapter 3. What is needed in the latter case is a long-term business model in which economic sustainability is fundamental.

Considerable investment is required to scale-up projects. Greater investment will be provided only on the basis of rigorous and thorough evidence. And this type of evidence comes

Technology

Users can use their smart phone or tablet to unlock and open doors, open and close window blinds, control the air-conditioning and turn lights on and off. Communications technology also enables residents to contact staff when necessary.

It is recognised that the model of support will change greatly over time as residents settle in and become more comfortable and independent using technology and equipment. Their feedback will change the shape of future delivery.

Funding

Annecto, a not-for-profit organisation committed to helping individuals with disability to engage with the community, provides support for the first two years for both Transport Accident Commission claimants and people with individual support packages funded by the Department of Human Services.

There are plans to develop a further 23 independent living suites in Victoria by late 2014.

RIPL allows for and encourages new providers to be involved in the procurement process for RIPL sites. Invitations will be made through the Victorian Government Tenders website, and industry engagement sessions will be held for interested parties.

There are a number of similarities between the Woodville West Urban Renewal Smart Living initiative (see Box 3) and the RIPL housing project in Abbotsford:

- It is acknowledged that what works for one person might not work for another. Choice should be there for users.
- Technology and human on-call support are available 24 hours a day.
- The support provider is independent from the housing provider.
- Apartments for people with disability are embedded in an otherwise conventional apartment complex, removing the idea of segregation.
- Both initiatives realise that the model of care will change with time in response to feedback from users. Flexibility is the key.

only from larger projects. Where pilot programs demonstrate real health benefits, productivity improvements and cost reductions, incentives for private investors to assist in scaling up the programs would be invaluable.

Evidence and evaluation to influence change

If research evidence is to have an impact on healthcare spending, it should be targeted and be used to inform policy and promote change.

Assessing the effectiveness of technology through research and evaluation can assist in the practical deployment of technologies that provide therapeutic benefits and a financial return on investment, with concurrent removal of inefficient devices and practices (Sorenson, *et al*. 2008).

Clear evaluation of technology, its effects and application is needed if healthcare costs are to be reduced. Discussions during this project

BOX 3

ENABLING ASSISTIVE LIVING AND ACCESSIBLE HOUSING

The Medical Device Partnering Program (MDPP) at Flinders University is funded by the South Australian State Government, and supports the development of innovative medical devices and assistive technologies through collaborations between researchers, industry, clinical end-users and government.

The MDPP is a unique model for collaboration that focusses on early interactions with all relevant stakeholders and results in products and services which are both cutting-edge technology and that meet identified market needs. Within the community there are a number of people with physical and neurological disabilities who want to live in their own homes, but require assistance or specialist care. Historically, these members of the community have had to uplift and move into a group or nursing home, to receive the 24 hour support they need. To help provide a solution to enable greater independence and social inclusion, the MDPP have been involved in a number of assistive technology developments, including home automation at varying degrees of customisation. Projects have ranged from large-scale purpose-built accommodation, to adaptation of existing housing to provide an assisted living environment.

1. Woodville West Urban Renewal Smart Living Project

Finding a solution to this problem was the driver for development of eight 'smart living' apartments at the Woodville West site in Adelaide, each featuring cutting-edge assistive technologies for people with disabilities. Collaboration between the MDPP, South Australian Department for Communities and Social Inclusion (DCSI), Housing SA and local technology providers enabled independent living through provision of in-home monitoring and remote support for people who would otherwise need 24-hour onsite care. The integration of assistive technologies into the apartment enables choice and control for people with a disability living alone. Each apartment is NBN connected and a concierge service is available for assistance, emergency and after-hours support 24 hours a day, providing security and peace of mind for the individual and friends and family. The development was based on user-centred design principles, with several focus groups held to ensure the apartments were purpose built based on user requirements, Following initial focus groups, information and evaluation sessions involving end-users, their family, friends and carers took place with feedback assisting to develop and shape the system.

The MDPP engineers provided design advice and technical specifications to ensure the building was equipped with user-appropriate remote support and in-home monitoring for people who would otherwise need 24-hour onsite care.

Technology

The technology was built from the ground up to allow for an all in one integration model. Each apartment features an automated system with an integrated call system (to an on-site concierge), environmental controls and communication devices, enabling significantly increased independence for residents. The apartments include sensory alerts to make emergency calls, smart communication such as Skype on TV, automatic intercoms, passive monitoring and remote controls for doors, blinds, light switches and appliances.

Funding

Central to this initiative was the desire for separation of functions/service responses, where individuals would be tenants who still have the responsibilities of paying rent and utilities through their support package from Disability SA. Each person has an individual tenancy agreement with the South Australian Housing Trust. Ongoing costs for the concierge service, daily support, technology and retrofitting is funded through Disability SA of DCSI.

Collaboration

The Smart Living Project was developed and implemented through a collaborative team approach. The team had experience in working with people with disabilities, which meant they had a greater understanding of the skills and requirements needed to drive and manage such a project. Experienced medical and technical engineers meant that all involved could understand the technology, how it could be used and adapted. Working with groups and individuals in different fields mean that there was constant learning and new skills developed with efficient use of time and expert knowledge. This working environment was successful due to the investment in time the initial pre- development stage. The team was committed to make it work and could see the benefits offered by such a project.

Outcomes

- The project is an example of a collaboration between university, industry and state government to deliver health technology benefits.
- It showcases cutting-edge technology-based care systems that provided cost benefits and increased quality of life, enabling greater independence and social inclusion.
- It also offered the opportunity for biomedical engineers to refine and develop technologies to maximise people's choices and control over their care setting.
- While the project involved eight apartments, the lessons learnt can be transferred to enable implementation on a larger-scale and application to other settings.

2. The Retrofitted Electronic Aids project

At the other end of the scale, the Medical Device Partnering Program embarked on the Retrofitted Electronic Aids project, which demonstrated that a range of readily available electronic and electro-mechanical products can be fitted to an existing house or dwelling for less than $10 000.

This demonstration project has shown that off-the-shelf products such as universal remote controls, intercoms and voice recognition technology can be easily controlled by a person living with disability, providing greater quality of life and independence. Technologies can be applied to a range of settings, in the homes of people with disability and those of the aging population wishing to remain at home for longer. The technologies can be added in a modular manner in accordance with user requirements.

identified the need for substantial funding within a project budget for an evaluation. It was suggested that about 10 to 20 per cent of the budget be specifically used for carrying out an evaluation. Such an evaluation should be rigorous and be designed before the pilot gets under way.

Investment in telehealth infrastructure requires high capital expenditure on the part of government. Even in cases where medical technologies are cost-effective, the available resources might be better allocated to other more cost-effective investments outside the healthcare sector.

It has been claimed that technological innovation is a determinant of health spending, but international research to support this claim is limited (Sorenson, *et al*. 2013). This project's Assistive Health Technologies for Independent Living discussions raised the prospect that government might not invest in health technology systems because, despite a previous 'misconception' that technology will reduce healthcare costs, use of such systems will in fact lead to increased costs. We are, however, starting to see greater government interest in telehealth and other technology opportunities than ever before.

Investment in larger, long-term care initiatives that are based on evidence can facilitate the uptake and use of consumer-oriented technology that will deliver efficient healthcare. This necessitates development and implementation of policies that are based on evidence, that encourage strong stakeholder support, and that produce a simple and effective message allowing technology to be mainstreamed without regulatory or political barriers.

Telehealth can be particularly convenient for families, providing time and cost savings while reducing disruption to daily life. It can encourage the use of local services, thus reducing the demand on tertiary services such as a specialists, hospitals and palliative care. Particularly in regional and remote areas, participation can foster a long-term partnership in care, with the benefits echoing well beyond one consultation (Jury & Walker 2013).

If a specific technology that offers substantial health benefits for a particular condition or group of individuals is applied to an alternative condition or group, however, the effect on health might be less significant or absent and could lead to an increase in costs. Impacts on costs can be affected by how the technology is administered or how it affects the delivery of care: some innovations might lead to increased use of personnel, resources and training hours, whereas others might reduce staff requirements or resources and therefore contribute to long-term economic benefits (Sorenson, *et al*. 2008).

Pilots with the National Broadband Network

The National Broadband Network (NBN) is a $36 billion infrastructure investment project aiming to deploy high-speed broadband to 90 per cent of homes in Australia. It has the potential to be an important enabler for implementation of health technology devices and systems.

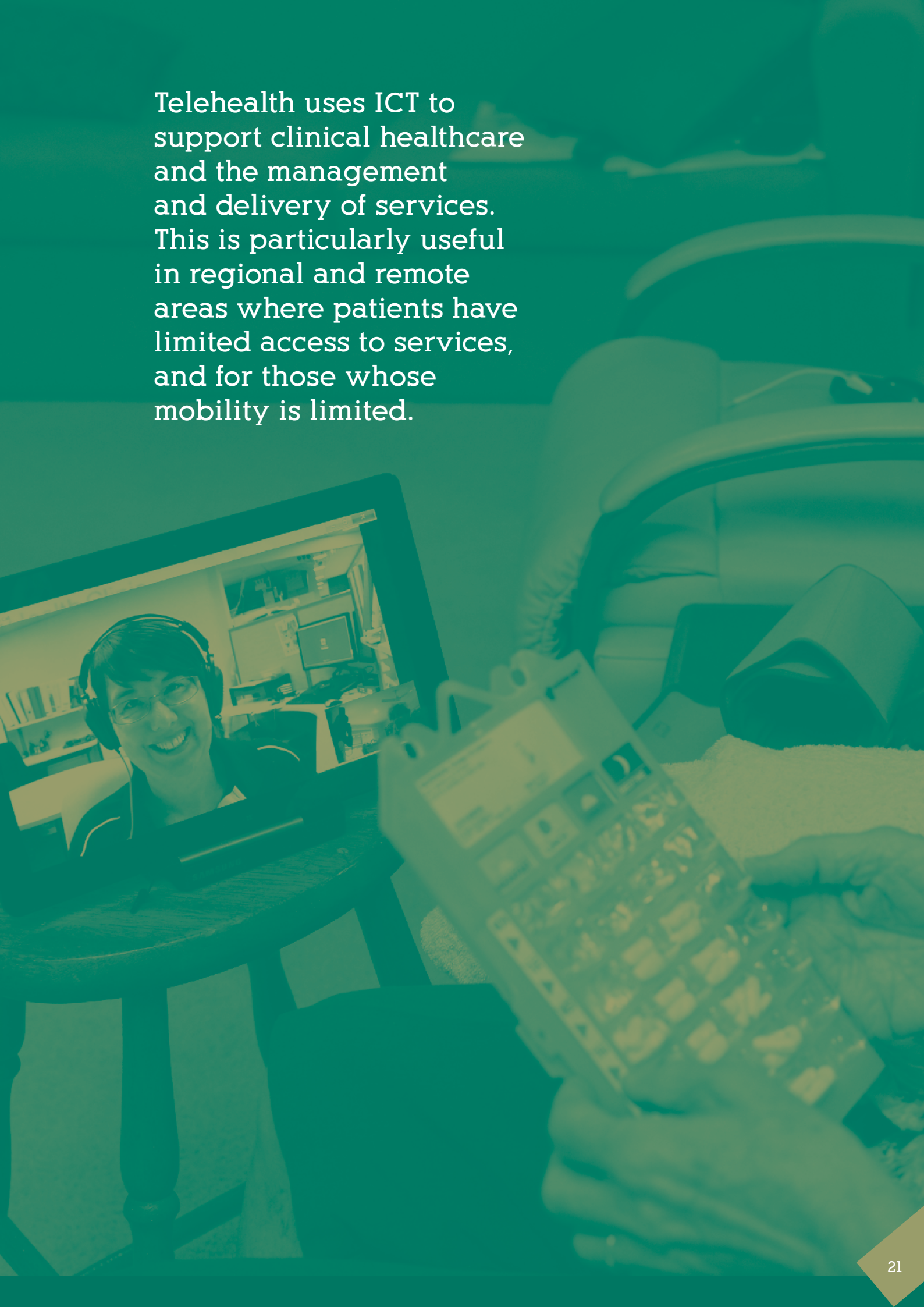
In 2012 the Australian Government Department of Health provided $20.6 million to nine organisations to develop and deliver telehealth services to NBN-enabled homes with a focus on aged, palliative or cancer care services, including advanced care planning. The Telehealth Pilots Programme aimed to show the evidence and opportunities for the extension of telehealth services in the future, including the business case for doing so.[1] Telehealth services can be delivered to the home in new and innovative ways, enabled by any broadband access technology considered fit for purpose.

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) are also involved in several NBN trials—see Boxes 4 and 5.

In 2010 the Australian Government provided funds of $466.7 million for development of personally controlled electronic health records, with the aim of making management of patients' health information more efficient and allowing the information to be shared safely and securely between healthcare organisations and the individual.

[1] http://health.gov.au/ehealth-nbntelehealth.

Telehealth uses ICT to support clinical healthcare and the management and delivery of services. This is particularly useful in regional and remote areas where patients have limited access to services, and for those whose mobility is limited.



BOX 4
CSIRO: THE HOME MONITORING OF CHRONIC DISEASE FOR AGED CARE TELEHEALTH PROJECT

We wanted to provide information to government that would help them make decisions on funding and long-term sustainability of telehealth service delivery programs.

Rationale

The project is the first multistate, multisite randomised controlled trial of telehealth in Australia. The research goal was to develop advanced modelling and data analytics and risk-stratify chronically ill patients receiving home-based telehealth services in order to decrease hospital admissions. Patients with chronic disease are high-cost patients to the health system. Providing a means for self-management of conditions at home through remote assessment by health workers can reduce hospital admissions and deliver effective care while improving quality of life.

The project aims to provide essential and previously unavailable data on deployment and methodologies that will allow telehealth models of service delivery to be scaled up nationally. Additionally, there will be the development of new intellectual property that will be applicable across a number of platforms and could be licensed to both health service delivery agencies and telehealth technology companies internationally.

Project

The project involved six fibre and fixed-wireless NBN-connected sites around Australia that have diverse models of care, representing a wide range of health service providers. Four test sites were located in public sector community-based health services, one was in a hospital setting and another in a not-for-profit community health service organisation. Each site enrolled 25 test patients who received home monitoring services and 50 control patients who received normal care. The trial, which was to run for 12 months starting in January 2013, is likely to conclude at the end of 2014.

The telehealth platform was provided by an Australian company, Telemedcare, a research, software and hardware developer. Telemedcare provided the deployment, training, support and specialised in-home monitoring units to enable participants to monitor their condition from home.

Outcomes

Outcome measures will be multifactorial, looking at health care outcomes, organisational change management, workplace cultures, socio-economic benefits, and user perceptions on the part of patients, doctors and administrators. Health measurements include electrocardiogram, blood pressure, weight, lung function, body temperature, blood oxygen and blood glucose.

It was noted that the patients are not the barriers in such telehealth trials: rather, it is organisational change that has major impacts on implementation. This trial had 99 per cent compliance, and it dramatically changed the way patients look at their own health condition as a result of telehealth monitoring at home. It is by far the most effective technique for behaviour change, something that came as an initial shock to the project organisers.

Barriers observed in the project and for general deployment

A number of barriers to success have become apparent:

- slowness in the NBN connection or no connection at all. This led to delays of up to six months in some areas
- the number of ethics approvals that need to be gained, rather than one overarching national requirement
- patient recruitment. The aim was to have 150 test subjects and 300 controls. The project had to be extended to the end of 2014 to ensure that it enrolled the required number of subjects
- difficulties getting GPs to participate. About 20 per cent wanted to become involved in the trial; the remaining 80 per cent wanted to be involved in a limited way through reports sent by email or fax
- lack of leadership and competence to align the 'silos' operating in this area, both state and territory and federal.

Keys to a successful project and long-term deployment

A number of keys to success have emerged:

- having a long-term business model
- the contract stated that in the last six months of the project CSIRO would work closely with the service providers to explore a sustainable model
- the need for a 'driver'—someone who is a committed leader, who is familiar with several aspects of the business and who has the power and capacity to get the networks together to push forward
- designing a project in a way that would deliver information to treasury and government that is scientifically rigorous and appropriately designed, with a large number of participants to provide thorough analysis
- having a strong research team and high-quality expertise. The team needs to be committed
- applying the telehealth model in a range of settings rather than in isolation. The lessons learnt along the way can assist in designing a strategy to scale up telehealth nationally
- looking at more than just one disease condition, so that the results can be translated to several conditions
- communicating with GPs to find out how they see telehealth working in the future
- having significant funding to design and carry out a trial and understanding that delays cost money and funding is required to cover added costs.

Funding

Total funding for the project was $5.47 million, which came from the Australian Government under the Telehealth Pilots Programme ($3 million), CSIRO ($1.27 million) and project partners ($1.2 million).

Partner organisations

Partners in the project were iiNet, Telemedcare Pty Ltd, Grampians Rural Health Alliance, Nepean/Blue Mountains Local Health District, Anglican Retirement Villages, Canberra Hospital, the Chronic Disease Program, Northern Area Health Service Tasmania, Townsville–Mackay Health Service and NSW Health.

BOX 5
CSIRO: SMARTER, SAFER HOMES

A success factor? The end user is the driver, rather than researcher or provider. CSIRO is simply introducing the idea and the user provides the framework for what technology is acceptable for use.

Rationale

Australia is challenged by the growing number of people in aged care facilities, and the available accommodation is expensive. Through the Australian eHealth Research Centre and the University of New England, CSIRO is conducting the Smarter, Safer Homes project to develop a low-cost, non-invasive sensor, monitoring and support system to enable people to live longer at home or in a supported living community by using broadband network connectivity.

CSIRO is working on the premise that some older Australians do not want to go into aged care facilities and want to remain independent. The project involves sensor networks installed in up to 20 broadband-connected residences with the help of healthcare workers, older residents and their families, an aged care facility and a local general practitioner.

Project

The pilot was 15 months in development. Initially it was to run for nine months, but it has now been running for two years and five months. The project is based around research and development and, on completion, can be handed over for commercialisation or to a service provider for licensing.

For the pilot CSIRO had to prove the concept, demonstrate evidence and refine the technology to enable the establishment of different service models and to align these with what is currently provided. One aim was to inform and provide to government evidence of a successful initiative for which it could provide funding support.

The drivers for the project were the seniors using the technology. CSIRO held workshops with seniors and engaged with providers and international groups from around the world (OrcaTech and Oregon Center for Aging and Technology).

Outcomes are measured through questionnaires and interviews on the usability and acceptability of the technology for the end user and their family. Some users did not want to be involved in the trial, but generally the uptake was good.

Opportunities

People are becoming more proactive about their health, and assistive health technologies have the potential to enable healthy, independent living for the aged and people with disability, provide major cost-savings for the healthcare system, and create larger competitive markets for existing and new players. Innovations that could affect healthcare delivery are described in Box 6.

Alleviating pressure on the healthcare workforce

The Health Care and Social Assistance industry is Australia's largest employing industry, having supplanted manufacturing two decades ago (DEEWR 2013). As more people age, more care is needed. The people working in the sector are ageing, too, and the economy cannot support the number of healthcare workers needed. Rather than looking at innovative ways of deploying technology to help reduce inefficiencies in the workforce, there have been

Technology

Motion detectors and energy sensors are placed around the home to monitor daily activity, and the data are reported back to family members or carers. The data are reported to an application on a tablet device owned by the elderly person, who retains full control over what gets reported to others and what stays private. Large amounts of data can be generated, and this should be processed in a way that helps inform decisions. The project focuses on gathering the right data to make better healthcare decisions.

The technology is not wearable and aligns with users' lifestyles. The aim is to look at the usability and accessibility of the technology and see if it affects psychological aspects or increases quality of life. The sensor infrastructure is flexible.

An important factor is the development of a platform that connects to any generic technology. Most of the technology was sourced internationally because of a lack of availability in the Australian market. Currently the technology is expensive—$3000 per home for 30 sensors.

This technology system does not require NBN connection: fast internet is sufficient. The NBN might be a factor if video-conferencing capability was to be used.

Partners

Research partners include the University of New England and the Oregon Center for Aging and Technology in the United States. The research is an Australian Centre for Broadband Innovation project. It is led by CSIRO in conjunction with National ICT Australia and NBN Co, with foundation funding from the New South Wales Government. At CSIRO the Autonomous Systems lab, the Human Computer Interaction lab and the Biomedical Engineering lab were involved in development of the technology and the study.

Flood detectors alert a response centre if water is left running

attempts to expand the number of healthcare workers from an already limited pool. Growing pressure on carers and practitioners can be alleviated by using assistive technologies in the home. For example, Royal Melbourne Hospital uses hand-held computers and a medical equipment tracking system, and Redcliffe Hospital in Queensland has implemented a kiosk-based automated patient arrival system. Both systems reduce the number of administrative tasks carried out by clinical staff.

Carers

The workload of paid carers has increased, time and resources are becoming more and more limited, and the availability of informal carers is in decline (Productivity Commission 2011). More efficient operational systems are needed. The use of telehealth and telemedicine could lead to better use of resources and better care by allowing easier and superior analysis and assessment of data and utilising expertise at anytime, anywhere. In other industries, technology has enabled increases

BOX 6
INNOVATIONS THAT COULD HAVE AN IMPACT

The fact that individuals are more proactive these days and attach greater value to their health has led to increased use of the internet and information and communications technology, which is in turn motivating technology innovation.

Big data

Concerns about 'big data' from health and data networks were raised during project consultations and are regularly noted in the literature, specifically about how to analyse data in a way that can help transform how healthcare is delivered. More medical information and health and wellness data will be generated in the next few years than ever before. The growing levels of broadband access and the proliferation of electronic health records, smart mobile devices, sensor networks and cloud computing have played a big role in the increase in data storage and processing capacity.

In Australia the health information infrastructure for data linkage was reported to be stronger or more developed subnationally, at the regional, state and territory and provincial levels or within networks of health care organisations rather than nationally. Australia has a complex web of legislation at the national and state and territory levels and a decentralised administration of health. Experts describe decentralised decision making for the approval of projects involving personal health data as problematic because of this. Data collection and linkage are challenging because legislation and governance regimes vary across the nation. Nationally consistent and flexible funding systems are crucial, but 'blame shifting' between state and federal agencies means that coordination and collaboration do not occur.

Social media

Social media applications are emerging as useful approaches for the dissemination and collection of health and lifestyle information because of their ability to reach a large audience in a short time and their ease of use, affordability and accessibility. The number of people aged over 65 years who use social media is growing: 65 per cent of all people over 65 have recently read a blog or social review, 30 per cent are increasing their use of social media and the average social media user aged over 65 has 48 friends or contacts and uses Facebook 10 times a week.

Social media offer important advantages:

- They provide the opportunity to connect socially with friends and family and to use services not otherwise available.
- Digital social enterprises that support the local community can be created.
- They can act as a trusted source of advice. Social media and online interactions provide consumers with a wealth of quality knowledge that allows them to make informed decisions about their health service providers.

In 2013, 60 per cent of culturally focused small and medium enterprises and 54 per cent of hospitality-focused SMEs had a social media presence. In contrast, only 23 per cent of health and community SMEs had a social media presence.

in productivity and allowed professionals to service a much larger number of clients.

Health professionals

Unless changes to staffing models are made, a shortage of 80,000 registered nurses is predicted by 2025 as a result of growing demand and limited supply (HWA 2012). If carers can speak to their clients virtually, gain access to case files from anywhere, and have their data uploaded this will alleviate workload pressure.

Encouragement, incentives and rewards could see such technology widely adopted by general practitioners and used by individuals. Uptake is at present slow, but streamlined regulations and policy changes that direct use of the technology could prompt improvements. For example, in Denmark all GPs are trained to use e-health and the MedCom platform. Citizens are also required to use the platform, which allows them to see their health status and book GP appointments online. Assistance for those who have difficulty using the platform is available (Ministry of Health 2012).

If telehealth is to be successful it needs to be used, and clinicians and users must be engaged in and committed to a collaborative process.

The Feros Care My HealthClinic At Home pilot project involves placing a device in the homes of clients with more complex care needs. The technology allows community care managers to do a portion of their case management visits virtually. A cost–benefit analysis has been completed, and the savings in travel time and the ability for care managers to increase their case load are potentially significant. The new Virtual Case Management Model will be trialled in Tasmania in July 2014, with the hope of clearly defined cost–benefit outcomes; it is a $2.4 million project funded through the Department of Health Telehealth Pilots Programme.

Creating a thriving medical technologies market in Australia

Globally, the medical device industry is growing rapidly, and there are opportunities for innovative Australian firms to compete in this market. A robust medical device industry is an important part of Australia's future, with the potential for producing national economic and social benefits through job creation, export growth and improved healthcare. Promotion and widespread adoption of assistive technologies could create an environment that nurtures research excellence, a highly skilled workforce and manufacturing capabilities in Australia and create a thriving, competitive market.

Creating and using independent knowledge

RAND Health considers that the invention of devices and systems will be enhanced by developing coordinated approval processes, providing independent technology assessments, and creating a market that encourages demand for technologies, which will drive down the cost of purchases (Mattke, *et al*. 2010).

Australian home healthcare policies should ensure that innovative technologies, services, medical products and devices are available from all service providers. Independent assessment of technologies can help in giving the end user the information necessary to assist their decision making. Technology to be developed and purchased by end users needs to be functional and capable of delivering the service outcomes and data intended. This information should be widely available and easily accessible.

For example, in the Woodville West Urban Renewal Smart Living project, much of the equipment that was put into the system was purpose built because nothing suitable was readily available for use. Obtaining independent advice about and evaluation of available technology—in terms of functionality, features and interoperability—can help ensure the best use of technology and money. In some circumstances simpler, less expensive equipment can produce the desired outcome. Programs should be dynamic and adaptable to changing circumstances, particularly advances in technology. The Woodville project evolved throughout its lifetime as a consequence of upgrades in technology, and what was ultimately delivered differed from what the initial project specifications had described.

3

SUCCESS FACTORS

Evidence-based research is important in many policy areas—not only healthcare. Access to relevant high-quality research evidence and collaboration between policy makers and stakeholders are said to be crucial success factors in influencing change (Oliver, *et al*. 2014).

For this project, interviews, consultations and the round-table discussion provided a wealth of information and opinions on what are the central success factors for widespread deployment and adoption of health technologies. The EWG identified the following success factors as highly important or crucial to the success of health technologies and systems in terms of sustainability and widespread deployment and uptake to enable independent living for individuals:

- Development and committed use of a long-term business plan.
- Using technology that is affordable and easy to access.
- Using technology that sits in the background of everyday living—where limited to no action is required of users to gain the health benefits.
- Consultation with end users and their family, friends and carers about technology—forming and using an environment where needs and wants are expressed and heard.
- Having a strong workforce and team commitment—a 'champion' and staff who have past experience working with the aged and people with disability and who are technology literate.
- Using technology infrastructure that can operate and integrate a range of devices and systems, especially as technology evolves: it is essential to avoid being 'locked into' just one provider.

A long-term, sustainable business model

For many large data projects, networks or research platforms, a major challenge comes in trying to sustain the endeavour once the initial funding has ended. Long-term sustainability of projects is essential (OECD 2014).

Analysis of current and forecast market demand can assist in developing the right model for service delivery. Risk, opportunity and cost–benefit analysis should take place in order to learn whether the benefits outweigh

the costs. Initial and ongoing resources need investment and revenue to maintain the investment. Feros Care is an example of an Australian aged care provider that is committed to a long-term plan based on technological innovation and users' needs (see Box 7). Incorporating growth in the business case ensures that scaling up can take place. Grants and pilot funding are small scale. Actively seeking a method for longer term sustainability before carrying out a trial can see successful trials being implemented on a larger scale. Such a planning process can reduce the lag time in applying for new grants.

Collaboration between consumers, insurance providers, Medicare, governments and the private sector can offer solutions to cost-effective services, where reimbursement strategies are planned to ensure a high quality of care, revenue is produced, and stakeholders are satisfied. Forty-five states in the United States have adopted laws on reimbursement for telemedicine, whereas in Australia the Telehealth Financial Incentives Program was abolished on 30 June 2014.

Market drive

Both public and private healthcare providers are responding to the healthcare challenges Australia faces. They are not, however, the only ones who are increasing their investment in technology in order to gain market share in what is likely to become one of the fastest growing and most competitive markets.

Telstra is Australia's leading telecommunications and information services company and is continuously looking for ways to keep innovating and diversifying to increase its business and market share; it is doing so by investing in or purchasing a number of health technology companies and products. Telstra's move into health is a business decision: representatives have been reported to say, 'We are not in it for love; it is a business decision'. Telstra is a good illustration of connecting all the components that are necessary to set up a successful e-health enterprise. In doing so, Telstra has been acquiring part or all of firms such as Fred IT Group (one of Australia's top healthcare IT companies), DCA eHealth Solutions, health record company IPhealth, and appointment-booking company Health Engine. Telstra has already invested about $100 million in healthcare technology. It is likely that other large IT firms will be increasing their presence in the health area, too—for example, IBM, Samsung, Google, Cisco and Motorola.

Generally, there is low compliance in relation to self-management of health. Ease of use and education about innovative information and communications technology that can support self-monitoring, compliance tracking, remote care and communications are required. Technologies need to be interoperable, so that each piece of equipment works well with existing infrastructure.

For years, interoperability between a central platform and multiple devices from different providers seemed a distant prospect. It is now a reality. In June 2014 Apple announced 'HealthKit', which is a new app that provides an easy-to-access platform to monitor daily health data. It is designed to integrate data from apps from other firms, rather than have them sitting in 'silos'. Apple has partnered with various health institutions, allowing healthcare providers to receive and transmit data from clinicians' visits. The company states that it has deep privacy protections in operation in order to safeguard sensitive records.

Many firms worldwide, small and large, want to reap the benefits of being a service provider in the growing health sector. As noted, Telstra is one company that has made the decision to push for a greater presence in the health sector (see Box 8).

Technology choice

Organisations

The choice of technology should align with the goals, vision and objectives of the business and be integrated into the long-term business model.

Organisations do not want to develop technology that is not useful or sought after

BOX 7
FEROS CARE

Feros Care is a community-owned not-for-profit aged and community care service that has been supporting older Australians since 1990. It realises that care delivery should not have a 'one size fits all' approach and should focus on creating a range of lifestyle options that best meet the needs of clients, to enhance their independence, social connectedness and healthy ageing.

Feros Care understands the role technology plays in enabling efficient service delivery and higher quality care and has integrated telehealth into its model of care. It realises that a growing number of seniors wish to stay in their home for as long as possible and are generally very accepting of and open to the concept of telehealth.

In 2009 Feros Care began a 45-client trial to determine whether technologies and/or models used internationally would provide similar beneficial outcomes when applied in the Australian context. Two fully self funded telehealth pilot trials have taken place with a view to understanding the cost, viability and scalability systems required for wider adoption and increased capability. Since then Feros Care has been involved in four funded smart assistive technology programs, each one different and involving various partners and stakeholders, such as technology providers, Medicare Locals, universities, local health districts and referral agencies.

The NBN health pilot: My HealthClinic at Home

The current NBN pilot is a very interactive service, with 190 clients involved in over 600 video calls in March 2014 alone. This entailed a telehealth nurse talking with the clients or social group or health literacy group video-conferencing. Vital signs of clients are monitored daily and clients are contacted by phone if data have not been received. Independent pre/post interviews with clients regarding their views on the technology were carried out by Southern Cross University.

The success Feros Care has had has not come without hard work. When asked for opinions about gaining traction in this area, respondents made the following statements:

- Develop and commit to a long term business plan.
- Plan the program around client expectations, wants and needs—'Initial field trials with clients and staff helped to refine the technology development for the My HealthClinic at Home interface'.
- Raise awareness nationally of the benefits of telehealthcare through briefings with government officials, gaining opportunities and providing information to influence policy change.

or is so expensive it will not be bought. Analysis of the market requirement and need for technology is fundamental to progressing through the business plan.

A needs assessment can outline the technology requirements from the perspective of the patients or users and the employees working with it. It can also evaluate whether specific technologies are suited to the outcome and can assist in purchasing and development decisions about the sophistication of the technology. Figure 1 highlights the relationship between technology development and business progression in order to develop

- Use regular and constant gathering and analysis of data, evidence and information and take opportunities to integrate this to make improvements—constant innovation and looking for ways to do better. Evaluation of clients' expectations, acceptance and barriers has shaped current models.
- The use of emerging technologies can provide a competitive advantage and create a new income stream and new opportunities. An in-house research and innovation team keeps the organisation abreast of new opportunities. Feros Care has received awards nationally and internationally for its innovative care models, use of technology, and providing positive living, culture and leadership.
- Never underestimate:
  - the skills required to plan and implement these programs from technology developers, clinicians (particularly those with telehealth experience) and marketing, business and economics experts
  - the power of partnering—multiple parties can benefit from strategic partnering
  - the finance, time and knowledge that need to be invested.
- Use technology that is easy to operate and runs in the background of users' lives—technology that does not require constant maintenance and staff to work it, apart from the cabling and telecommunications staff for installation.
- Avoid being locked into a specific technology supplier. Technology is constantly evolving and innovative products will be coming onto market.
- There were several suggested barriers to the greater use of telehealth in Australia:
- the high cost. Telehealth involving video-conferencing costs $84-plus per week, which is generally not affordable for the general public without a government subsidy
- the fragmentation of the sector. It includes many stakeholders, industry bodies and peak bodies, and this means messages can be mixed and confusing. Governments need to be informed of the effectiveness of technology before they will be willing to commit and implement policies to encourage participation
- quality and limited technology in Australia resulting in overseas suppliers often being used.

technology that will be suited to the market and achieve market success.

The premise behind Figure 1 is that technology development must progress simultaneously with business opportunity development. Good development moves along the chart as the bold line suggests.

Moving too far along the technology axis and towards a prototype demonstration without focusing on business development will often lead to market failure—a technical solution that nobody wants or that leaves the developer trying to find a problem for their new technology to fix.

BOX 8
TELSTRA HEALTH

Having set up a new e-health division in 2013, Telstra has chosen to focus on seven market segments in healthcare, one of them being home health and aged care, which includes provider applications, telehealth, care coordination, consumer health portals, enabling technologies and data analytics.

The initial aim is to target the home health and aged care sector before moving towards tackling the challenge of the broader healthcare sector. Telstra has identified three main reasons for this move:

- continued growth of the health system
- innovation and efficiencies that can be achieved for the health care system via e-health solutions
- the 'many valuable but disconnected technologies which individually cannot address major system challenges' (Shane Solomon, National Investors Day, Sydney 2013).

Telstra's strategy is to build these capabilities through a combination of investments and partnerships with successful e-health companies and to then leverage Telstra's strengths and move to a new level by connecting different e-health capabilities in an innovative way to enter the mainstream health system. Telstra wants to provide better connectivity, implement emerging technologies, and deliver cloud-based services as part of its e-health strategy.

Mr Solomon, head of Telstra's e-health division, recently commented, 'The strategy is to connect these islands of e-health technologies and create an e-health service offering that can systematically address the major challenges confronting the health system'. Telstra believes it is uniquely placed to bring health into the digital age by investing and partnering across the e-health market to leverage and connect technologies to address the major challenges confronting the health system consistent with Telstra's strategic focus.

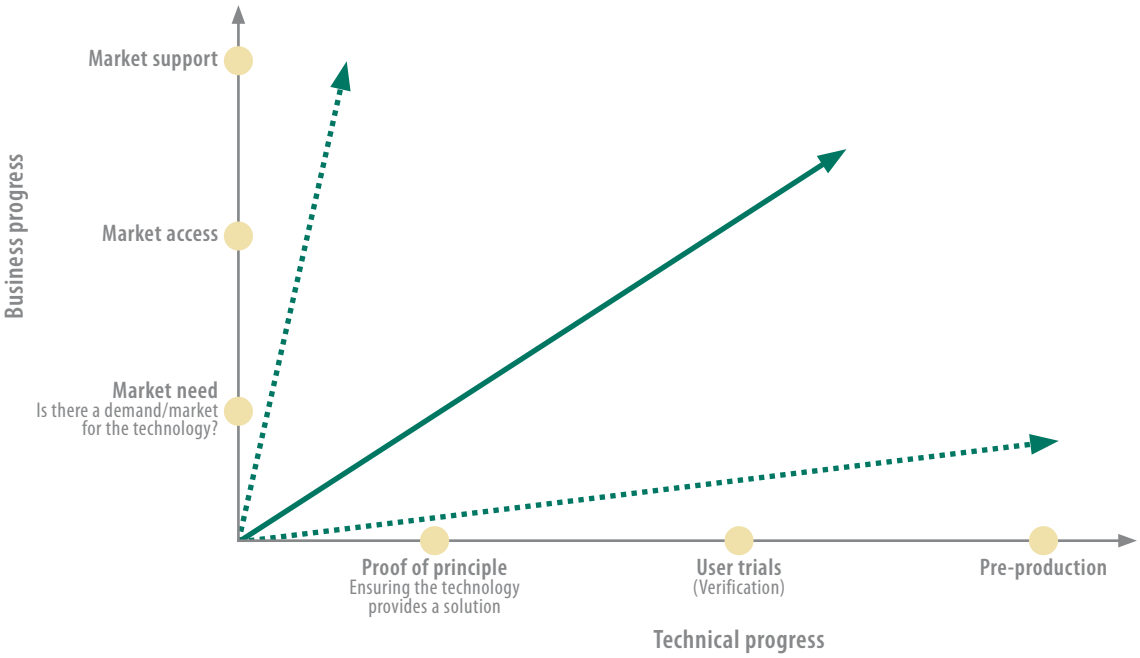
Telstra has positioned its operations to respond to the current challenges by developing a Healthcare BluePrint. The hallmarks of the blueprint are reliable communications, innovative solutions and professional integration. The blueprint responds to calls from healthcare providers for access to homogeneous network architecture, complete integration across devices and networks, as well as the need to provide greater capability, security and integration and to achieve cost reductions.

On the other hand, rushing too far up the business development axis while not checking whether the technology is available or possible can also lead to market failure. This scenario results in investors losing money and blaming the technology for not being able to deliver the outcomes promised by their 'brilliant' business opportunity.

Users

Assistive technologies should be used to improve an individual's health, wellbeing and quality of life. For these benefits to accrue the technology needs to be used and wanted by the end user. All the case studies described in this report highlight the power of engaging with users and their family and support networks in connection with the use of technology. Focus groups should provide

Figure 1. A successful technology-to-market trajectory



open discussions of technology options from the providers or vendors, and the needs and concerns of the end users should be taken into account. In the Woodville West Urban Renewal Smart Living initiative, only technology the users were comfortable with using was integrated into the apartments.

A central consideration for adopting and using technology for the aged and people with disability is that the technology enables functional independence without disruption to family members and carers. Technology should be usable.

Technology is not static: it is constantly evolving, and there is a rush to keep updating and bringing to market the next best gadget. Apple, for example, is annually placing a newer version of the iPhone and iPad on the market, building on the system capabilities of the old version. This leads to similar firms and competitors doing the same thing and flooding the market with a large range of technology for users to choose from. Given the rapid turnover of technology, there is a need to have technology and communications infrastructure that can operate across a range of systems and providers—rather than using just one provider or only having the system requirements to deal with older system versions.

Building capacity and capability

Implementation should be more about culture change and aligning economic and other incentives. Promoters of culture change can learn from past successes and failures. Promotion and knowledge sharing about what works also lead to a greater understanding of the capabilities and benefits of health technologies.

An interdisciplinary network has the potential to bring stakeholders together. Rather than keeping a list of 'tips and tricks' about what works close to home, it is important to share experiences, gain access to knowledge, and find the right partner. An environment that fosters knowledge sharing and innovative ideas is essential. This is happening internationally; for example, the US Veterans Health Administration and the UK National Health Service have a history of working together to share learning and experiences and so encourage continuous improvement. The report *Making Connections—a transatlantic exchange to support the adoption of digital health between the US VHA and England's NHS* looks at what each institution can learn from the other to ultimately advance and increase

the uptake of assistive health technologies in mainstream services (Cruickshank, *et al*. 2013).

Several other reports identify similar factors associated with the range and uptake of technologies for the rapidly ageing population and frequently comment on the need for stronger alliances between industry and research to improve the use of technologies in the aged care sector (Connell, *et al*. 2008). There are, however, barriers to publicly funded research organisations working with industry, and these pose a challenge for collaboration (Bell, *et al*. 2014).

The development of fully functioning knowledge networks and markets can have a significant impact on the efficiency and effectiveness of an innovation effort … Their development is important for stimulating innovation and improving its efficiency … Some good practice exists … but significant scale-up is required. (OECD 2010)

Knowledge from research and experience can be of little value if it is not translated into outcomes. Collaborations can catalyse knowledge transfer and outputs that lead to innovations capable of improving community living in all sectors. Organisations should create opportunities for innovation and change where interdisciplinary groups can work together. Successful collaborations take work and require commitment from all parties.

Facilitated collaboration

Some organisations—Feros Care is a good example—are openly willing to share what they have learnt, positive or negative, so that others are not wasting time chasing ideas and processes that lead nowhere. Although Feros Care has a great story to tell and would like to tell it to other organisations, it is aware that there is currently no way to do this. Funding and time are required to build capability; open discussion between groups is vitally important.

This way of thinking is at the core of the Medical Device Partnering Program in South Australia (see Box 9). Program participants consider that facilitated collaboration is crucial to an innovative health technology industry. There are many benefits to be gained from entering partnerships with one or many organisations, and one significant inhibitor is lack of knowledge about who to partner with and when. The MDPP realises that local manufacturers with great products might not have the resources and knowhow to take an idea further, or medical researchers might need a manufacturer to develop a device. The MDPP acts as 'linker': it supplies information, online and in printed form, about partnering with organisations that can assist with business development, design and manufacturing, government grants, intellectual property and regulatory expertise.

Learning from pilot programs

Lessons learnt, however small they might be, can have dramatic effects if turned into action. Pilot programs designed to answer a question can help build a comprehensive story and develop a recipe, or 'toolbox', for success. For example, taking the lessons from a series of comparative implementations places a focus on translation. Determining how to respond to different challenges can make it easier to streamline a roll-out into the mainstream.

Building a tech-savvy workforce

Discussions throughout this project made it apparent that more and more assistive health technologies will come into play in the future and that education, regular training and up-skilling of health professionals, carers and tradespeople will be required. People will need to know how to operate the technology and be able to help end users gain access to technology that meets their needs.

Tunstall is an international telehealthcare provider that offers online educational material such as videos to show users and clinical staff how to effectively operate technology.

It recognises the need for continual training in the fast-moving health sector and invests the effort to deliver this knowledge. CSIRO has developed a program that operates like a type of social networking portal to discuss technology use between staff members who are working on the National Broadband Network telehealth trials. A closed portal for staff, it allows for teleconferences and continual sharing and learning. These two examples show that access to information is available when the user wants to use that information at a time that suits them.

The Woodville West Urban Renewal Smart Living project experienced problems relating to continued maintenance of the technology. This was largely the result of the contract for the platform system and the maintenance that applies to that device. Other products from alternative vendors have their own warranties and separate technicians who deal with any problems that arise. Project participants learnt that future projects need to have one contract for maintenance of the entire system.

Internationally, the Reading Institute and Simmons College in Massachusetts are partnering to offer a new graduate degree program to train educators to become specialists in assistive technology—ranging from low-tech rubber pencil grips to a wheelchair-compatible computerised communication system. Their research has shown that few technologists had the background in helping teachers and students to use devices specifically in the classroom.

Coventry University in the United Kingdom offers a masters degree in assistive technology designed to equip students with the knowledge and skills required to use and implement assistive technology effectively. The course combines theory on work-based practices, policies and procedures and implementation of work-based projects; it also allows engagement with the product design and development processes and applies this practice in real-life situations.

Promoting change through leadership

Organisational workplace changes will occur. If technology is to be used more widely in all areas of service delivery, training and development should be encouraged and supported. Strong leadership and management skills are crucial to promoting change in the workplace and within sectors. Traditional work methods will be adapted and changed, and change is not always welcomed by all. Leadership and new ways of thinking will be required if we are to see significant change in service delivery (CS & HISC 2014; Yu 2012). Effective implementation calls for a change in culture, attitudes and thought processes.

The US Veterans Health Administration is a world leader in using telehealth to promote independent living for its patient population (Lindeman 2010). Success in the widespread deployment and uptake of telehealth by the organisation has come about because the motive was based not solely on technology roll-out but also on responding to patients' needs. Crucial to implementation was its being championed by senior leadership. Technology can be a hindrance or an aid, depending on how it is applied and how well it fits into the existing system. Health technologies need to be properly managed. In Australia there is a lack of competence in this regard. It is important to have champions who can act to build examples of successful initiatives and encourage others to progress this area.

The South Australian Department of Community and Social Inclusion realises that many people need support and that there is never enough money. It was committed to finding alternative solutions to meeting the needs of individuals and understood the need to go about this in an innovative way, and was a driver for the Woodville West Urban Renewal Smart Living project. Funding was difficult to obtain because of the rigorous application processes and the justification required, but it was nevertheless allocated because the area was considered worthy of assistance and

BOX 9
THE MEDICAL DEVICE PARTNERING PROGRAM

The nationally recognised Medical Device Partnering Program is a South Australia-based program that facilitates the development of medical devices by coordinating unique collaborations between researchers, industry, end users and government. It provides a mechanism for the development of prototypes, proof of concept and/or commercialisation planning for new potential Australian medical device products and has a particular focus on finding solutions for clinicians, the ageing and the disabled. Three publicly funded South Australian universities—Flinders University, the University of South Australia and the University of Adelaide—are involved.

Medical devices give Australia the opportunity to position itself in a growing global market, taking advantage of research and manufacturing capability across the nation. Australia has high research expertise but a poor history of innovation and commercialisation nationally.

The MDPP has several important functions:

- It provides a platform for identifying and assessing new product opportunities with clinical relevance.
- It conducts early-stage technical exploration projects to develop concept models and demonstrate product potential.
- It coordinates and manages relationships between all stakeholders.
- It provides advice and assistance along the product development pipeline.

Since its launch in July 2008 the MDPP has received over 250 approaches from companies and/or inventors, and over 150 have been assisted in various ways. This innovative science- and industry-focused program has had a number of successes:

- Companies have benefited from new collaborative relationships that optimise future opportunities and reduce risks inherent in the research and development process.
- Researchers have benefited from engagement in innovative, state-of-the-art projects, enhanced relationships with industry partners and end users, and better funding prospects.
- Collaboration between research institutions and across disciplines has increased.
- Companies have worked together, sharing expertise, information and equipment.
- End users have benefited from working with researchers and commercial partners to provide solutions to identified problems and needs.
- The community has been engaged through focus groups providing feedback on ideas.

The MDPP is an example of a structured approach to stakeholder engagement and

collaborative product development in an industry where collaboration is difficult because of the predominance of small and medium enterprises. Initial funding was from 2008 to 2011, but success has seen the program expand and grow, and it will continue to strengthen in the future.

The program's success is evidence that, given the right opportunity and a transparent and effective model for engagement, barriers to collaboration and innovation can be overcome. The program was structured to provide a market-driven model for research that develops links with industry from the outset, identifying opportunities for industry and researchers to work together to achieve mutual benefits and provide guidance and assistance through the commercialisation pathway. Obstacles to effective research and industry collaboration have been overcome through a transparent approach focused on building relationships.

The success of the MDPP led to the securement of funding from 2013 to 2016 from the South Australian Department for Manufacturing, Innovation, Trade, Resources and Energy to facilitate the delivery of the Manufacturing Works, Medical Technologies Program, or MTP. This program allows companies, commercial enterprises or individuals that agree to form an entity with a current or proposed connection to South Australia to benefit from research and development assistance through the Medical Device Partnering Program. Participants in the MTP will receive up to 250 hours of laboratory and other technical support to assist with any stage of the research and development process.

In 2015 the MTP and the MDPP will be relocating to Tonsley, within Flinders University's new purpose-built six-storey, 16 000 square metre facility. The $120 million investment in Tonsley will enable Flinders to deliver high-quality teaching, drive innovative research, establish business collaborations and share knowledge, aligned with the South Australian Government's high-value manufacturing vision and activities on site. It is to be the heart of teaching of computer science, engineering and mathematics and related research, entrepreneurship, commercialisation and business collaboration.

Tonsley will become a centre for innovation and collaboration, supporting business cluster development and initiatives and boosting knowledge transfer between industry and research bodies. It will support product invention and development, inspiring new product creation through meaningful connections and targeted interactions. Industry, education facilities and communities will be co-located on one site, establishing a critical mass of capabilities and services to promote the development of health technology.

the proposed outcomes offered multiple and future benefits and were supported by the local member of parliament.

Intellectual property

'Intellectual Property' (IP) refers to the applications of the mind to develop new and original inventions, brands, literary or artistic works and is divided into two categories—industrial property and copyright. An IP system can foster innovation, encourage the flow of ideas, and strengthen collaborative links nationally and internationally (WIPO 2012; IP Australia 2013).

Intellectual property is a major concern for many organisations because of problems with IP ownership and theft, revenue sharing, lack of trust and fear of 'talent poaching'. These deterrents are difficult to manage as a result of the strong personal and financial considerations involved (Bell, *et al*. 2014). Intellectual property can be both and an enabler and an inhibitor for the sharing of knowledge, translation of research, and the formation of collaborations and networks.

The power of human capability in innovation led to an exciting exchange during the EWG's round-table discussion. It was suggested that it is the intellectual property combined with the human capability that provides the value and that many organisations invest heavily in intellectual property but very little in human capability. Greater investment in the people who can move the vision forward is needed.

An environment that is inviting for collaboration—where trust is built and kept—forms the basis of ongoing relationships. Sharing of ideas and increasing innovative capability could help lower the cost of innovation and encourage more diverse technology creators, but strategies need to be developed to ensure that rewards are provided to innovators while accommodating humanitarian and economic goals.

The Advisory Council on Intellectual Property recommends developing and promoting educational resources and tools to help all stakeholders form and participate in collaborations. Interaction between stakeholders will improve with increasing experience and involvement in interdisciplinary collaborations, since this makes it easier to align differing interests, expectations and objectives and accommodate differing viewpoints (ACIP 2012).

It is important to build trust among potential partners before committing to new partnerships and progressing with innovative ideas. Approaching the subject of intellectual property too early might scare off possible partners. They have limited resources and limited time to seek advice from legal, business and technical experts, yet the intellectual property of a firm can offer a way of gaining a sustainable competitive advantage.

The Medical Device Partnering Program has created an environment that allows inventors from research, industry and the health sector to submit their ideas for a product, which is then reviewed and possibly selected for assistance from the program. The MDPP can make use of expertise from three universities, the South Australian Office for the Ageing, research centres, business advisors, government agencies, and thriving local manufacturing firms and small and medium enterprises. The focus of the MDPP for the past three years has been technology for aged care.

One possible way forward could lie in having an 'open-source model' with different collaborators, whereby a project idea could be showcased and a network of individuals from diverse backgrounds could build on the project. Open-source models can facilitate collaborative approaches that accelerate innovation.

If leading organisations are willing to be more informative about their technology and experiences, this might lead to further solutions.

Nationwide integration of health technologies

Internationally, responsibility for the delivery of healthcare services is shared between various sectors and organisations. To ensure that healthcare delivery is coherent, some countries have a digitally connected healthcare system. In Denmark, for example, delivery of health information (discharge letters, referrals, lab test orders, prescriptions and reimbursements) between hospitals, GPs and private organisations—including aged care facilities—occurs through the MedCom communication platform, which was first established in 1994. Initially uptake was slow, but now this information exchange is almost fully electronic. By the end of 2011 health data for over 85 per cent of the Danish population were uploaded into secure electronic health records to deliver increased patient safety and improved patient treatment, access to information for better decision making, and cost-effective and efficient exchanges of information between health professionals and patients (see Box 10). New Zealand is regarded as an exemplar of the way health record interoperability can be used to promote productivity and reduce costs in the health system.

Translating success factors

A digital healthcare future depends largely on the following success factors:

- Widespread integration of information and communications technology and having an ICT-ready population. At present 83 per cent of Australians are internet users (ABS 2013b).
- Having the right infrastructure, where all players in the healthcare sector can be digitally connected in one centralised, secure place allowing for efficient data exchange.
- Having policies and legislation that ensure that healthcare data are used ethically and for the good of the patient and that give the end user the right to withdraw health professionals' access to their health information at any time.
- Having a clear framework around the financing of the system, inclusive of state, territory and national governments as well as the private sector and end users.

BOX 10
E-HEALTH IN DENMARK

In Denmak the aim is to provide access to information for citizens, patients and health care professionals.

- In a secure part of the website the patient has access to personal health data on treatments, notes from hospital records and information about medicine and visits to practitioners.
- Patients have access to various e-services, including making appointments with GPs, prescription renewals, and electronic communication with the GP.
- Patients also have access to information on waiting times at all public hospitals and ratings of hospitals in terms of patient-experienced quality and service.
- Patient networks give the patient the ability to discuss their own condition, treatment, and so on, with other patients with a similar diagnosis, which is especially relevant for patients with a chronic disease.
- The handbook for patients consists of 3000 quality articles with information about diseases and treatment.

Source: Ministry of Health (2012).

4

CREATING A NETWORK

Rationale

If we are to realise the potential of smart technologies in future healthcare we need an interdisciplinary, multi-sector method of accelerating the adoption of innovative approaches, including new technology-enabled capabilities, to the more effective and efficient provision of aged and disability care (ATSE 2012). A network and adequate infrastructure support can foster development of innovative approaches to independent living, for the aged and people with disability, that use assistive health technologies and collaborative endeavours.

In May 2014 the European Telecommunications Standards Institute held a two-day conference[2] attended by representatives from Europe, Indonesia, Russia and the United States. Those present reached four important conclusions:

- Information and communications technology solutions for healthcare are available and are effective—but only if incentives are provided for GPs to use them.
- Application of standards to level the playing field for market entry for small and medium enterprises while improving services to the end user can assist future progress.
- An improved level of medical care may be achieved if medical practitioners and the information and communications technology industry work closely together.
- Ethics, privacy and security should underpin any new healthcare technology infrastructure—just as traditional medicine has always required.

A solution to this national and global challenge needs to be user centred, with stakeholders from a variety of sectors working together. No single discipline has the skills and the voice to make change alone. A concerted effort by all involved is necessary. Open communication between users and medical practitioners, researchers, healthcare providers, technology and device developers, carers, economists, ethicists and social scientists, advocates, potential funding bodies and government entities can ensure that innovative technology is readily available and accessible and effectively meets the needs of the user. This calls for investment and cooperation between industry and the private sector, as well as working with end users.

[2] www.etsi.org/news-events/past-events/735-2014-03-indo-european-dialogue-on-ict-standards-and-emerging-technologies.

Interdisciplinary projects involve individuals from different backgrounds bringing differing points of view and methodologies together to deal with problems that are too complex or too extensive to be tackled by a single discipline. Previous reports, by Bammer (2012) and Webber (2013) as part of the ACOLA *Making Interdisciplinary Research Work* program, made findings that made possible the development of a draft evaluation framework that could be used together to ensure successful collaboration between differing disciplines in an effort to find a solution.

Groups do want to work together. For example, Feros Care has said it would like to explore partnerships, participate in working groups to build awareness, and openly share its knowledge to build momentum and see others working towards wide-scale implementation of assistive technologies in Australia.

Connecting the networks

Ensuring that assistive technologies become part of mainstream health service delivery requires collaboration. A wide range of organisations in Australia are working to advance the adoption of assistive technologies in healthcare. Groups and networks have been forming, sometimes in an ad hoc manner, for years. The overall impact of these networks would, however, be greater if the knowledge, experience and expertise of the many sectors were combined and leveraged.

The need for an Australian national network in healthcare technologies based around emerging technologies was highlighted in 2011 at a Brisbane workshop organised by the National Enabling Technologies Strategy Expert Forum of the Australian Government Department of Innovation, Industry Science and Research. The primary conclusion of the workshop was 'the multidisciplinary nature of aged care services across ICT, health and medical care, housing and other services means that many stakeholders and agencies need to work together to fully implement the vision for aged care in the future' (Alford & Johnston 2011).

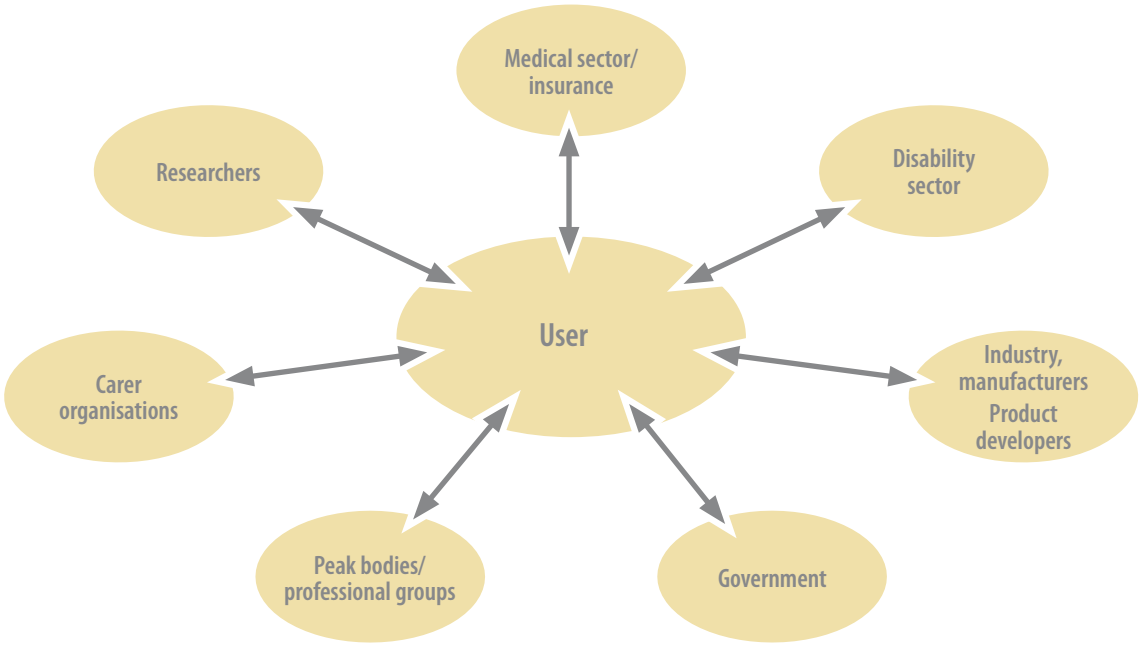
With support from the Department of Innovation, Industry Science and Research, ATSE convened a workshop in Sydney in October 2012, bringing together technology providers, researchers, consumers and carer organisations across the disability and aged care sectors (ATSE 2012). Participants unanimously agreed that the interdisciplinary nature of technologies required in these sectors to meet future needs made the creation of a network essential. Recognising that there were already numerous organisations with their own constituencies, the workshop established a clear vision for an Emerging Assistive and Medical Technologies Network. The model proposed put users at the core of the network, where their thoughts and feelings are heard by all stakeholders and stakeholders can openly collaborate with each other to offer effective solutions (see Figure 2).

The governance system for such a network should be flexible and resilient, capable of responding to rapid change while at the same time providing sufficient stability and clearly defined responsibilities to ensure effective policy and program delivery. This means the strict demarcation of control areas and power between different 'silos' must come to an end. Appendix A presents the value proposition business plan for such a network.

The alternative is to build strong, empowered networks that permeate vertical, horizontal and multi-level boundaries between organisations and allow the different policy areas and levels relevant to ageing and disability care, as well as public and private care providers, to shape policy and implementation.

Among the primary considerations such a network should take into account are making a difference, providing equitable access to technologies and treatments, intellectual property development, sharing resources to develop smart technology for end users, and attracting funds for translation of research into reality and the adoption of smart technologies. Network members should include large, small and medium enterprises and be welcoming to multinationals.

Figure 2. Examples of sectors that could be linked by an Emerging Assistive and Medical Technologies Network—with the user at the core



Better communication and coordination between different groups would help establish more efficient care, with each care provider contributing their individual capabilities towards the best patient outcomes. The central challenge is to establish the organisational and practice culture needed to sustain this inter-profession and inter-organisation collaboration.

Interest in pushing forward with this agenda is growing. The concept was unanimously supported by all participants in the present project. As an example of the benefits of interdisciplinary cooperation, the Academy of Technological Sciences and Engineering, in conjunction with the Victorian Department of State Development, Business and Innovation, facilitated five small breakfast meetings in 2013 to discuss the development of healthcare technologies. People with backgrounds in device development, architecture, healthcare service and delivery, academia and government came together. The meetings were highly interactive and provided ample opportunity for networking between organisations. Several collaborations have since formed and have been working together on projects in this area.

The report *One in Four Lives* is an industry position paper developed and backed by firms such as BT, Medibank Private and Philips; it also has the support of smaller firms, not-for-profit organisations and academics (Altman, *et al*. 2014). The group is calling for a national approach and strategy so that telehealth can be effectively adopted for use in hospitals and care facilities and at home.

Special interest groups such as the Health Informatics Society of Australia's Aged Care Special Interest Group and industry alliances such as the Australian Aged Care Industry IT Council are also involved in these developments. A committee of the Australian Aged Care Industry IT Council convenes the Information Technology in Aged Care Conference every year.

Creating networks takes time and money and calls for a high level of openness from all parties (Bammer 2012). People need to want to work together on an idea. Sometimes they are forced together for administrative reasons, rather than because of a shared interest in a common problem. Not only can this mean that no worthwhile joint research emerges: lack of critical mass can also lead to a weakening of the component disciplines, resulting in a lack of intellectual 'steam' and rigour (OECD 2011).

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EXPERT WORKING GROUP

Dr Erol Harvey FTSE (Co-Chair), Chief Executive Officer, MiniFAB Pty Ltd.

Dr. Erol Harvey, FTSE is co-founder and CEO of MiniFAB, a product development and manufacturing company focussing on point-of-care medical diagnostics and microfluidics. He has had roles in academia and private industry, serving on various State, Commonwealth and International Committees such as PMSEIC Nanotechnology Committee, Future Manufacturing Industry Innovation Council, Victorian State Government Medical and Health Exports Strategic Committee, and the Helmholtz MicroNano Program Review Committee. In 2012 he was named Emerging Technology Entrepreneur of the Year and in 2011 MiniFAB was named Emerging Technology Enterprise of the Year by the Victorian Manufacturing Hall of Fame.

Professor Jeffrey Soar, Professor and Chair in Human-Centred Technology, University of Southern Queensland.

Dr Jeffrey Soar holds the Chair in Human-Centred Technology in the School of Management & Enterprise at the University of Southern Queensland. He is a researcher in assistive technologies for ageing and aged care. Jeffrey came to academia following an extensive executive-level career in health information technology management for federal, state and regional authorities in Australia and New Zealand. He has over 150 refereed publications and has been awarded over 30 research grants.

Professor Greg Tegart AM FTSE (Co-Chair), Deputy Chair of the ATSE Health Technology Forum.

Greg Tegart has had a long career in academia, industry and Government in the areas of research, teaching, administration and providing high level policy advice on science and technology. After graduating in science in Melbourne, he went to England for post-graduate study and remained there in academic positions for 13 years. He returned to Australia to BHP in Melbourne to lead its new products research. He then moved to Canberra as a Member of the Executive of CSIRO and then was appointed Secretary of the Australian Department of Science and Technology and later, Secretary of the Australian Science and Technology Council. Since retiring from the Australian Public Service he has held academic positions at the University of Canberra, Australian National University and Victoria University.

Associate Professor Elizabeth Ozanne, Professorial Fellow, Department of Social Work, The University of Melbourne.

Elizabeth Ozanne is a social gerontologist, social worker and Professorial Fellow in Department of Social Work, Faculty of Medicine, The University of Melbourne. She sits on the Executive Committee of Institute for Broadband Enabled Society at the University and is involved in several current research projects exploring the intersection of population ageing and new technologies. She is author of six books and numerous chapters and journal articles on aged and community care policy and practice in Australia and internationally, and is a member of the Ministerial Advisory Committee of Senior Victorians preparing the next State Ageing Plan for Victoria.

Ms Anne Livingstone, Research and Development Director, Global Community Resourcing Pty Ltd.

Anne has been involved over the past 15 years in a range of multi-faceted Australian based businesses which have interests internationally in innovation, development and research in health and medical areas. She has been involved particularly in major projects in the aged care, disability services and in broader primary health areas. As the Research and Development Lead for Global Community Resourcing she is involved in a number of innovative research and practice change projects specifically concentrating on service model and workforce redesign.

Prior to this role she held roles as the Manager of Community Care portfolio interests for the Peak Industry Aged Care Association at a state level and held a number of national representative roles including in the areas of Workforce Development, Rural and Remote Service Delivery, Research, Technology and Community Care Development.

She has been involved in the establishment of a number of new service areas, including for carers, as well as participating in international and national research projects which incorporate assistive and enabling technologies. She is currently a Council Member of the national Aged Care Industry IT Council (AClitC) and Chair of the National Home Care Committee of AClitC as well as holding Directorships on several National and State Community Care Projects.

Dr Clarissa Martin, Program Lead, Institute for Safety, Compensation and Recovery Research.

Dr Clarissa Martin is a Program Leader Lead at the Institute for Safety, Compensation and Recovery Research (ISCRR) and is responsible for developing the methodologies underpinning the Health and Disability Services Delivery Program research under the Neurotrauma Strategy Priority 1, Models of Lifetime Care.

Clarissa has a clinical background in physiotherapy and neurological rehabilitation. She has previously worked as a Senior Lecturer at the School of Physiotherapy, The University of Melbourne and, more recently, completed a post-doctoral research fellowship in the area of models of home-based rehabilitation for people with Parkinson's disease. In addition to her role at ISCRR, Clarissa also holds a consultant position on the TAC Clinical Panel.

STEERING COMMITTEE

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Professor Leon Mann FASSA

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Professor Rod Tucker FAA

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Ms Harriet Harden-Davies, Manager, Policy & Projects, Australian Academy of Technological Sciences and Engineering

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We also thank Professor Ron Johnston FTSE of the Australian Centre for Innovation for facilitating the round-table discussion and providing strategic advice.

ATSE—specifically Ms Harriet Harden-Davies and Ms Sarah Parker—provided project management services on behalf of the secretariat of ACOLA These contributions are gratefully acknowledged.

EVIDENCE GATHERING

Consultation

As part of the evidence-gathering process, the EWG interviewed the following individuals:

- Mr Steve Alexander—Manager Community Transition, Disability Services, Department for Communities and Social Inclusion, South Australian
- Ms Jennene Buckley—Chief Executive Officer, Feros Care
- Ms Lisa Capamagian—Manager, Tunstall Healthcare Strategic Implementation
- Professor Branko Celler FTSE—Project Director, CSIRO National Telehealth Trial
- Professor Enrico Coiera—Director, Centre for Health Informatics, University of New South Wales
- Mr Geoff Cottrell—Technical Services Manager, School of Computer Science, Engineering and Mathematics, Flinders University, South Australia
- Dr Mohanraj Karunanithi—Research Team Leader, Integrated Mobile Health Systems, The Australian e-Health Research Centre, Computational Informatics, CSIRO
- Dr George Margellis—national committee member, Australasian Telehealth Society

The round-table discussion

The EWG held a round-table discussion session in Melbourne on 15 May 2014. Participants were invited to provide input for the project and to discuss the project aim. The EWG thanks the 21 participants for their contributions:

- Mr Steven Alexander—Government of South Australia Department for Communities and Social Inclusion
- Ms Jennene Buckley—Feros Care
- Mr Geoff Feakes—Tunstall Healthcare
- Dr Jill Freyne—CSIRO
- Dr Leif Hanlen—NICTA
- Dr Erol Harvey FTSE—MiniFab
- Mr Brett Henderson—Victorian Department of State Development, Business and Innovation
- Professor Ron Johnston FTSE—University of Sydney
- Dr Mohan Karunanithi—CSIRO
- Ms Anne Livingstone—Global Community Resourcing
- Dr David Noble—BDI Health
- Professor Elizabeth Ozanne—The University of Melbourne
- Ms Sarah Parker—Australian Academy of Technological Sciences and Engineering
- Ms Bronwyn Pike—Telstra Health

- Professor Karen Reynolds FTSE—Flinders University
- Dr Gerry Roe—Victorian Department of State Development, Business and Innovation
- Professor Jeffrey Soar—University of Southern Queensland
- Professor Leon Sterling—Swinburne University of Technology
- Ms Annalisa Swan—IBM
- Professor Greg Tegart AM FTSE—Australian Academy of Technological Sciences and Engineering
- Dr Jacques de Vos Malan—Australian Council of Learned Academies

Case studies

Further information on case studies referred to in this report can be found from the listed sources:

Woodville West Urban Renewal Smart Living

Medical Device Partnering Program (MDPP)
www.flinders.edu.au/mdpp/mdpp_home.cfm
mdpp@flinders.edu.au

Government of South Australia Department for Communities and Social Inclusion
www.dcsi.sa.gov.au/services/latest-news/media-releases/smart-living-apartments-give-people-with-disability-more-independence
enquiries@dcsi.sa.gov.au

Integrated Housing Project—The Summer Foundation

www.summerfoundation.org.au/the-issue/housing-model

Winkler, D, Farnworth, L, Sloan, S, Stringer, K, & Callaway, L 2011. Young people in nursing homes: White paper, Melbourne, VIC: Summer Foundation Ltd & Monash University.

The Commonwealth Scientific and Industrial Research Organisation (CSIRO)

CSIRO 2014, A Digitally-enabled Health System, Digital Productivity and Services Flagship, CSIRO
enquiries@csiro.au

Smarter Safer Homes
www.csiro.au/Organisation-Structure/Divisions/Computational-Informatics/Smarter-safer-homes.aspx

Home Monitoring of Chronic Disease for Aged Care
www.csiro.au/Organisation-Structure/Flagships/Digital-Productivity-and-Services-Flagship/Health-services/Monitoring-Chronic-Disease-for-Aged-C.aspx

Feros Care

www.feroscare.com.au/about

telehealth@feroscare.com.au

APPENDIX A
THE EMERGING ASSISTIVE AND MEDICAL TECHNOLOGIES NETWORK BUSINESS PLAN

Introduction

This paper presents the rationale, objectives of the proposed emerging assistive and medical technologies network and a plan for implementation. This Network proposal was developed in December 2012 following input from participants at the Enabling Assistive Technologies Network Workshop in October 2012.

A network to realise the potential of smart technologies in future healthcare

The mounting challenges of population growth and demographic ageing in Australia will place increasing challenges on maintaining healthcare standards with rising healthcare costs. New approaches to healthcare are imperative based on the convergence of enabling technologies such as nanotechnology, biotechnology, information and communications technologies, and cognitive science (smart technologies). The development and deployment of new assistive and medical technologies can improve quality of life, enable healthy independent living and decrease healthcare costs by providing innovative, cost- effective solutions.

To realise the potential of these technologies in improving quality of life and driving innovation, there is a need to improve the connection between smart technology research and its translation into commercialisation and practice. This requires a multi-disciplinary, cross-sector network that brings together the wide range of stakeholders—including researchers, consumers, carer organisations, investors, the medical sector, and governments—to work collaboratively on the development and deployment of smart technologies that are needed by the nation. Recognising that numerous bodies already exist with their own specialised communities such a network must be seen as a "network of networks" which pulls the existing bodies together. Participants from these bodies at a recent ATSE workshop[3] developed the following mission statement for such a network:

> 'A Network that actively fosters and facilitates the adoption of innovative approaches, including new technology enabled capabilities, to the more effective and efficient provision of aged and disabled care and healthy independent living.'

By putting users of technology-assisted products as the central focus of all activity, such a network offers a unique mechanism to support high-quality independent living and drive the creation and adoption of innovative approaches to healthcare. By bringing together users, researchers and manufacturers in a collaborative environment the network will provide ready access to economic opportunities and social engagement for all Australians constrained by ageing and disability.

Network objectives

The core objective of the network is to provide improved health and life services for individuals, carers, families and healthcare personnel. It will pursue this by:

1. Supporting and facilitating the exchange of information and access to expertise.

[3] The formation of a network to link the various parties across the disability and aged care sector was explored in detail in a workshop convened by ATSE on 25 and 26 October 2012 (Appendix 2 *Workshop Communique*). The workshop highlighted the opportunities and challenges emerging from the application of assistive technologies for older Australians and people with a disability; the future of the Australian medical technology industry and its possible contribution; the potential for assistive technologies to significantly transform human capabilities; and the role of cross-sectoral collaboration in effective application of enabling technologies.

2. Promoting collaboration to evaluate existing and stimulate new technology-based solutions to aged and disabled needs for independent, healthy living and overcome barriers to their adoption.
3. Providing a "touchpoint" and clearing house to allow new ideas to be evaluated and brought through to products.
4. Taking an advocacy role to Governments to facilitate the development and adoption of emerging assistive and medical technologies.
5. Serving as a point of contact in Australia for similar networks around the world.
6. Stimulating major research initiatives and the development of centres for assistive technologies in universities and research centres designed to drive appropriate innovation.

Network goals and outcomes

The network will have a strong focus on achieving desirable outcomes, by working with and linking the various existing groups in this space, that will in turn encourage membership:

- Access and Connection
  - Facilitate the interchange of knowledge on technologies to meet the needs of physically and mentally challenged people of all ages.
  - Facilitate the evaluation of new ideas and their development into products.
  - Stimulate the use of modern technologies such as social media, virtual communication and targeted face-to-face networking sessions to facilitate linkages between the various sectors and interest groups in this area.
  - Promote equitable access to technologies and treatments for Australians.
- Advocacy
  - Advocate a national agenda, building awareness of end-user needs for assistive technologies, influence policy development, and drive appropriate change.
- Collaboration
  - Create and promote opportunities for interested parties to work together on projects of mutual interest.
  - Facilitate co-ordinated approaches across the sector.
  - Share resources to develop innovative technology based solutions for end-users to enjoy healthy independent living.
- Facilitate and attract funding
  - Facilitate funding for the translation of research and development and deployment of smart technologies.
- Information exchange
  - Promote sharing of information and experiences, both within and beyond the network, through conferences and meetings utilising a range of communication strategies including social media.
  - Provide a database of current research and research needs in assistive technologies.
  - Regular, succinct information on research, projects, funding opportunities, reports and general activity through social media
- Innovation and commercialisation
  - Encourage innovation through enabling collaborative linkages between industry, researchers and end-users.
  - Promote and foster commercialisation through linking researchers with industry and vendors.
- Making a difference
  - Support the inspiration and inclusion of the next generation in promoting access to technologies to enable healthy independent living for all ages.

Benefits from the network

The key benefit that the network will deliver to Australia is healthy independent lives for all Australians through the use of smart technologies. This will entail: making a difference; providing equitable access to technologies and treatments; sharing resources to develop smart technology for end-users; and attracting funds for translation of research and the adoption of smart technologies.

The core value proposition for membership centres on the provision of access and connection to information, expertise and opportunities. In addition, there will be specific benefits to individual member categories (which are loosely defined as researchers, businesses and consumers):

Businesses

- Access to a wide range of ideas and information about what is happening in the emerging assistive and medical technologies area, access to the guidance and perspectives of end- users and opportunities to better identify customer needs.
- Facilitating the creation of active working relationships with researchers to facilitate translation of research into products.
- Opportunities to accelerate getting an idea to market.
- Professional development opportunities.
- Opportunities for trialling and accessing new technologies.
- Opportunities for new business and/or consultancy.

Consumers / Users

- Building awareness of end-user needs for emerging assistive and medical technology to inform ideas and product development to increase healthy independent living.
- Providing opportunities to tailor research and create appropriate and effective solutions for individual needs.
- Making a difference: achieving equitable access to technologies and treatments to build a healthy and fulfilling life for Australians through the effective and efficient use of enabling technologies.

Researchers

- Opportunities to network and collaborate with other researchers, businesses and consumers in the emerging assistive and medical technology space.
- Opportunities to collaborate on grant applications.
- Opportunities for and focus on translational research, innovation and implementation of smart technologies including clinical service delivery.
- Opportunities to access a wide range of ideas and information and share/ disseminate research.
- Opportunities for end-users to connect with, and inform researchers and companies about the products they want/ need for appropriate and effective solutions (tailoring the research to community needs).
- Facilitating the formation of active working relationships between researchers and product developers to facilitate translation and to access the guidance of targeted end-users as a researcher.

Implementation

Discussions arising from the October workshop have suggested that in order to get the network started, foundation members are required who will commit to support the network for an initial period. These discussions also indicate that the network will need a dynamic, enthusiastic leader to drive it with the support of a small team and the guidance of a Steering Committee to provide governance in the first year. This structure would preferably be provided within an existing organisational structure, to achieve the benefits of cost saving and logistical ease. It is envisaged that a 'host' organisation is required to sponsor the network

and nurture it for the 'start-up phase' and first year of operation, before its graduation as an independent entity. Preliminary analysis suggests that a fully operating network would require an operating budget of approximately $1 million per year.

A key priority for the first year of operation would be to expand the membership base beyond the foundation members, achieving 'buy-in' from key stakeholders, developing a strategy for engagement and delivering value to members. This may include the development of a web platform, a program of networking events and the development of research capacity. The measurement of success against a set of key performance indicators (linked to the objectives) at the end of year 1 will be an important factor to demonstrate value and encourage members to 'sign up' for the next year.

A sustainable business model

Operations

The operations of the network will involve: advocacy facilitation, identification of emerging events and issues, capacity to respond to key national issues including analytical capacity, facilitating connection (including social media) and collaboration (including opportunities for networking), and provide access to information and expertise. Facilitators will be required to promote and assist with the operations of the network and would require an honorarium. Operations will include marketing, leadership, administration, membership management, information analysis and governance.

Key features and capabilities

The network will be open to the wide range of players in the emerging assistive and medical technologies space, seeking to draw on the strengths of existing networks. Using virtual communication, social media and face-to-face meetings, the network will implement an engagement strategy to connect members. The network will have a strong policy focus, seeking to take an advocacy role to influence policy development to better achieve the network objectives.

Governance

The network will be incorporated, not for profit and equitable. It will be important for the governance mechanism to be transparent. A Board will be established to oversee the operations of the Network (expenses will be paid). The Network may need a charter / Terms of Reference / constitution.

Funding

It is important that the Network be self-sustaining. The model for this may rely on a mix of grants, project funds and membership fees. A three tier membership fee structure is proposed with annual fees in line with the following: platinum members (may include large companies) $50,000, institutions $20,000, individuals $2000 and students *and consumers* free.

Potential sources of funds for both ongoing operations and projects include federal, state and local government agencies, research organisations, companies (including care providers and technology companies), users, industry associations, others (including medical insurance companies) and philanthropies. The concept of crowd funding could be explored.

Activities

Examples of possible activities include: a major annual conference, specialised workshops, electronic communications, opportunity to collaborate to establish new initiatives, bringing together like minded groups to work on problems of common interest.

Network membership

The EAMT Network will put the end-users of assistive and medical technologies (as the main beneficiary) at the heart of the network, linking the many, disparate parties and building on their existing strengths to create a network of network.

Consultation conducted via video conference

Door sensors alert carers if residents exit

A LifeLink alarm includes a pendant that can be pressed to alert an emergency response centre

A pager can be worn to alert carers if a resident wanders

Pillow sensors can inform the user of calls and alerts

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