Test of Change Stage One: Proof of Concept: Project Evaluation

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Executive Summary

The Test of Change project is a partnership led by Alzheimer Scotland, funded by the TEC Programme, Scottish Government to support technology enabled care services across Scotland to adopt new digital commodities. This first stage, Stage One, focuses on feasibility and proof of the concept that affordable technology-based products can be of value in the care of vulnerable groups. The project brings together 17 partners, across 6 locations.

The aims for the full Test of Change Project, in three stages, are to identify, nurture and prepare technology enabled service improvements for national scale-up, with three stages planned. Stage One focuses on proof of concept of the use of technology enabled care services, with Stages Two and Three covering larger scale trials and scale up.

A need was identified for an assessment tool which takes into account the use of consumer technology to meet individual outcomes. A co-design process, involving 14 individuals from 9 partner organisations took place. Four workshops were held between January and March 2019. Partners involved in the design specifically included clinically trained staff currently involved in assessing need, to ensure alignment with existing processes where possible. Service users were also involved. Resources were provided to partners to help them to get user engagement within their services. Two service users attended, each attending three of the four workshops.

The prototype Tool, called ADAM: About Digital And Me, consists of a structured question tree, which links to a catalogue of products and services. It has been tested with 21 clients, by Test of Change project leads, Nicola Cooper and Gillian Anderson.

Assessments were undertaken on 21 potential participants and 16 Use Cases were taken through to completion. These Use Cases demonstrated proof of concepts and a range of qualitative impacts – peace of mind and independence for service users and their carers, keeping people active, enabling remote carers to stay in touch, enabling easier communications and improving safety in the home. Initial work was also completed on two other Use Cases, one to improve support in an acute medical setting and the other to provide a demonstration facility for carers to try out technology in an experiential environment.

As well as showing progress towards individual's personal goals, there were unintended benefits to the quality of life for carers. One carer was able to have a week's respite break and used the technology to 'check-in' remotely for reassurance. The impact on professional carers was more mixed, with some negative issues needing further exploration. The project revealed issues in trust and attitudes to risk associated with data ownership and sharing. Whilst the value of using data for monitoring trends and spotting problems earlier was explored in some case studies, approaches to restrict risks were also explored. Some of the regulatory compliance issues for collaborating with statutory providers need further work and were not resolved. Workforce capability and culture was at times a barrier to the implementation of the use case tests and was only particially overcome.

Although this is still at an early stage, the project has generated a range of learning, which is discussed thematically under Trust, Communications, Future Workforce, Influencing and Decision-Making. These lay the foundations for more in-depth exploration in Stages Two and Three of the Test of Change project.

Background to the Project

This Test of Change project, has the aim to support technology enabled care services across Scotland to adopt new digital commodities. This part of the project is Stage One, focusing on feasibility and proof of the concept that affordable technology-based products can be of value in the care of vulnerable groups. The project is led by Alzheimer Scotland and funded by the TEC Programme, Scottish Government. It brings together 17 partners, some of whom had different initial plans and approaches to the project, but who had shared goals. The process of agreeing a shared approach and of collaborating with each other has been a critical aspect of the project.

Alzheimer Scotland was approached to lead because they have a track record in finding, testing and sharing digital solutions. This is demonstrated by the work of their Digital Leadership Team, and in particular the Dementia Circle model, which formed the basis of this piece of work. In previous work supported by the Technology Enabled Care Programme, Alzheimer Scotland co-produced a Technology Charter for People living with Dementia in Scotland which sets out the rights and principles that should be expected, a suite of supporting information to help people make good decisions, and designed and delivered a learning programme; Confident Conversations about Technology to over 1600 practitioners, families and carers over a period of 18 months.

Changes to the project timeline were agreed by partners and funders, taking an approach aligned to ‘agile software development’, in which small components are developed, tested and revised progressively, rather than adhering to a detailed specification for the entirety. We may say that an ‘agile project management process’ was adopted. In a similar vein, the evaluation process has taken a participatory, constructive, real world approach. The independent evaluators have adapted to changes in the project plan and supported articulation of shared aims, goals and desired outcomes. This could be said to be an ‘agile evaluation’ and the report that follows reflects this approach. The project is described according to an evaluation framework – aims, objectives, processes, outcomes – with evidence from partners and clients provided in a supporting evaluatory commentary.

Figure 1: The Test of Change project

Test of Change

17 Partners

Alzheimer Scotland
Caledonia Social Care
Angus HSCP
Argyll & Bute
Blackwood HC
Bon Accord
Dumfries & Galloway
East Lothian HSCP
Edinburgh City Council
Enable
(NHS) Grampian
(NHS) Highland
Loretto/Wheatley Group
North Lanarkshire HSCP
Viewpoint
Life Enhancing Automation Ltd
Rapport CIC

6 Locations

Aberdeen,
Dumfries,
Inverness,
North Lanarkshire,
Stirling,
West Dunbartonshire

3 Living settings

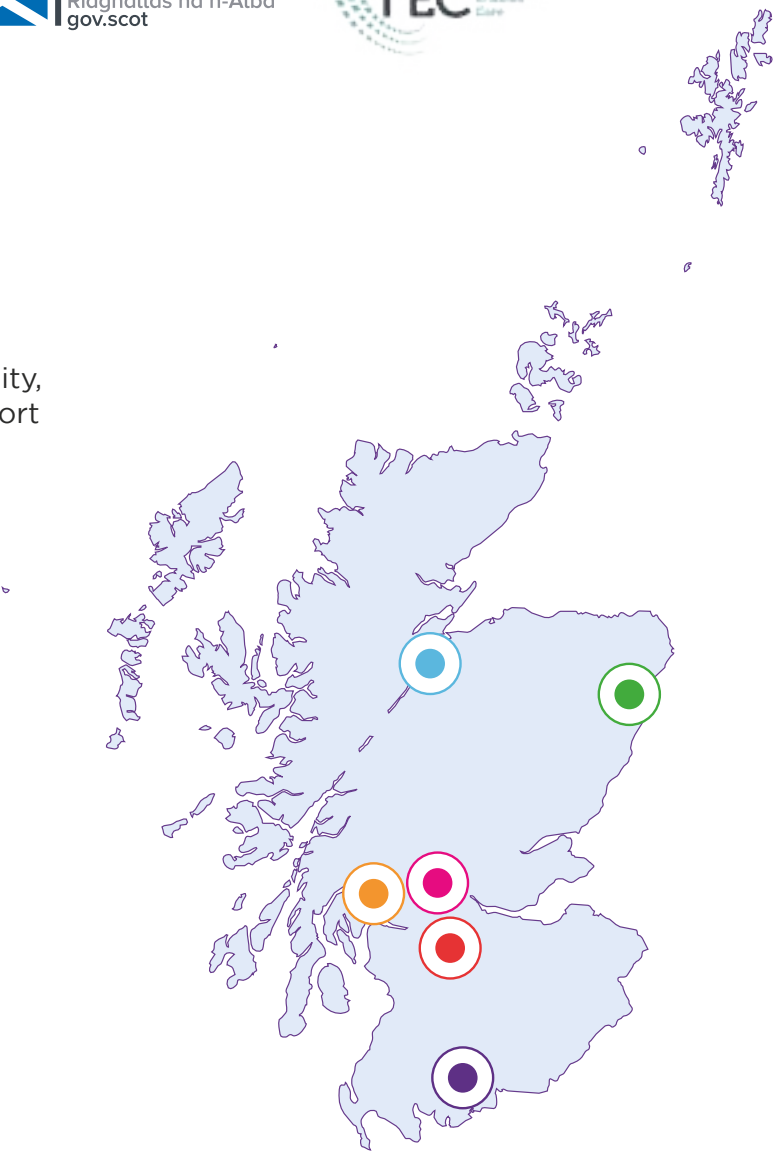
Independent at home
Supported housing
Acute Ward

4 Workshops

Glasgow and Edinburgh

4 Groups

Dementia,
Falls and frailty,
Learning disability,
Overnight support



Aims and Objectives

The aims for the full Test of Change Project, in three stages, are to identify, nurture and prepare technology enabled service improvements for national scale-up, with three stages planned. Stage One focuses on proof of concept of the use of technology enabled care services, with Stages Two and Three covering larger scale trials and scale up.

This project sits within Stage One and has four themes or categories for clients: dementia, falls and frailty, learning disabilities, reducing overnight support.

The start of the project was delayed by 9 months, due to contract negotiation processes. This meant that some partners no longer had staff in place or were able to immediately give management priority, hence the first part of the project focused on agreeing priorities and a detailed project plan, undertaken through a series of workshops and background discussions.

By February 2019, final negotiated objectives for the project had emerged as follows:

1. Select appropriate technologies that are affordable and easily available, mainly 'Citizen Tech' consumer products;
2. Agree a common assessment process for clients seeking help to self-manage more effectively and develop an Assessment Tool;
3. Identify 25 use cases of clients who would benefit from technology enabled care, across the four themes and partner sites;
4. Install and monitor the 25 use cases for 4-6 weeks.

Given the remaining timescale of the Stage One project, with an end date of June 2019, these were ambitious objectives. This meant that some prioritisation was necessary in the selection of sites and use cases.

As far as possible, two different streams ran in parallel. The Assessment Tool development activity proceeded with a team of partners, technology providers and stakeholders. Separately, discussions were held with partners to select sites and initial conversations were held with clients to identify appropriate use cases. Partners self-selected following discussion to be part of one or both workstreams.

‘Citizen Tech’

The Test of Change project set out to use readily available consumer technology, or Citizen Tech, to meet clients’ needs. Products selected were all chosen to be affordable and reconfigurable, as needs change. A substantial task, carried out by Alzheimer Scotland and two Innovation Partners, was reviewing and evaluating consumer products, configuring them – sometimes using them in a way that is not their primary purpose, and sourcing. In some cases, a number of possible solutions needed to be compared. The full range, with their features, pros and cons, will eventually form the ‘Product Catalogue’ that links to the Assessment Tool (ADAM). An extract is shown on the next page.

Photo: left - Gillian Anderson with Linda and John.
Photo: right - Paul.

Figure 2: A sample of Citizen Tech products, with key features

	Echo Show	My Home Helper	iPad	Android Tablet
Customisable	Very limited	Yes	Limited	Yes
Operating system	Amazon Alexa	Open Source	iOS (apple)	Open Source / Android
Ease of use	Uses voice interaction and touch screen	Easy Requires little or no interaction	Touch screen + Siri voice assistant	Touch screen + Bixby / google assistant
Remote operation	Yes, using Alexa app	Yes, exclusively	No	No
Video calling	Uses “drop in” and calling	Call in, Auto answer, No outgoing calls	Facetime, Alexa app, Skype, WhatsApp, Messenger	Google Duo, Alexa App, Skype, WhatsApp, Messenger
VC auto answer	Yes	Yes	No	No
VC permitted callers only	Yes	Yes	No	No
Device Cost	£200+	£200+	£400+	£100+
Subscription	No	Yes, Monthly/Annual	No	No
	Voice activation gives base of use for many controls, smart home, IoT devices.	Great for family and carers giving support remotely.	Intuitive design + compatibility across Apple range. Easy to use for those familiar with Apple.	Good for those who are familiar with Android system and who want a low cost option.

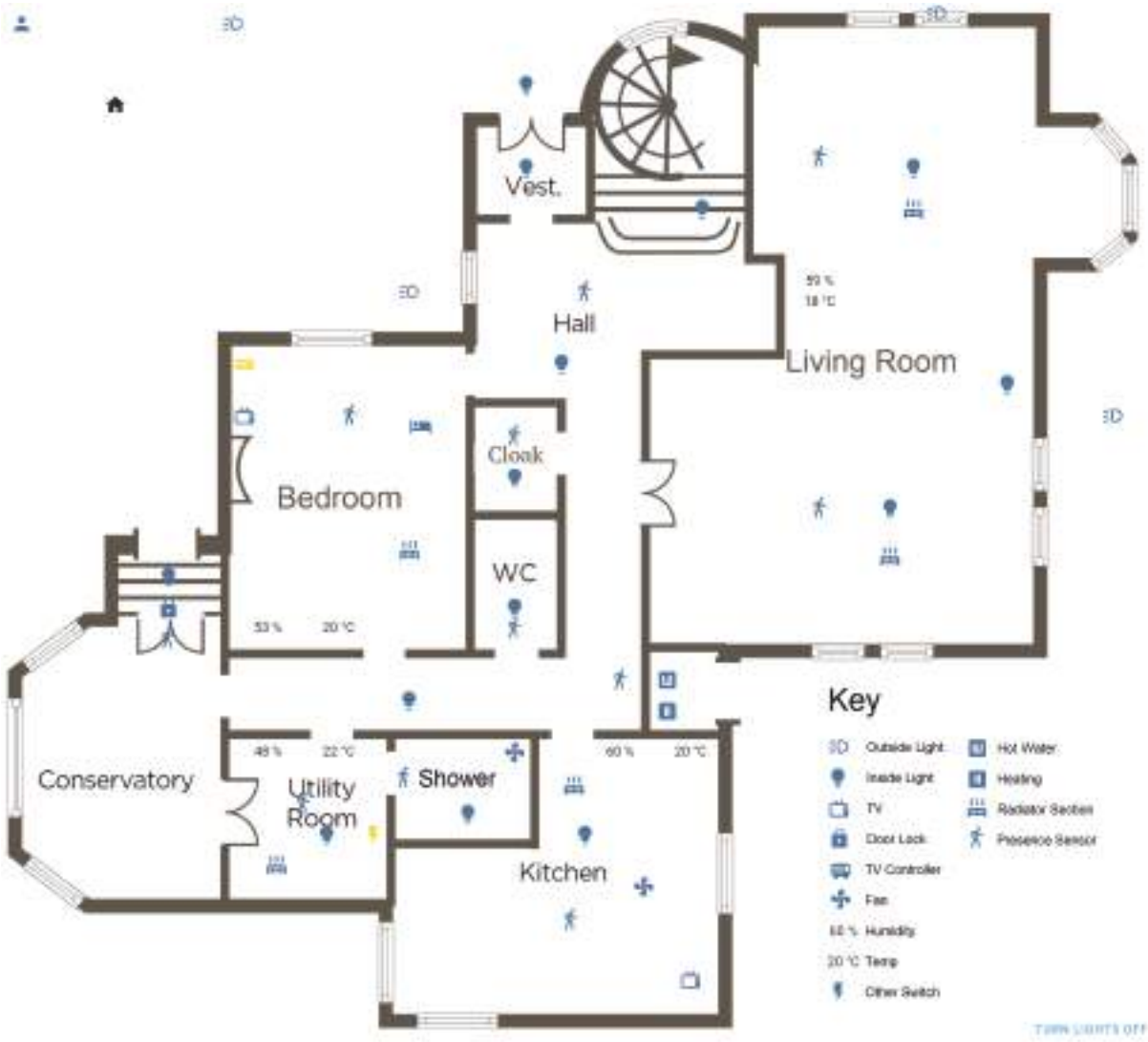
LIFE ENHANCING AUTOMATION

RAPPORT NETWORKS

Whilst the purpose of this project Stage One is not to examine financial viability, some cost information has been collated. The average cost of the equipment installed for each use case was £850 per person. If taken across those living at home, the cost drops to £525, with those in supported accommodation averaging £1120. The difference in costs is due to the nature of equipment required by those users who required a more intensive level of support generally. This cost is also higher than a scaled up model would be. At this stage the project is exploring an extensively personalised model with unique use cases. As experience is gathered, we would expect to see some trends emerging which would allow for a more standardised starting point from which personal configuration will be possible. A substantial part of the value added by the project ethos is through customisation and configuration of the technology to the needs and outcomes of the individual client. This has required significant time input by the project team, support staff and managers, with family members and the clients themselves. There is significant learning from this part of the project, explored later in this report.

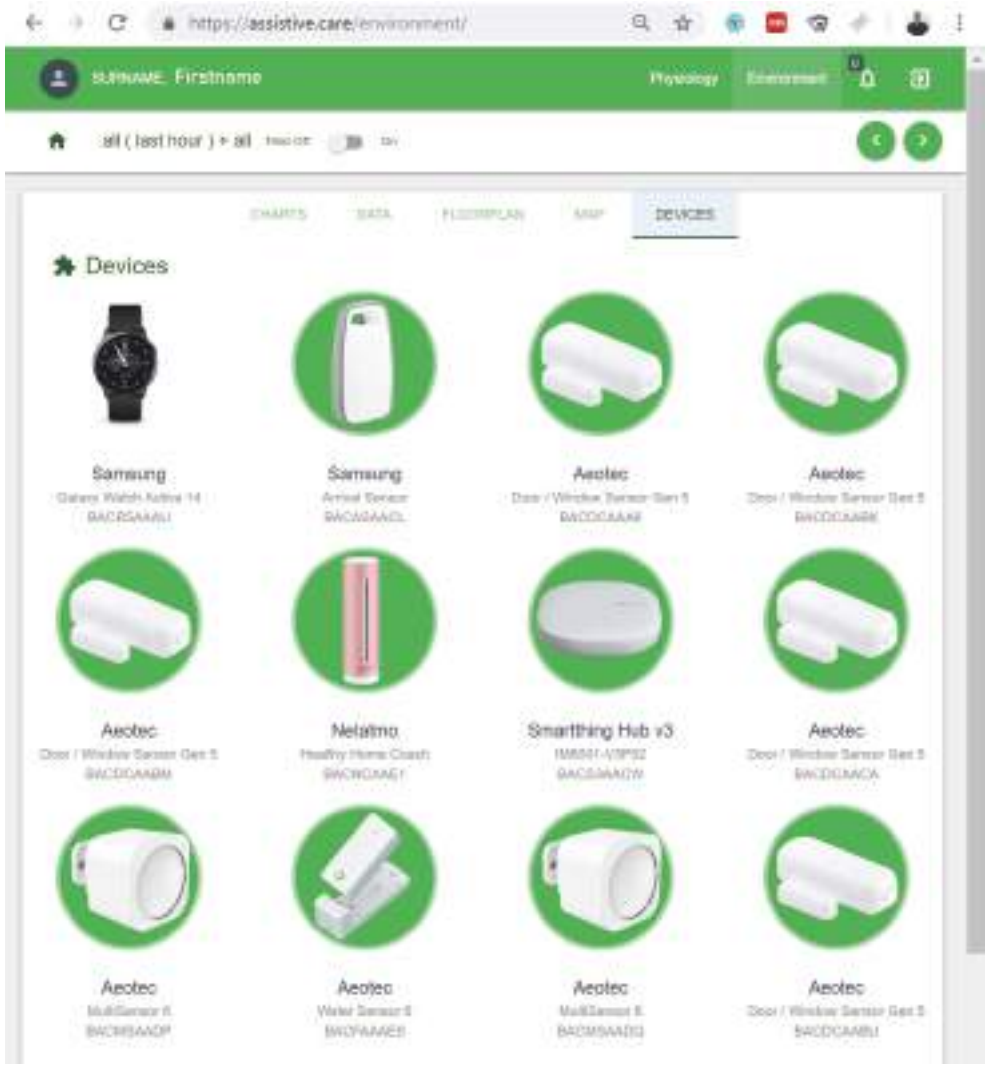
In addition to using off the shelf equipment, Test of Change has partnered with two technology integrator companies, or Innovation Partners, who provide bespoke systems. Their products have been tested in some of the Use Cases.

Figure 3: A schematic of a 'smart home' configured to be controlled on the LE Automation platform



LE Automation have developed a 'smart home' platform to integrate light switches, door controls, household electrical appliances (eg. cookers), security cameras, fire alarms into a simple interface on a tablet, based on Raspberry Pi technology and standard devices. Household equipment and services are hard wired into a home's electrical system and linked to a standalone hub (the 'brain of the house'). Their system is intentionally offline, not connected to the Internet, but can be accessed remotely by mobile devices through a secure connection and configured to send alerts to family, professional carers (such as a call centre), or emergency services. The system means that an elderly or vulnerable person can specify 'rules' for how their home is managed. For example, if a fall is detected (by a movement sensor), the system will 'speak' to them. If they do not respond or otherwise reset the system (to indicate they are OK), lights and heating are turned up and alerts are sent. If there are risks of forgetting to switch off an appliance, such as a cooker, the 'brain' can automatically disconnect it after an agreed period of time. A demonstration facility has been installed at Alzheimer Scotland's Dementia Resource Centre in Clydebank.

Figure 4: Screenshot of a dashboard to control a typical Rapport sensor suite



Rapport CIC integrate low cost environmental, movement sensors, Samsung smart watches and tablets to provide monitoring of both homes and residents. Their focus is on combining and analysing physiological and environmental data to better understand a person's requirements. For example, if it is suspected that someone is dehydrated, sensors can be attached to a drinking glass or the kettle, combined with environmental sensors to monitor temperature and humidity. Over a period of days or a week, valuable insights can be drawn. The technology can be described as the Internet of Things, using open source Application Programming Interfaces (APIs) and secure data management. Support staff and family can monitor and interact with the person, via a mobile phone, tablet or PC. Dashboards can be configured with different levels of access and detail for the individual, family members and support staff.

ADAM

About Digital And Me

The Assessment Tool

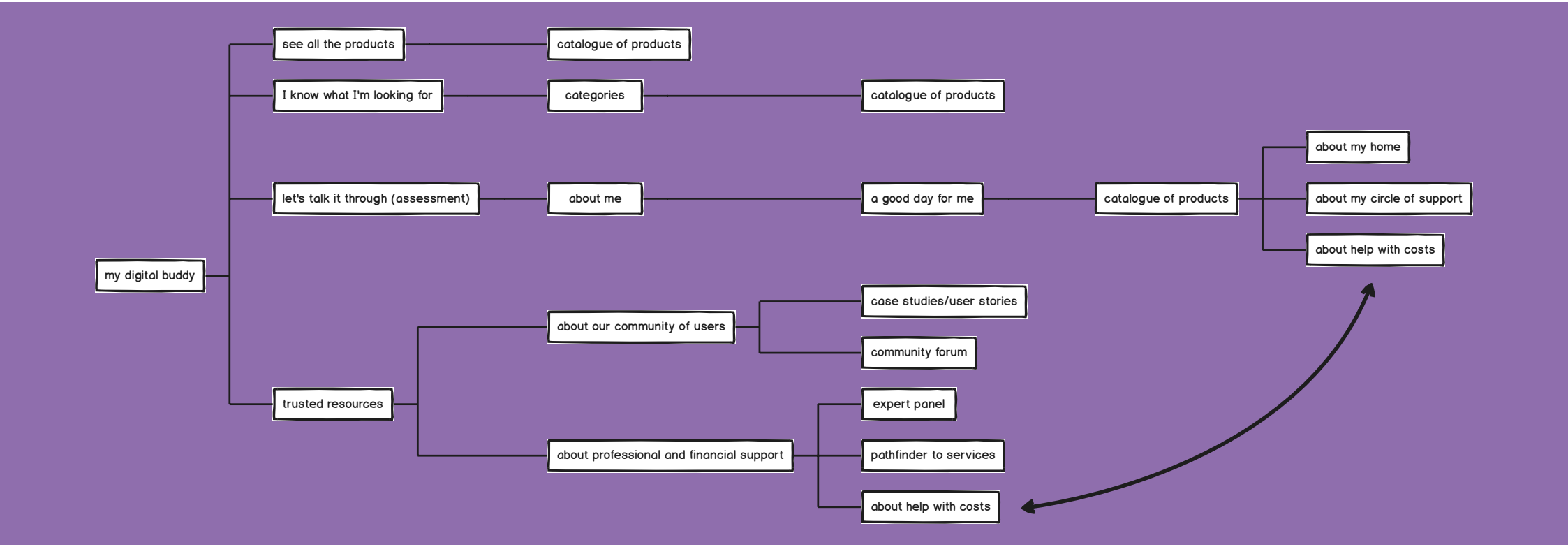
In the exploration phase of the project, a number of existing assessment and self-assessment tools were explored to discover if they could be used or amended for the project. It was clear that there was nothing which takes into account the use of consumer technology to meet individual outcomes. Available assessments centred around the use of existing telecare provision or daily living aids, such as grab rails and other non-digital solutions, with advice given being reliant on accessing by chance someone who had a particular interest in technology, rather than a default option. This gave the partners the opportunity to design a model with the potential to be scaled for national use by individuals and practitioners looking for way to self-manage long term health conditions.

A co-design process, involving 14 individuals from 9 partner organisations took place. Four workshops were held between January and March 2019. The first workshop focused on what the Tool should do and what it needed to achieve. Partners involved in the design specifically included clinically trained staff currently involved in assessing need, to ensure alignment with existing processes where possible, and that the question set gave a full and clear picture of the needs of clients within our four themes. Service users were also involved. Resources were provided to partners to help them to get user engagement within their services. Two service users attended, each attending three of the four workshops.

Figure 5: One of the outputs from Workshop 1

WORKSHOP_ONE_THEMES	CHOICE	TRUST	PERSON CENTRED
I want.....	I want to use this on a device that I already have. • optimised for mobile devices so I can use it wherever I am • interoperable with other systems I use • flexible, accessible, friendly	I want to be assured that this is a safe platform to use and that the resources shared are from trusted sources. • DPIA and GDPR compliant • content generated by experts in digital and health • catalogue of solutions and services	I want this to be asset based and outcome focussed. • personalised • gives options and choice, my decision
I would like.....	I would like to be able to access this anywhere, anytime. • always on • allow update notifications • select frequency of communications I receive	I would like to hear from professionals and from my peers. • expert panel • community forum • case studies • user stories	I would like this to be part of a personalised health and well-being ecosystem. • predict changes in my health and well-being • collect data from wearables and smart home devices • grow with me - follow my journey
It would be great if.....	It would be great if I could speak to someone 24/7. • doesn't need to be someone I know, but should be someone who can access my profile and has appropriate skills • a chatbot or voice assistant is ok for some things	It would be great if I could share this with my family and those who support and care for me. • levels of permission • link to GP - primary and acute care • in case of emergency info	It would be great if it was voice activated and could recognise me just from my voice. • natural interaction

Figure 6: A wireframe diagram as work in progress for ADAM



The second, third and fourth workshops developed the detail of how it was going to work, in practice, and the details of the question tree. This has been realised as a wireframe.

The resultant Tool, called ADAM: About Digital And Me, exists in prototype form. It consists of a structured question tree, which links to a catalogue of products and services. It has been tested with 21 clients, by Test of Change project leads. In this test usage, the project leads have extensive knowledge and skills to assess needs, select products and propose implementation to the clients. In the longer term, ADAM will include learning and rules that automatically select and propose products.

Figure 7: ADAM prototype, next page

About Digital And Me

About ADAM

ADAM is a virtual assistant and uses artificial intelligence to learn and to make suggestions.

ADAM is very curious and asks a lot of questions because he is trying to learn how to help people to maintain their independence and quality of life.

ADAM looks for consumer technology solutions that are widely available and can signpost to other relevant options.

"Hello I'm ADAM. I can help you find things that make everyday living easier and more enjoyable."

"Talk to me about what you would like help with and I will give you suggestions for things that could help."

- Tick boxes
- Icons
- Prompts
- Drop down options
- Use to measure outcomes benefit vs risk

0%

About Me

Help ADAM get to know you

I am filling this in for:
Myself
A person I live with
A person I care for
A person I support as a professional

I am living with
Dementia
Learning disability
Frailty & falls risk
The need of overnight support
Other

I have legal capacity
I have a legal guardian

I like....

Yoga
Going for coffee
Seeing friends
Travel
Puzzles/Sudoku
Pets
Movies
Helping with grandchildren
Cooking
Other...

Create avatar
or
Upload profile picture
or
Create voice ID

About A Good Day For Me

Tell ADAM about a good day for you

I know I've had a good day when....

What are you doing?
Who is with you?
What do you have with you - in your bag or in your pocket?
What couldn't you be without?
e.g. mobile phone, specs

Things I take with me

IMPORTANT

What happens and when?

Night
Noon
Morning

I have a good day
Most days
Sometimes
Hardly ever

About Everyday Challenges

ADAM wants to know about your challenges

"I have a challenge with...."

"Things would be better if I had something to help with..."

Themes

Everyday living
Getting out and about
Feeling safe and secure at home
Having a meaningful life
Staning connected

Subgroups

Having fun
Loneliness
Self care
Etc...

Imagine you can have one wish. What would you wish for?

I wish...

My Ideas
Things I am interested in knowing more about that I think could be helpful.

About My Home

ADAM would like to know about your home

I am
Very independent
Likely to ask for help sometimes
In need of support 24/7

I live in
My own home
Managed accommodation
Other

I have
Wifi
Telecare
Digital care management
Technology that I use to support my healthcare

Subgroups

Voice assistant
Calendars and Reminders
Smart watch
Other

Find out more about data sharing and privacy

I trust technology

0 10

I am confident in using technology

0 10

About My Circle Of Support

Tell ADAM about the people around you who help.

I have people who help me with instructions and setting things up.

Your partner
A neighbour
A grandchild
A support worker
Other

Create avatar

I need a person to help with instructions and setting things up

Help

Ok

Link to support

About My Solutions

ADAM has some suggestions for you

ADAM has some suggestions for you based on what you said you'd like help with.

Signpost to non digital solutions

Why this product
What challenge it helps with
How it works
What it requires
e.g. wifi, plug socket, monthly subscription etc.

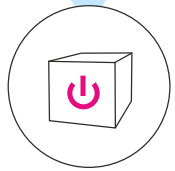
●●●●○ *Time to set up*
●●●○○ *Level of skill*
●●○○○ *Cost*

About help with costs - signpost to help with this e.g. SDS

About what other people are doing - case studies, videos.

All about the products

- Link to catalogue of products.



About My Journey

ADAM would like to stay in touch

100%

ADAM would like to stay in touch

To do this ADAM needs to save your information and set up a profile for you. This will be private and can only be accessed by you.

YES please

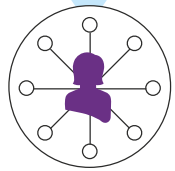
NO thanks

Your data will be deleted.

Use ADAM to review and update your assessment and share outcomes with others of your choosing e.g. family

Choose to receive notifications about new products and services relevant to you, as well as updates that optimise the usefulness of your current products.

ADAM will ask for feedback to find out if you have found the products suggested helpful.
This feedback will help ADAM to make better suggestions in the future and for others.

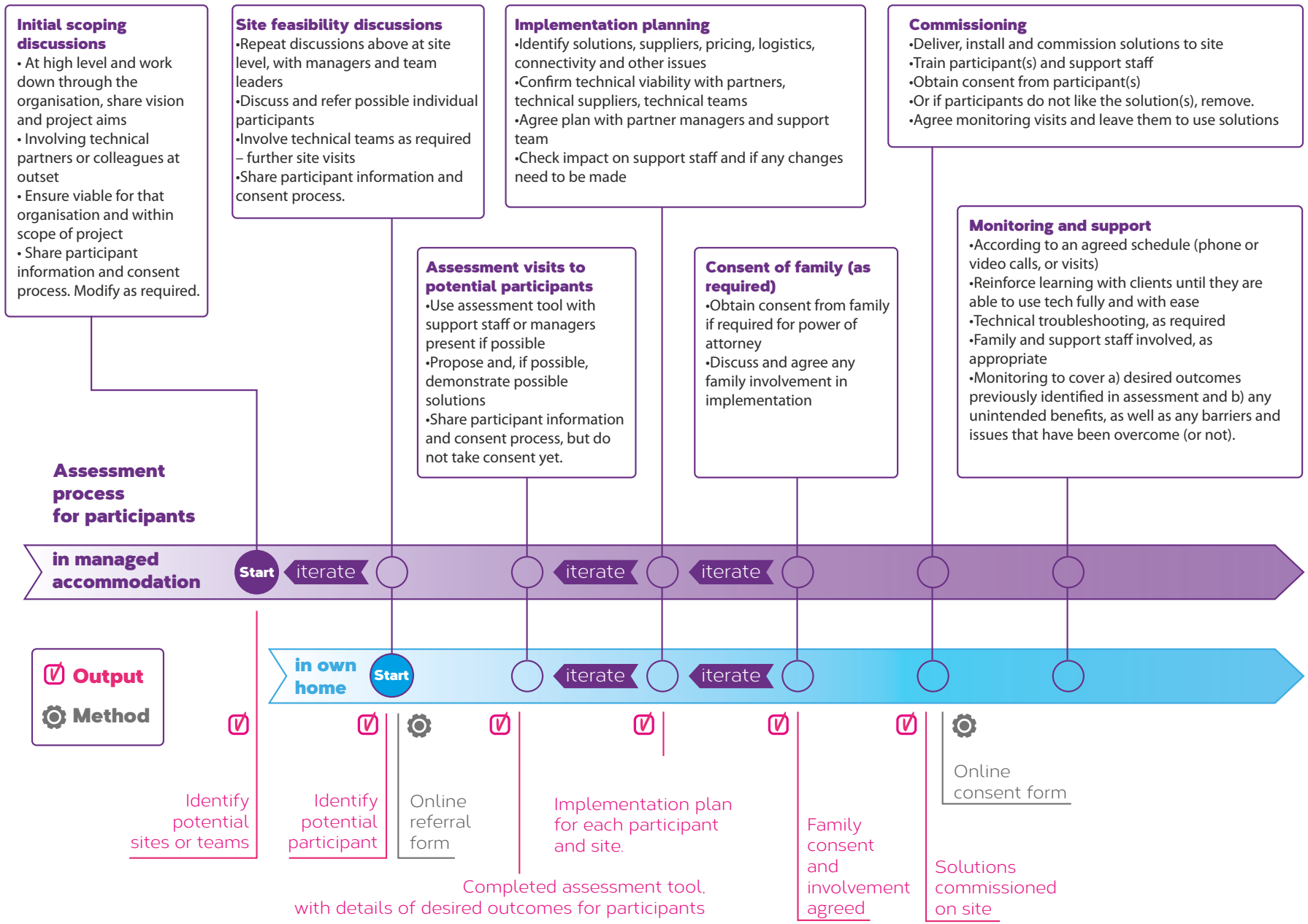


Activities:
Citizen Tech Tests

The target of identifying 25 Use Cases for a range of Citizen Tech products, with a representative group of service users, across the different sites and themes, was challenging given the time scale. Those partners who were in a position to engage quickly, provide staff input and move to selection of sites, validation of participants and implementation were prioritised. With more time, a more rigorous and perhaps fairer approach would have meant that more partners could have engaged effectively and evaluated the benefits. However, a representative sample was identified and taken forward, bearing in mind that the evaluation and learning will be shared with all partners. Following validation of individual participants, assessment conversations took place using ADAM and equipment was installed. The proposed solutions were agreed with the user, their families, carers and support staff. Technical issues were also checked. Modifications were made as required, until a solution was acceptable to all. Training, support and monitoring continued with significant input during the implementation phase, to deal with any problems, to remind users and their carers of features and to reconfigure as necessary. The process diagram summarises how this was done and is described in more detail for some of the Use Cases.

Photo: Elaine at home.

Figure 8: The process used in setting up and delivering the Use Cases, showing different entry points for service users in managed accommodation and living in their own homes.



Assessments were undertaken on 21 potential participants (Table 1), testing and further refining the question tree. Given constraints of time, a total of 16 Use Cases were taken through to completion (Table 2). The full list of equipment used in the project is shown in Table 3.

Table 1: List of participants who were validated to take part in the project

	Participant Name	Location	Theme	Progress to implementation
1	Keith	Aberdeen – Managed Accommodation 1	Dementia	Yes
2–3	Iris & Paul	Aberdeen – Managed Accommodation 1	Falls & Frailty	Yes
4	Billy	Aberdeen – Managed Accommodation 1	Dementia, Falls and Frailty	Yes
5	Carol	Aberdeen – Managed Accommodation 1	Falls & Frailty	Withdrew
6	Jean	Aberdeen - Managed Accommodation 2	Dementia	Yes
7	Delia	Aberdeen - Managed Accommodation 2	Dementia	Yes
8	Alice	Aberdeen - Managed Accommodation 2	Dementia	Yes
9	Richard	Aberdeen - Managed Accommodation 2	Falls & Frailty	Yes
10	17 Male Patients	Aberdeen Royal Infirmary	Falls & Frailty, Dementia	Yes – limited
11	Elaine	Stirling – own home	Dementia	Yes
12	Paul & Marion	Stirling – own home	Dementia (Paul)	Yes
14	Donald & Christine	West Dunbartonshire – own home	Dementia (Donald)	Yes
15	John & Linda	West Dunbartonshire – own home	Dementia (John)	Yes
16	Leonard	North Lanarkshire – Managed Accommodation	Learning Disabilities	No
17	Derek	North Lanarkshire – Managed Accommodation	Reducing overnight support and Dementia	No
18	4 shared house residents	Inverness – Managed Accommodation	Learning Disabilities Reducing overnight support	No
19	Julie	Dumfries- Managed Accommodation	Learning Disabilities	Yes
20	Alan	Dumfries – Managed Accommodation	Learning Disabilities	Yes
21	Clydebank Dementia Resource Centre	West Dunbartonshire	Dementia	Yes

Reasons for non-implementation

A number of participants did not proceed further with the test, for a variety of reasons:

- Billy had problems looking after himself in his supported accommodation, was losing weight and having problems sleeping. It was agreed with his family and professional carers that Rapport CIC would install sensors to explore and understand the problem more fully. However, before this could be fully understood, he was admitted to hospital. The sensor suite was installed and, in the days leading up to his hospital admission, the data showed some indication of decline in Billy's routines and environment.

- Leonard and Derek are two brothers who live together in supported accommodation. The goal was to reduce overnight support and increase independence. They were assessed and an iPad with apps were proposed. However, there were issues to resolve in agreeing changes to staff support, which could not be resolved in the time of the project. A key issue was that there was no point introducing digital support, if staff would continue to provide full care.

- Carol chose not to proceed because she felt the equipment would be intrusive. Her case was complex and the diagnosis not yet clear, so there were possibly conflicting medical needs that could not be addressed in this project.

- NHS Highland identified a shared house in Inverness for the test. Six residents, with learning disabilities, were referred and 4 (2 were out at the time of assessment) were taken through the ADAM assessment process. Their goal was to provide residents with a means to video call out to the new Waking Night Responder Service for reassurance instances where a visit was not required, and for home-based activities, which they could do independently of staff, including group activities. The solutions proposed were based on the Alexa platform. Detailed discussions were held with site staff and relevant managers. There were concerns about data security, liability and legal processes. A full Digital Protection Impact Assessment (DPIA) was requested, but due to limited time it was judged that this was not possible.

Table 2: List of Use Cases, in which Citizen Tech solutions were tested.

Table 2: List of Use Cases, in which Citizen Tech solutions were tested

	Participant Name	Condition	Personal Goals	Citizen Tech Implementation
1	Keith	Dementia	Maintain activities for quality of life and prolong cognitive capabilities, maintain friends and family connections	Sensor suite and watch, My Home Helper
2–3	Iris & Paul	Falls & Frailty	Improve mobility and independence, family connections, appointment reminders	Sensor suite and watch, Kindle Fire tablet
3	Billy	Falls & Frailty	Maintain activities for quality of life and health	Sensor suite and watch.. Admitted to hospital so stopped early
4	Jean	Dementia	Maintain activities for quality of life and prolong cognitive capabilities, maintain family connections	Sensor suite and watch, My Home Helper
5	Delia	Dementia	Maintain activities as long as possible - advanced dementia, family involvement needed	Sensor suite and watch
6	Alice	Dementia	Maintain activities for quality of life and prolong cognitive capabilities, maintain family connections	Sensor suite
7	Richard	Falls & Frailty	Epilepsy has curtailed activities, increase activity, maintain cognitive abilities, alleviate boredom, reduce stress	Sensor suite and watch, Android Tablet
8	17 Male Patients	Falls & Frailty, Dementia	Improve mobility and independence, cognitive capabilities, family connections, reablement	iPad Pro, apps, Attend Anywhere
9	Elaine	Dementia	Loneliness and feeling safe	2 x Echo Dot – for her and her son and his partner
10	Paul & Marion	Dementia (Paul)	Increase independence and maintain cognitive capabilities, reduce stress.	Echo Show, Tile, Headphones
11	Donald & Christine	Dementia (Donald)	Maintain activities for quality of life and prolong cognitive capabilities	Proximity, GPS, Hydration (Ulla), Water dispenser, My Home Helper
12–13	John & Linda	Dementia (John) Falls & frailty (Linda)	Maintain activities for quality of life and prolong cognitive capabilities.	Samsung tablet, GPS (OneTouch withdrawn, Propod introduced), Bluetooth Speaker
14	Julie	Learning Disabilities	Reduce anxiety around time and support needs, enrich quality of life	Bone conductor headphones, Android tablet, Alexa app, Google Family Link
15	Alan	Learning Disabilities	Communication of needs to staff when exhibiting stressed behaviours, enrich quality of life	Echo Show, bone conductor headphones, six Echo Buttons
16	Clydebank Dementia Resource Centre	Dementia	Demonstrate what is possible with Citizen Tech, safe place to try equipment.	Smart home using Raspberry Pi integrated devices

Table 3, the full list of equipment used in the project

Product Name	Retail Price
Hue Dimmer	£16.99
Flic Button	£29.99
Hue Motion Sensor	£34.99
Hue Starter Kit	£50.99
Harmony Hub	£74.99
Ring Battery	£19.99
Ring Doorbell	£179.00
Echo Buttons	£19.99
Amazon Plug	£29.99
Galaxy Watch	£228.99
Presence Sensor	£29.99
Kindle Fire	£89.99
Kindle Fire Stand	£43.99
LED Tap Lights	£6.99
My Home Helper	£299.99
Netatmo Air Quality Monitor	£80.99

Product Name	Retail Price
Ulla Hydration Reminder	£21.99
Hot Water Dispenser	£59.99
Tile Pro	£39.99
Echo Show Stand	£24.99
Echo Show	£229.00
Echo Dot	£49.00
Kettle Tipper	£39.99
Memo Minder	£22.95
Headphones	£49.99
Aetoec Sensor	£26.99
Raspberry Pi	£45.99
SmartThings Hub	£80.00
Snips	£112.02
Energy Meter	£70.00
Contact Sensor	£35.00
Dry Contact Sensor	£45.00

Product Name	Retail Price
Dock for Dry Sensor	£18.00
Wall Plug Meter	£36.00
Bed Mat	£50.00
4G Router	£135.00
Wifi Repeater	£116.00
Float Switch	£5.00
Water Weld	£10.00
Music Player	£130.00
One Touch	£200.00
Pro Pod	£200.00
Samsung Tablet	£180.00
Bluetooth Speaker	£40.00
4G Mifi Hub	£40.00
4G payg Internet	£150.00
Rugged Case	£20.00
iPad Pro	£1000.00

Selected Use Cases

After validation of the participants, assessment using ADAM, agreement with users, staff and families, equipment was ordered, installed and commissioned as quickly as possible. Due to a range of technical issues, the time period for which people have been able to use their Citizen Tech has varied between one and four weeks, at the time of writing.

The impact - both positive and negative – is therefore fairly limited and will need to be re-evaluated after a longer period has elapsed. However, a selection of individuals is profiled here, to give some idea of how Citizen Tech has been used, the hurdles to overcome and the initial impact.

Photo: left to right - Alan, Jean, Julie and Julie's Mum.

The Mamma Mia fan

about me
Julie is a young woman in her twenties who loves listening to music and looking at photos on her iPod. The Mamma Mia soundtrack is her favourite.
Julie has a learning disability and has had medication for her epilespsy from 14 months old.

about a good day for me
Most weekday afternoons Julie goes to a day centre where she meets up with friends and enjoys arts, crafts and hobby classes. Julie's perfect day would be to see her sister and her new puppy.

about my challenges
Julie has challenges around meaningfully filling the day and managing anxiety. She is easily bored when she does not have carer support. She also needs reminders so that she is not stressed about who is visiting or not visiting. Julie gets stressed if she doesn't know what's happening around her. The main example of this is her care calendar and new carers arriving who don't know her. She has a folder with the photocopied rota sheet, but it isn't always up to date. Julie is able to recognise familiar text, like the names on the rota, but she doesn't read. Julie needs encouragement to do physical activity and has a Polar band to monitor this.

about my home
Julie has a lovely modern home, with a garden opening onto a pretty, communal courtyard. It is managed accommodation with staff on hand if she needs them.

about my circle of support
Her mum lives nearby and visits regularly. She also has other family who she sees often. Julie calls her mum and other family on her mobile phone in the evenings when she is bored. Care staff support her with personal care, cooking, shopping and outtings.

if I had a wish
Julie's wish is to have a care calendar with photos of staff, showing who is coming in. Julie's mum would like to have a care calendar that can be shared with her digitally and include medication tracking. (Julie's medication has been missed several times, possibly due to staff shortages).

Reduce anxiety around time and support needs, enrich quality of life.

about my solutions
Julie has an Android tablet, with the Alexa app, which she can use to play music, videos and to see her photographs. Her family can also use it to make video-calls to her. It is configured to receive calls only. She also has bone conduction headphones, which enable her to hear music while still hearing background noise, so she stays more involved.

Digital

+ positives
Both Julie and her mother have already started to benefit. The new tablet and its apps have given Julie things to do. She is enthusiastic and ready to learn new skills. The headphones are working well for her. The video-calling to her mother keeps her in contact, during the evening. Julie had enjoyed seeing her sister's new beagle puppy on a video call. A Spotify account has been set up (monthly fee paid by her mother) and she is using the tablet regularly with 4G data. A broadband subscription is being considered. Additional apps have been added to the tablet, which is being monitored by her mother using Google Family Link, which lets a parent pre-approve apps for installation.

– minuses
On a weekly monitoring video-call, Julie's mother reported problems getting the video-calling to work between her home and Julie's flat. Unfortunately, someone had unplugged the 4G hotspot, and she had not been able to reset it successfully. It was decided that a sign should be made saying 'do not unplug', so that cleaners or other staff could be made aware. On this call, which took place at Julie's flat with Julie, her mother and her carer present, Julie needed to be shown again how to use YouTube. However, monitoring data showed that she had used many of the features on the Alexa app.

! interesting
A Digital Care Calendar was researched by the project leads. Nothing suitable currently exists. Also, staff are adjusting to various changes and new systems, so introducing another new application should be left until other things are up and running.

The gadget guy

about me
Paul used to be the person at work that other people would go to with their tech enquiries and he's still very keen on having the latest gadgets. He is also very interested in current affairs and a fan of rock and classical music.

Paul is an active retired person, living with his wife in his own home in Stirling. He was diagnosed with dementia two years ago and the couple are still adjusting to it. Both are used to using technology and want to maintain their independence as much as possible.

about a good day for me
A good day for Paul would be to catch up with a friend and chat world affairs, perhaps over good long walk, followed by lunch.

about my challenges
Paul wants to be independent and can get quite easily frustrated. He has challenges around remembering to do things and finding his keys or other objects. He needs reminders as he feels anxious when it is near to an appointment, in case he forgets. He wants to be able to continue to go out for walks or to meet up with friends. It is also very important to both of them that his wife can continue to have some free time and does not need to worry about looking after Paul. A pinch point in the household is when Paul plays his music loudly, which helps him to relax, but causes his wife to feel stressed.

Paul often quotes Michelangelo "I'm still learning".

about my home
Paul's home has many of the gadgets he loves. He has a talking wristwatch, an iPhone, a MacBook, iPad and Amazon Echo. He uses Siri for reminders, but is starting to find icons and apps tricky. The couple have done some 'future proofing' to the house, renovating the downstairs bathroom into a wetroom for Paul. However his wife is clear that "there's only so much I'm prepared to do to modify my house".

about my circle of support
His wife finds her role as a carer challenging at times and is keen to maintain her quality of life also. They have grown up children and grandchildren, but they aren't close by. Their son plans to move closer to them soon. They have a 'dementia dog' (a specially trained assistance dog to help people living with dementia) and the dog is a great support to both of them, perhaps sometimes defusing some stress in their relationship. Paul is very sociable and is actively involved in a number of groups, including being a member of the Rotary Club. He is on the committee for his local Dementia Friendly Community. Paul also has a support worker a few days a week.

if I had a wish
Paul's wish is to live into his 80s at home with his wife.

Increase independence and maintain cognitive capabilities, reduce stress.

about my solutions
Paul has been supplied with an Echo Show, Tile (key finder) and bone conduction headphones.

+ positives
The Echo Show, with Alexa, has proved so successful that the couple have bought themselves a second one to go in the kitchen. Paul already had an Echo in the living room but after owning it for a few months he hadn't made much progress with it and his wife had taken very little to do with it, preferring her Sonas speaker. The show was given to Paul because of its additional functionality with the screen display and also being a gadget guy he loves new tech. Paul found it worked well and they were experimenting with new things to get the maximum benefits. Paul's wife is pleased with how well it works. She sets up all Paul's reminders, his appointments, reminders to take medication, to drink water and suggestions to listen to music or do something else. It has worked so well, that she was able to go on holiday for a week without anxiety.
The headphones have also proved useful. It means that Paul can repeatedly listen to the same music, without his wife having to hear it.

– minuses
On the first monitoring visit, some troubleshooting was needed with the Tile, which fits to key fobs and other objects so that they can be found. It had to be linked properly to Alexa. There were also issues with the tile getting mixed up with the GPS tracker that they use for the dog. On the second monitoring visit, Paul was still not using the tile, partly because he found it too bulky to put in his pocket. The bone conduction headphones were found useful, although he needed help in resetting the link with the Echo Show.

! interesting
Interestingly we wondered if his wife would give the old Echo a go and if she liked it perhaps then she would support Paul to use his, making the adoption and learning of it easier and also encouraging her to feel comfortable in setting up routines etc. - this tactic worked and Marion didn't just like having the Echo in the kitchen, she loved it and is considering giving her son the Sonas.

Digital

The crime fiction enthusiast

about me
Jean enjoys reading crime novels and has a collection in her home. She would rather be out and about than sit in front of the television, which she can't really be bothered with. In the afternoons she quite often goes to bingo and other recreational classes. She tries to maintain as many activities as possible, to keep active.

about a good day for me
A good day for Jean would be going out for lunch with her daughter.

about my challenges
Jean was diagnosed with dementia in 2016 and was struggling to manage at home. She needs a way to keep in more regular touch with her daughter and for her daughter to know that she is safe. Jean also complains of feeling cold, although her room is very warm, and this is being investigated by her GP to find out if there is an underlying condition.

about my home
At the end of 2017, Jean was able to move into a self contained flat in managed accommodation in Aberdeen, where she has the option to have her meals provided and to eat with other residents in the communal dining area.

about my circle of support
Jean's main family support comes from her daughter, who lives in Spain. In between her visits, they keep in touch regularly by phone.
Staff are always around and they help with daily living, and reminders about mealtimes and activities.

if I had a wish
Jean's wish is to chat to her daughter whenever she feels like a bit of company and reassurance.

Maintain activities for quality of life and prolong cognitive capabilities, maintain family connections.

about my solutions
Jean took part in the test to use the Rapport CIC sensor suite to monitor her environment. She was also supplied with a smart watch to collect other physiological data. She has a MyHomeHelper to keep in touch with her daughter and set reminders for medication, hydration and activities.

+ positives
The MyHomeHelper is working well for messages and reminders. Jean's daughter can remotely add events from her mobile phone. She has added her photo, reminders for activities and sends messages every few hours to say things like "Why not get yourself a cup of tea and biscuit". Jean finds the clock face much easier than a conventional one, because it tells her whether it is morning, afternoon or evening. Sometimes she wakes up after a sleep and does not know what time of day it is, so this really helps. The writing is big and it is right in the middle of her shelf, so always visible.

– minuses
They are still working on using the MyHomeHelper for video calls, as the quality has been poor. This may be an issue with Jean's broadband, which is being looked into. They are also having problems because Jean is disorientated when her daughter suddenly appears on the screen – it is easier if she phones first, but this defeats the object. The device also sends out alert sounds she does not understand, so she tends to think it is someone at the front door. They are working on choosing the best sounds for her.

! interesting
Jean's daughter, although remote, has been very involved in the test and has given substantial feedback on the MyHomeHelper and on the sensor suite. She is now in direct contact with Rapport CIC and they are working on getting her access to the data being collected. This will help her to more fully understand her mum's needs and give support appropriately.

Digital

The Cheeky Joker

about me
Alan has a good sense of humour and enjoys winding up the staff who support him. He goes to recreational classes some days and enjoys music. Alan is in his late thirties and has learning disabilities and IBS.

about a good day for me
A good day for Alan would be meeting up with friends.

about my challenges
Alan attended mainstream school until his mid teens, but seems to have lost some ability since then.

He can get very stressed by new people and situations. Alan doesn't like when people talk about him, but not to him. He also doesn't like having too many people in his house. When he is stressed, he becomes upset and cannot communicate well. His frustration at not being able to verbalise his needs can appear to be aggressive, particularly for staff who are not used to working with him (a problem given the current staffing challenges where he lives).

He has an ear problem, which can be exacerbated by using conventional headphones.

Alan needs a way to communicate his needs when he is stressed and upset. He also needs ways to relax and deal with the stress.

about my home
Alan lives in his own home in managed accommodation in Dumfries. He has a lovely modern home and access to gardens.

about my circle of support
His main family support is his mother who lives nearby. She visits regularly and they have a Chinese takeaway together on a Sunday. She does not use a smart phone or any computer equipment. She is nervous of the security risks of the Internet. Alan needs a lot of care. His mother and one of his longer term carers are the best able to understand him, but cannot always be with him when he has stressful episodes.

if I had a wish
Alan wants to be in control of his life and to make his own choices.

Communication of needs to staff when exhibiting stressed behaviours, enrich quality of life.

about my solutions
Alan has been supplied with an Echo Show, with six external Echo Buttons. These are configured to say 'Leave me alone', 'I have a sore ear', 'I have a sore stomach'. He has bone conduction headphones, which work outside his ears.

+ positives
On a monitoring call, it was reported that the buttons had been working well and Alan's mother would like to have some more options. There are 6 buttons available only 3 of which have been configured. This is possible but needs discussion with all carers. One issue to consider is what would happen if Alan can ask for something that he cannot have – for example, 'I want to go for a walk', when it is dark and wet outside. Alan had a range of other issues, unrelated to the Tech, which were under review.
A second monitoring visit was set up and three more buttons were configured. One is for Alan to say, 'I have a sore head', the others to start and stop the radio. Alan's mother said that he had already been able to use the 'I have a sore stomach' and both were pleased with this.
Alan is successfully using his headphones and making good initial progress, but it is too early to report any clear outcomes. He tried using them with the new button to switch the radio on and was pleased that he would be able to hear music in his bedroom.

– minuses
So far only a few staff members are aware of the buttons. More engagement from staff is required for the buttons to have an positive impact as a communication tool for Alan. Staff shortages and turnover could make this challenging.

! interesting
Alan's mother is considering getting broadband at his home, and taking lessons so that she can also use Citizen Tech. As well as being able to keep in touch with Alan and support him to use the new items, she likes the idea of being able to watch the Springwatch webcams.

The walker and the bowler

about me
John and Linda have many former interests, including walking and bowling, but due to poor health they have become quite isolated. Most days John goes out for a walk and Linda uses the time to catch up on sleep, or to do her Sudoku puzzles. When they are both at home the television is usually on, but John isn't really engaged. They both like to listen to music. John can sing along to some of his favourites and knows all the words.

about a good day for me
A good day for them would be getting out to the shops.

about my challenges
John has a diagnosis of dementia and needs to have someone with him at all times, and Linda has osteoporosis and cataracts. She is also a smoker. She often gets tired and has sometimes had to forego hospital treatment to look after John. Postponing surgery for her cataracts has put Linda at increased risk of a fall.

John likes to go for a walk, but is not keen to stop anywhere, which means it is hard for Linda to take him out when she goes shopping. John has wandered off before and is at risk of getting lost, which makes Linda anxious. Linda also finds it challenging to keep him meaningfully occupied, doing something he enjoys, when he is at home. If Linda was assured he was safe, she would be less stressed and able to maintain her own mobility.

about my home
John and Linda live in their own home in West Dunbartonshire. This has been their home for many years and it has become quite cluttered. Linda has things she would like to do, like clear out a room, but she isn't able to do this herself.

They have a laptop that their daughter-in-law got them, but they don't know how to use it. Linda can navigate around the TV channels well, but her eyesight presents some challenges.

about my circle of support
John has help 3 mornings a week from his support worker. They usually go for a walk. John also has a friend who comes round and goes for a walk with him. Their daughter died 10 years ago and had been their main source of support. Their son lives nearby but is not closely involved in their care. They both rely heavily on John's support worker and he helps with lots of additional things, like setting up the television. If it weren't for him, they might struggle to stay at home.

if I had a wish
They wish they could get a good nights sleep.

Maintain activities for quality of life and prolong cognitive capabilities.

about my solutions
John has GPS tracker to reassure Linda and help keep him safe. This is linked to a Samsung tablet and also his carer's phone. To keep them both happily occupied, they also have a shortcut to YouTube on the tablet, so that they can play music. This links wirelessly to a speaker, so that they can both listen.

+ positives
Linda had seen some benefit from the GPS tracker during the first day or two that it had worked, but it was too early to give any positive benefits. However, if it can be made to work, this could play a significant role in enabling them both to stay in their home for longer.

– minuses
When visited a week after being provided with the equipment, Linda reported some problems with the GPS tracker. It was 'going to sleep' and not reactivating properly when the sensor moved. This seemed to be a technical fault, reported to the supplier, with a short term fix to make it work for them. Linda had also not made much use of the tablet and speaker, because she had forgotten how it worked. After being shown again, she wrote some notes down and was confident she would be able to use it now. The One Touch GPS device was swapped for a Pro Pod 4. It has similar features to the One Touch but doesn't offer 2 way calling, so Linda couldn't have a conversation with John through calling the device. This isn't an issue as John would be unlikely to benefit from this feature and could be quite disorientated by hearing Linda's voice from the device. The GPS Tracker Shop Web portal was saved to the home screen on Linda's tablet and Linda made notes on how to access it and the "breadcrumbs" trail. John and his support worker tested the device out the following morning on their regular walk and Linda was able to see where they had been. It seems to be working well so far.

! interesting
Now Linda is thinking about how to encourage John to take it with him. When he was first diagnosed their daughter insisted that he carry a mobile phone and Linda crocheted a cover for it that allowed him to wear it round his neck. John has accepted the GPS and Linda is becoming more confident with the technology.

Digital

Improving support in an acute care environment

Photo: Aberdeen Royal Infirmary, Ward 17.

Aberdeen Royal Infirmary requested support to 17 male patients on an acute medical assessment ward. The goal was to provide them with activities, ways to engage with family and friends, facilities for video consultations with consultants and other staff. Due to lack of time, only limited implementation was possible. An iPad was supplied, configured to provide music, films, video-calling using Attend Anywhere. Issues to enable patients to securely share the device, with separate logins, music and film choices, contacts, needed to be resolved with appropriate processes determined by the partner. Some initial sessions were carried out with staff to demonstrate the potential and were positive.

Demonstrating capabilities for families

The Dementia Resource Centre in Clydebank has been set up as an experiential environment, with a range of Citizen Tech equipment for families to 'try before they buy' and to get expert advice from staff on possible ways to use the solutions to improve care. This includes the LE Automation 'smart home' kit, as well as a number of off-the-shelf products.

All the devices that have proved most popular are available - Echo Show, My Home Helper, Alexa, GPS trackers and other things. Staff have received training, but to date only limited use has been made by the facility by the general public. More activity is planned for the future, once the staff have developed their capability through experimentation.

Photo: Clydebank Dementia Resource Centre staff learning about the technology suite from Charles Vincent (LE Automation).

Benefits to family carers

In many of these Use Cases, there is a close family carer involved, who either lives with, lives nearby or keeps in close contact with the person. For these family carers, their situations can be incredibly challenging. Several of them have reported benefits – both intended and unintended.

Photo: Jean's daughter who lives in Andalucia, Spain.

Jean's daughter, who lives in Spain, has much more information about her mother's activities and is confident that she will be less anxious as a result.

Alan's mother, who has always been wary of using computers, is thinking of setting up her own Citizen Tech around her personal interests.

Paul's wife has been able to go away on holiday for a week, keeping in contact remotely, and feel confident that he will manage. She has also started using Alexa for her own interests.

Staff in managed accommodation

There have been staffing problems (sickness, turnover, missing handovers, changes to normal staff) in all of the managed sites, which have sometimes caused difficulties. For example, Julie's Wi-Fi hub was inadvertently unplugged and her tablet could not be used for a couple of days until it could be reset. Jean's smart watch was not taken away to be recharged, as had been agreed with her daughter, due to a missed communication. Conversely, other staff have become very involved and helped to use the equipment. Julie's carer has worked with her to find the music she likes on YouTube. John's carer has been helping to test the GPS tracker for him.

Photo: Dunmuir Park, Castle Douglas, Dumfries.

Due to lack of capacity it has not always been possible to involve staff as much as would be desirable in assessment and commissioning. However, there is an ongoing issue to work through here. More work is needed to understand how to communicate with so many people, some of whom may only be caring temporarily for the Citizen Tech service user and who may not see troubleshooting of Citizen Tech as part of their role.

It was obvious to the project leads that the staff on site were working at capacity and had very little time to make available in order to learn about new things. This presents difficulties where services are looking to move to new delivery models, but don't have the capacity to take time to design these models or manage the change process with staff. There are conflicting feelings about the introduction of technology, with some staff members enthusiastic and seeing clear benefit, while others felt it was just another thing that would add to their workload.

The value of monitoring

The Rapport sensor suite with smart watch equipment has been deployed with 8 people, in the two managed sites in Aberdeen. Each installation is slightly different, geared to the needs of the service user, and there is as yet limited data to report on.

Two cases are described.

Case 1

Jean had complained of feeling cold, although her flat was very warm. There were also concerns she may suffer from dehydration. Some preliminary monitoring is shown in Figure 9, using sensors to measure carbon dioxide levels, temperature and humidity. In the first week the temperature is fairly constant, the carbon dioxide levels (CO2) are low, indicating good air circulation and humidity level at the low end of the comfortable range. There then occurs a period where the temperature rises and then starts to oscillate more widely. This is combined with a rise in CO2, indicating a reduction in air circulation (most likely because somebody closed the windows). There are also some clear peaks in the bathroom humidity levels, suggesting showering activity without ventilation. Of note there are also two peaks close together, one in the evening, one the next morning. The CO2 then returns to baseline levels, but the temperature continues to oscillate around a lower mean level. These data suggest that Jean has difficulty in maintaining the internal environment of their flat at a temperature she finds comfortable, while ensuring adequate air circulation. It is unclear whether this is due to the heating arrangements in the flat or her own actions. Putting contact sensors on the windows and a sensor on the thermostat would resolve the remaining uncertainty and help her carers to find a solution.

Case 2

Billy's condition was poorly understood and he was not able to communicate well. His family asked for sensors to get more information. A set of sensors were installed to monitor movement in different parts of his flat, toilet flushing, opening and closing of the fridge door. Monitoring took place over a 24 hour period leading up to his being hospitalised due to a deterioration in his condition. The data (Figure 10) shows that Billy spent time in bed in the early evening (18:30 onwards). A staff evening check can be seen around 20:00 (indicated by the front door opening and closing twice in a short period) and shortly afterwards Billy got up to go to the toilet (as indicated by the toilet flushing). He then went back to bed for another hour before getting up around 21:30. There then was a 3 hour period until 00:30 where there was movement in the bedroom, but the bed does not appear to be occupied. After this, there is a 2 hour period of restless activity in the bed until soon after 02:00 when Billy gets up and goes to the toilet. Then he went to the kitchen (via the Living room) and the fridge was opened, but the door was not closed. Shortly after the front door of the flat was opened and closed and then Billy finally retired to bed, getting up around 10:30. The overall impression is that Billy was most likely in an agitated and confused state prior to his deterioration. The uncharacteristic pattern of activities in the preceding evening could potentially have acted as a prompt for earlier intervention and possibly prevented the need for hospitalisation.

Figure 9: Monitoring data for Jean

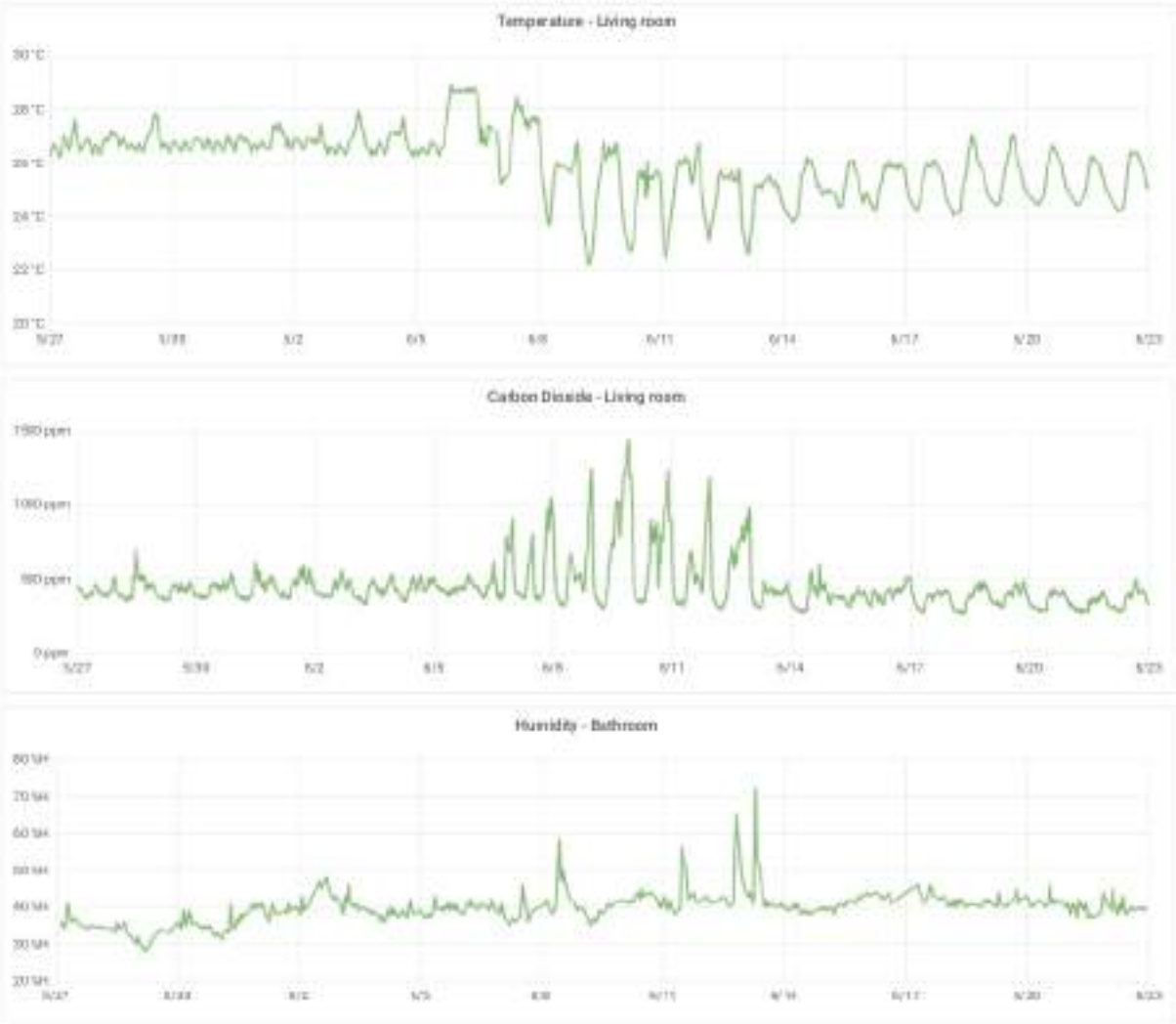
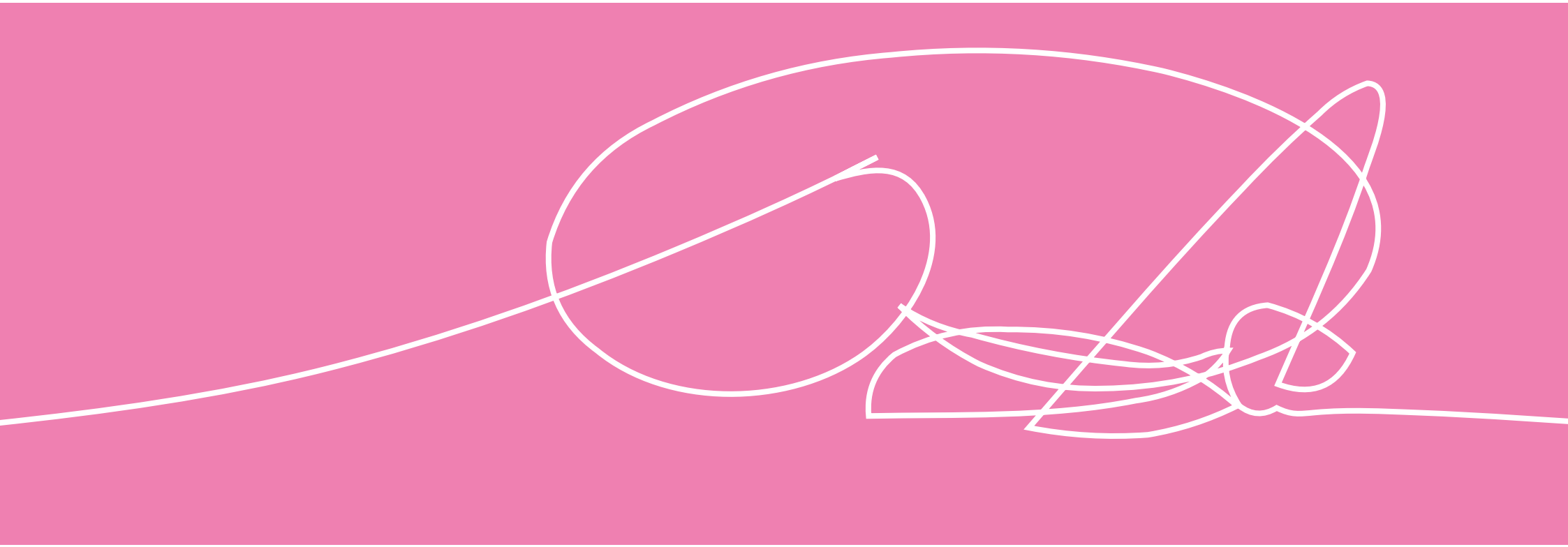


Figure 10: Monitoring data for Billy



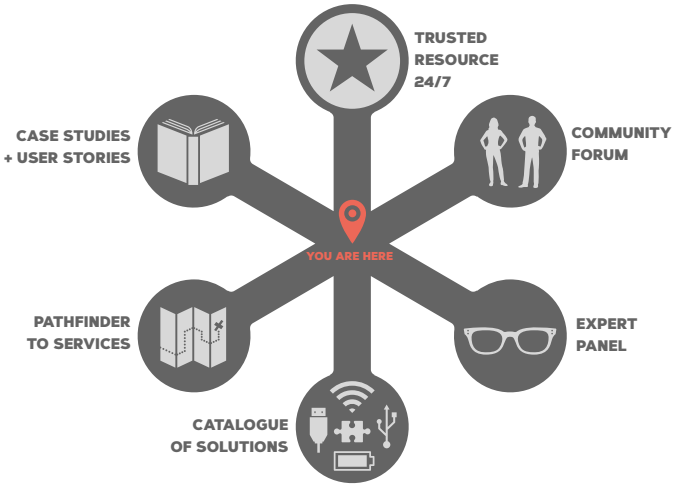
Learning

Learning from the project has been recorded continuously, through a process of interviews and group discussions with the project team, partner managers and staff, service users and family members. In total, 15 stakeholder interviews or meetings have taken place (excluding those with the project team).

"I'm still learning"
Michelangelo

Figure 11: The Assessment as a Trusted Resource, from Workshop 2

Trust



Issues around trust have needed to be addressed throughout the project. There is an emerging recognition that there are risks associated with the owning, storage and sharing of data, although the details of these risks are not always well understood. For some people – service users, families and staff – the reaction is to avoid any use of connected devices, which can be a missed opportunity. As with any change process, it is essential to recognise and address people's concerns quickly. Some of these were generic, but many were poorly articulated. In particular, the concerns about data risks, what could happen and how it is controlled, need to be discussed in full. In general, these fall into two categories – fear of being hacked and fear of being spied on. More information needs to be provided on the likelihood, severity and ways to mitigate these risks.

The project team and suppliers have dedicated resource to understanding and articulating the risks. All recommended products are considered to be safe, if used responsibly. Responsible use, in this case, has included securing devices in a way that limits users potentially damaging safety settings, careful selection and control of passwords, selection of technology that meets security standards. However, one partner withdrew from the project as there had not been a Data Protection Impact Assessment (DPIA) for Alexa and other consumer devices. Interestingly, Amazon have recently announced that they are partnering with a number of healthcare companies and have regulatory approval under the US Health Insurance Portability and Accountability Act (HIPAA 1996) [1,2], which is an important step. However, further work is needed to confirm regulatory compliance in UK law. Within the Scottish Government Digital Health & Care Strategy, information governance, assurance and cybersecurity are recognised as a priority [3].

There need to be guidelines and training for partners. This needs to include templates for use by Health & Social Care Partnerships (HSCPs) and others, formal data sharing agreements and protocols for working with service users. With consumer technology, there can be different ownership arrangements. Some families may have chosen to purchase products themselves and would ideally like a way to integrate with their formal care provision. Others could receive Citizen Tech as part of a broader care package. There is clearly a difference in liability in these cases, which need to be reflected in guidance and regulations. The Digital Health and Care Alliance (DHACA) have produced a web-based Technology for Carers Toolkit [4], which provides useful advice on selection of equipment – although it does not include the Citizen Tech tested in this project. They report a recent survey: 'A poll commissioned by Carers UK as part of this work shows consumers are missing out on the benefits of technology when it comes to supporting health and care needs. Though 7 in 10 of adults online across the UK use technology to help them manage their money (72%), shop (71%), for social networking (67%) and for communicating (66%), less than 3 in 10 (29%) turn to technology when it comes to helping with health and care. Those aged 45 – 54, the age people are most likely to be a carer and those over 55 were less likely than other age groups to be using technology to . support with care. Men were significantly less likely (25%) than women (33%) to use health and care technology'.

Although some informal carers use Citizen Tech more widely to support vulnerable people, this project seems to be a trailblazer in providing a more formal test within statutory care settings. Related projects include those at two local authorities in England (Oxfordshire and Hampshire), who have initiated the use of Alexa for older people in the community. Hampshire are working in partnership with PA Argenti, from whom an evaluation report is available [5].

Conversely, the use of data can be turned into an opportunity. Rapport CIC have identified a number of potential benefits to collecting and analysing data, to spot trends, get a fuller picture of a person's situation and earlier warning of problems. Their platform has been secured according to NHS Information Governance (IG) regulations, to ensure it can be used effectively.

There is a clear need for a 'trusted broker', who can advise Scottish health and care providers, as well as the general public, on appropriate Citizen Tech solutions. Test of Change and the ADAM tool can fill this gap. Part of this role needs to include horizon scanning and facilitation of tests for new entrants to the market. An example here is the Clydebank demonstrator facility for LE Automation.

Trust within the partnership had to be developed very quickly, albeit with some issues of expediency. This groundwork is important to establish a brokerage and information service at scale. The partners need to collectively agree on the risks and their management, particularly related to data, but also in the areas of taking consent and in how care is affected by using technology.

Communications

Embarking on a project of this nature, within a seven month time window and with partners who had not previously worked together was one of the most challenging aspects. All stakeholders interviewed mentioned this as an issue. The project team adopted a pragmatic approach, sometimes making decisions and moving at a speed that meant partners could not always engage as fully as they wished. In some cases, this meant that potential Use Cases had to be abandoned. In others, miscommunication meant that it was deemed wiser to withdraw a participant from the test. Many problems could have been solved by having more time to share information and reach a common understanding, although the project leads recognise that all of the partners have many other targets to meet both from local and national agendas, as well as delivery outcomes. They clearly could not have spared much more time to participate in this project.

Once the engagement with test sites, service users and families started, it was clear how complex the communication issues were. Each Use Case is different, with a different set of stakeholders and organisations involved. All should be involved in the process, or, at least, be kept informed. This was not always easy. In at least one case, a partner felt they had not been 'kept in the loop', while project team members felt that they had 'not been able to get hold of' the relevant managers. Ultimately, this process can be streamlined and made more systematic, which will address some of these perceptions.

The involvement of family members needs to be considered on a case by case basis. It also needs to be constantly monitored, as family may become more engaged once they see the benefit. The process of agreeing consent is useful in starting these conversations. For example, one Use Case included Echo Buttons the user could press if he was not able to express himself directly. His relative was involved in discussing what the buttons should say and do. It has been important to learn personal preferences for communications. Some family members prefer to use email, others require phone calls and many of the service users need visits.

The most significant time requirement has been communications with service users. The project team have developed a range of instructions and reminders (such as 'Alexa cards' to suggest how a person might ask the device to do things) for the test. There have been requirements to reconfigure equipment, for instance, once people realised how it worked, or to create shortcuts to do common tasks. The time required had been underestimated, which meant that tests took longer to set up and ran for a shorter time before the end of the project. Similar experiences have been reported by other projects, reviewed by Greenhalgh et al (2015) [6], where they note that it is impossible to have a 'production line approach', as each case is different and needs customisation, adaptation and personalised support and propose the ARCHIE model.

Future Workforce

The role of staff in using Citizen Tech for care is critical. When fully scaled up, all staff will need to have some ability to spot opportunities for individuals to benefit from Citizen Tech, signpost to and use ADAM. Some staff will also need to assist and support service users to select, procure and implement solutions. There will be a need for digital specialists, with some clinical or carer training, to configure, train and troubleshoot solutions for the service users and their families. Training for all levels needs to be planned [7] and this is recognised in Government reports and policies [8,9,10].

However, lack of skills was by no means the only barrier to implementation of the project. Many staff working with the project team were very stretched and had no capacity to engage with the tests. For Use Case tests in managed accommodation, the plan was that Assessments would be done jointly by project staff and site support staff, but this only happened in a small number of cases. Handovers between staff were problematic, even though as much as possible was documented by the project team. In practice, staff rarely have time to read information. There is also a high turnover of staff.

There are also more direct barriers. Staff can be resistant to change, particularly if it is perceived to come from an external agency. They have real concerns about how it will affect their employment. In one of the managed accommodation sites, staff knew that they were going to be losing work hours, due to changes in legislation for sleepovers. The technology solutions, which were part of the redesign of this service, were very directly a threat. This is a real issue and needs high level management communications and actions. Some of these issues are explored by Greenhalgh et al (2018) [11] in an exploration of reasons for non-adoption of health and care technology. They note that not only can there be barriers with staff, but also barriers due to team dynamics and organisational arrangements.

More structurally, provider organisations within the NHS or local authority framework are just not set up to join short term projects such as this one. Although funding was available to cover replacement costs for support staff or managers, in most cases it was not taken up. Recruitment processes are very tightly controlled and even those wishing to take advantage of the funding found it hard to get through their internal systems within the time available. There were issues also with releasing front line staff, who would have made valuable contributions, because they were not able to work flexibly. Such staff need to be in clinics or have a case load which needs to be done on particular days of the week, but the project needed them to be able to respond for a set number of hours, at any time during the week. Finally, cost pressures on public services mean that current procurement models encourage a lowest cost service, which can leave little room for staff development and training within awarded contracts. This only exacerbates the issues of care being seen as a profession which is not valued and where there is no career progression, leading to a shortage of workforce at a time when our ageing population needs it most.

Influencing and Decision-Making

The dynamics between different individuals, including family members, staff and managers, as well as other participants within managed accommodation sites, were important in influencing decisions. Clearly some individuals are more receptive of technology, as well as being possibly more adept at learning how to use it. These 'early adopters' [12] were often able to give confidence to those more sceptical of taking part. In three of the Use Cases there are husband and wife couples, both with long term conditions. The attitude of the spouse would often influence the other one in making decisions.

In the case of people living in managed accommodation, the decision-making process is more complex and distributed across several people. Negative attitudes slowed down engagement in the project at some of the facilities, although it is hard to say if any specific individual withdrew. Some of the staff chose not to engage or took part only very passively. Where there was a staff member who was interested in the project and keen to be involved, it was easier.

There were similar issues with family members, but generally less resistance than with staff. Family members generally are more willing to give a possible solution a try and rarely is there a situation where they feel threatened by what is proposed. However, there were concerns about their own skills in operating the technology and those of their relative.

The Technology Acceptance Model (TAM) [13], an approach based on human centred design, recognises that individuals make decisions to adopt technology on the basis of two things – perceived ease of use and perceived usefulness. The model has been expanded and updated to include influences and environment, reframed as the Unified Theory of Acceptance and Use of Technology (UTAUT) [14], and including elements of other sociological frameworks. Figure 10 below is useful in the context of the Test of Change project.
A user may have an intention to use technology ('behavioural intention') but their 'use behaviour' will be dependent on 'facilitating conditions' (for example, support visits, troubleshooting, training).
The model also represents the 'social influence' from colleagues, family, general media, as well as attributes and attitudes of the individual concerned. Note that 'voluntariness of use' is considered to be an important factor – service users and families are strongly involved in making technology adoption choices, but the same may not necessarily be true of staff.

Figure 12: The UTAUT model for user acceptance of information technology (from Venkatesh et al 2003).

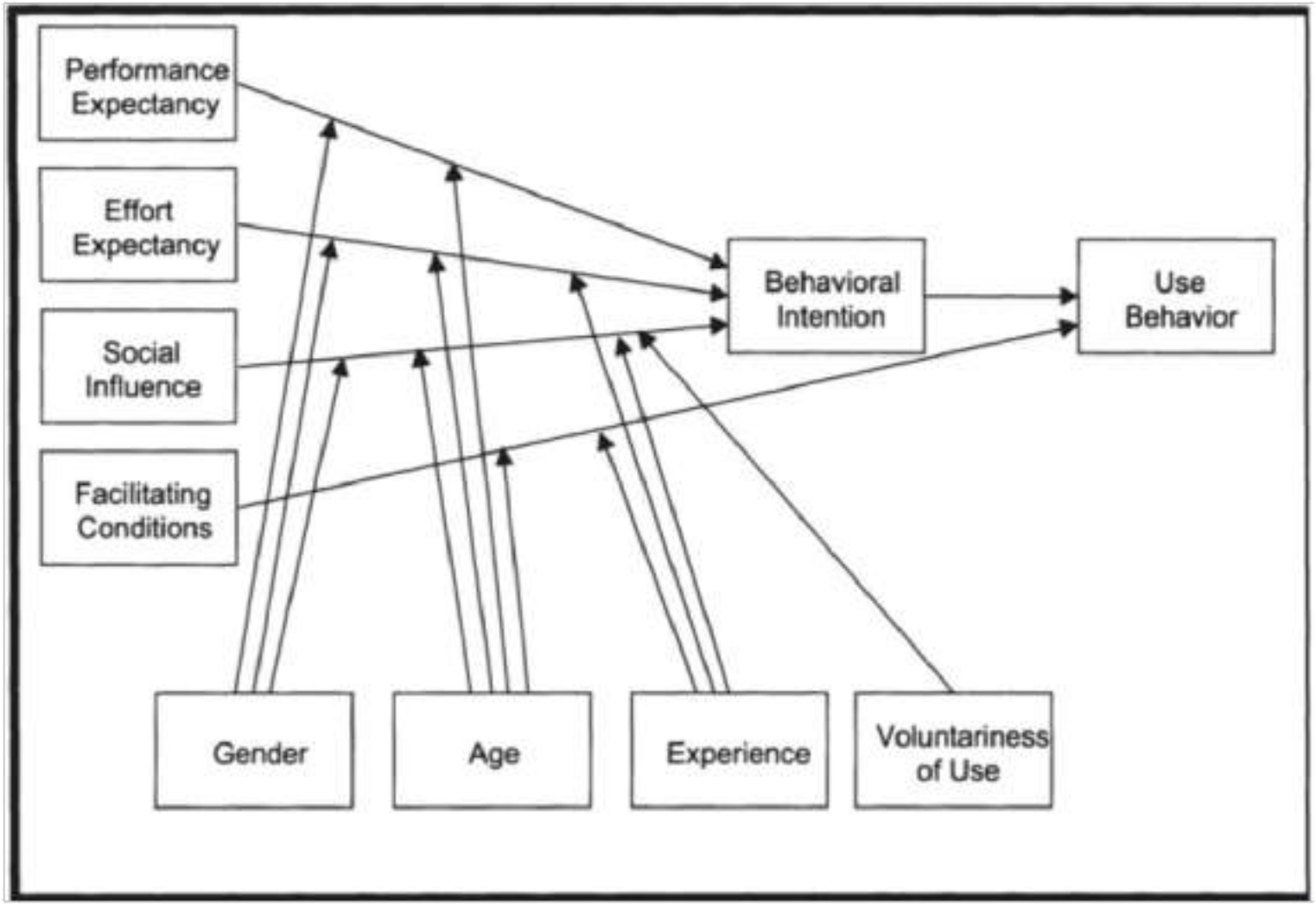
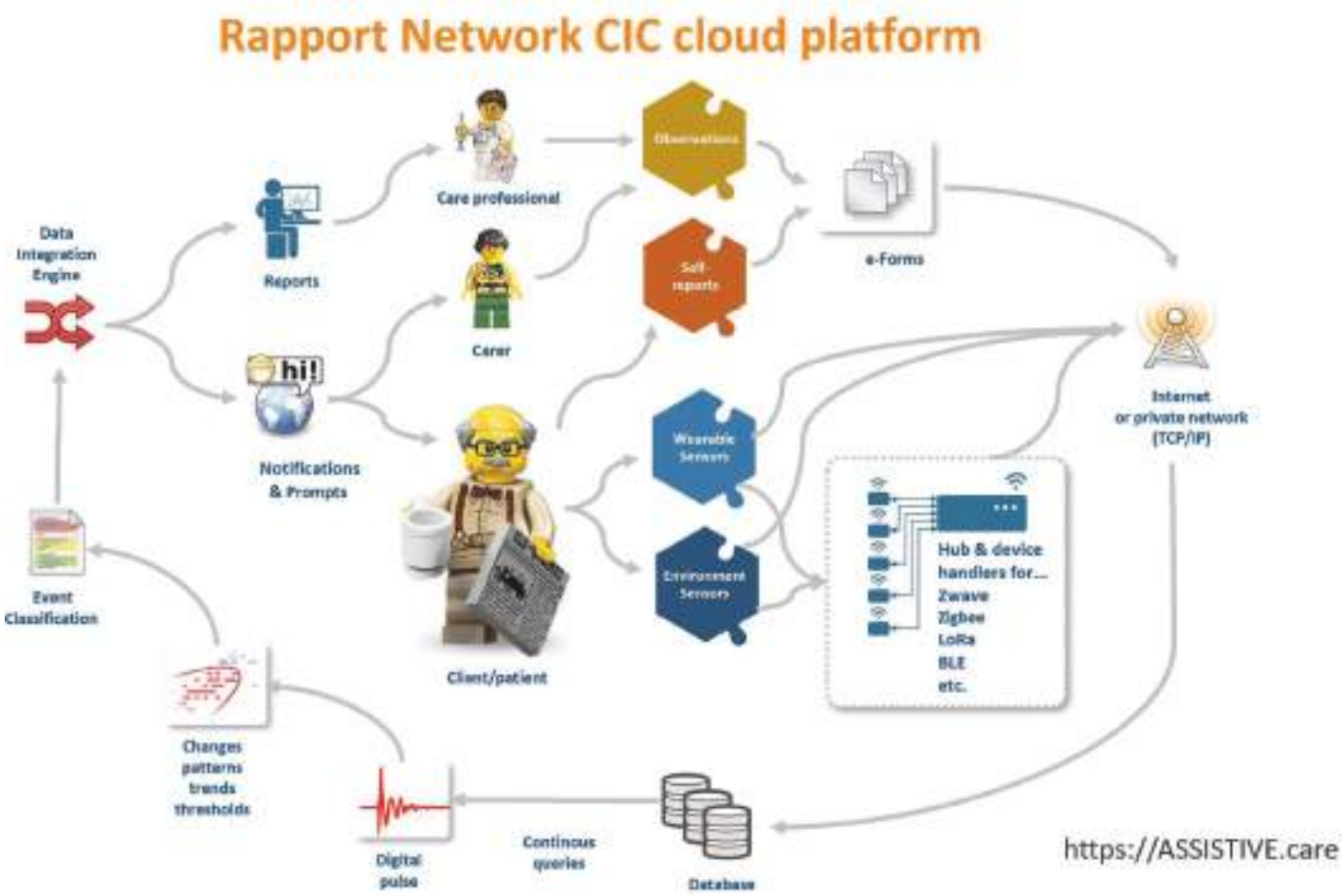


Figure 13: The Rapport platform, showing 'feedback loops' as data alerts and analyses are shared

Experience by the project partner Rapport CIC is that people start to engage with monitoring data once they see some benefits. Small alerts or results feed their interest, encouraging them to keep monitoring. A similar process applies as the circle is widened to include others. Staff will get engaged once they see, for example, that a person's sleep patterns can explain their behaviour. The influence widens to include other professionals, family and perhaps – eventually – a wider community of users.

This is shown graphically in Figure 13.



Conclusion and Recommendations

Stage One of Test of Change has demonstrated feasibility of using Citizen Tech to improve quality of care for people with dementia, learning disabilities, frail and at risk of falls, and to reduce overnight support. The Stage Two project should be launched, as soon as possible, and the existing Use Cases allowed to continue for a period of time sufficient to evaluate outcomes. Initial discussion with the existing users and partners has shown that they are keen to remain involved in the next stage.

It is recommended that Stage Two is:

- of two to three years duration
- retains the agile model of delivery and evaluation
- extends the existing Use Cases for a longitudinal study
- puts in place a full data protection, information governance and ethics framework
- develops processes, templates, training materials for the scale up stage
- uses ADAM in a more developed form
- makes provision for technology partnerships and horizon scanning

Consideration should be given to focusing Stage Two on a particular geographic area, demographic group or long term condition.

During Stage One, cost savings and return on investment have not yet been explored, beyond noting that the average cost of equipment installed was £525 for those living in their own home, £1120 for those in managed accommodation. Across all use cases, this equates to an average of £850 per person. Each Use Case has needed an individual approach. Partner organisations are structured differently, and family involvement has varied. More work needs to be done on the financial issues during the remaining Stages.

In a full cost recovery model, we need to include

- Staff time for selection, validation and assessment of clients
- Costs of equipment, commissioning and installation
- Training, monitoring, troubleshooting and modifying resource.

Savings to statutory services will be found from

- Reduced hospital visits due to earlier warnings of problems
- Saving in staff time, particularly for overnight support
- increased self-management reflected in fewer referrals to telecare at early stages and lower levels of need

In addition, it is important to explore the tangible benefits to carers, such as reduced travel costs for emergency visits and options to allow carers of working age to remain in employment, or to maintain their own health and wellbeing

Return on investment should also look at less tangible benefits, such as improvement in quality of life for both service users and families. There should also be some investigation of the impact on the workforce, such as improved job satisfaction, reduced stress and opportunities for learning.

The issues explored within the Learning section of this report need to be addressed within a fuller evaluation, particularly those that may impede scale up, such as trust and data security frameworks. Sufficient resource needs to be provided for this learning to be used effectively and to the benefit of all who use care services in Scotland.

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Next Steps

CivTech 4.0

One of the outcomes of the Alzheimer Scotland Test of Change is a prototype of an asset based assessment matching people with long term health conditions to a personalised digital solution.

The assessment, which has been named ADAM – About Digital and Me – considers personal outcomes, community of support, infrastructure and accessibility and offers a combination of commodity technologies tailored to meet the needs of the individual. It is designed to be accessed by the general population.

During the Test period, the assessment and its translation to a solution has been carried out by the Digital Leads from Alzheimer Scotland, but in order for it to become scalable, it needs to become a digital offering.

The opportunity to take the next step towards this has come through CivTech 4.0 in the form of a challenge lead by the TEC Program and Alzheimer Scotland which will create a minimum viable product over the next 6 months. The tender which is open now, until 12th August 2019 poses the question “How can we help people with long-term illnesses access technologies that can enhance their care?” and invites applicants work alongside us to create a solution.

The outcomes specified include:

- Revolutionising digital supports offering across all care sectors in Scotland
- Personalising digital supports for Scottish Citizens
- Reducing the care burden for Informal carers
- Reducing isolation, enabling connection
- A once for Scotland approach to digital supports
- Early adoption/ point of diagnosis adoption of digital with trusted resources and support available
- Existence qualitative evidence/ crisis points
- Increased awareness and uptake of SDS budgets

In phase 1, 3 applicants will be awards £3000 to work on the problem for a 4 week period, with one being selected to go forward to the accelerator phase and receiving £20,000 to work for a further 4 months, and then present the MVP at the demo day in March 2020.

Key dates for the process are:
09 October 2019 Exploration Stage Pitches
04 March 2020 Final Demo Day

To date 8 companies have registered an interest through Public Contract Scotland, so we anticipate a good selection of tenders from which to shortlist.

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