University of Strathclyde Glasgow

Fraser of Allander Institute

Social Care Innovation in Scotland

October 2023

Executive Summary

This grant aimed to explore the potential for innovation clusters in Scotland's social care sector and the role of public sector investment in supporting such development. The research focused on the possible role of the National Care Service in stimulating innovation in social care delivery.

The research encountered several challenges, including the lack of compelling evidence in the existing academic literature on innovative procurement practices and innovation in social care. There is a consensus that public sector procurement can spur private-sector innovation, but the impact is sector-specific and is hampered by challenges like funding, contract size, and government policy.

International evidence reveals few feasible models for innovation adoption in public services and social care, but some participants proposed considering the Accelerated National Innovation Adoption (ANIA) Pathway for the NHS as a potential model for social care. However, the ANIA is currently very health-focused and would require investment to ensure that social care is properly represented.

There is a clear need for better data usage in the National Care Service, with personal data stores being a favoured solution. However, consensus around other needs is lacking due to barriers like the digital skills gap among the workforce, limited access to devices, and poor connectivity.

Existing social care infrastructure does not fully support innovation adoption and diffusion, with issues like the lack of digital skills among frontline workers and management, and the absence of basic physical and software infrastructure. Despite these challenges, participants were optimistic that on-the-job training could overcome resistance to technology adoption.

Scotland's innovation assets and entrepreneurial infrastructure do support social care innovation, but engagement is patchy and not representative of the sector as a whole. A gateway or hub for social care innovation could help bridge the gap.

Scottish universities provide valuable skills for innovative activity, but their research does not seem to focus on delivering innovations in the social care sector.

Venture capital (VC) was generally seen as unsuitable for the social care sector due to issues like the complexity of the customer journey, a highly regulated environment, and the slower pace of the industry. Grant funding was seen as necessary, but government support should be more targeted and include industry involvement.

In conclusion, the lack of good international examples of innovation adoption in public services and social care provides an opportunity for Scotland to lead the way in this field. Robust monitoring and evaluation of interventions will be crucial to adding to the international literature on innovation adoption.

Introduction

The Independent Review of Adult Social Care (IRASC) also referred to as the 'Feeley' Review after its chair Derek Feeley. IRASC recommended that responsibility for 'vision, improvement and innovation' sat within the 'national' level responsibilities alongside overall accountability; a recommendation that the Scottish Government accepted.

In parallel to its ambitions for social care, the Scottish Government has published a National Strategy for Economic Transformation (NSET), setting a 10-year vision to transform Scotland's economic future, with a sharp focus on innovation, emerging industries and productivity.

More specifically, NSET commits to:

- Establishing Scotland as a world class start-up nation.
- Encouraging an entrepreneurial mindset in the public sector.
- Accelerating the emergence of new industries, particularly where these industries contribute to personal wellbeing and social progress.
- Supporting the growth of new small businesses and social enterprises.
- Strengthening domestic supply chains around critical services and infrastructure.
- More strategically leveraging SG's position atop key supply chains (e.g., health, social care, housing and energy) to generate greater economic impact.

The aim of this project is to provide evidence and analysis that can help the Scottish Government to achieve NSET aims through investment and support for innovation in social care. We have drawn on a wide range of data, literature and discussions with experts to understand the current state of play, the potential that could be reached, and the barriers and enablers that stand in between.

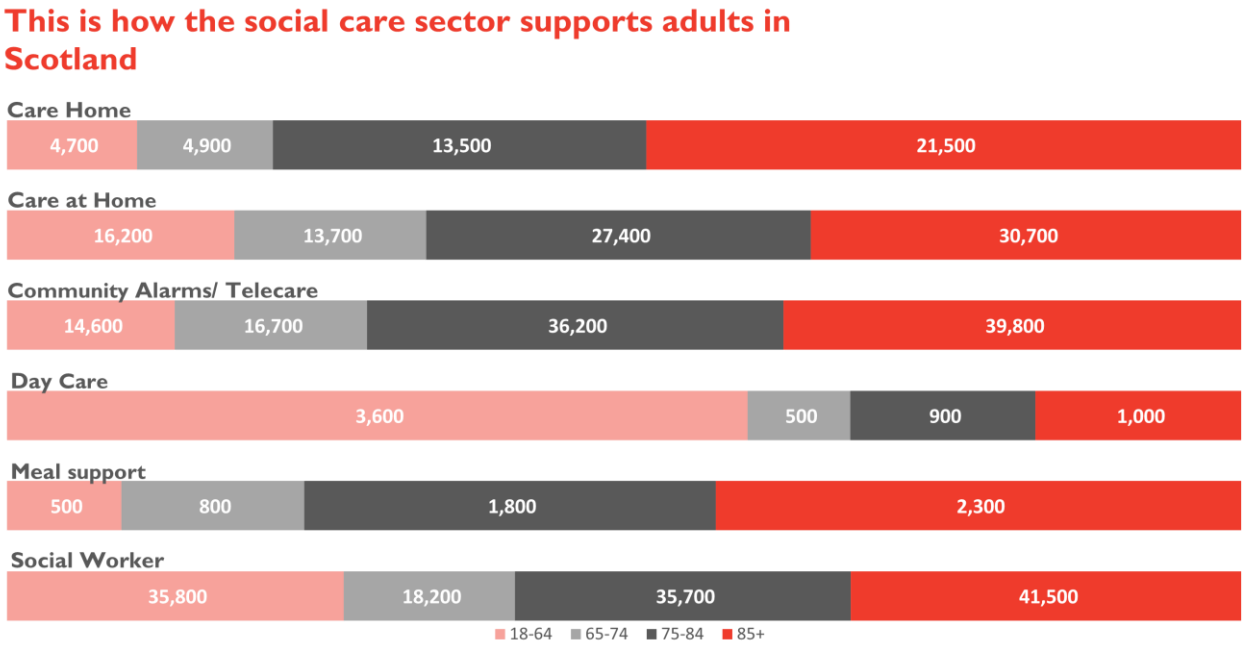
Contents

In the final section, we consider to what extent we have been able to address the grant questions: the aims of the original grant have evolved as we have carried out the research, so these have been reframed to ensure the report is useful. The original grant objectives are set out in Annex 1.

1 Background to adult social care in Scotland

Throughout 2021-2022, adult social care services provided crucial support to approximately 220,000 adults across Scotland. Encompassing a wide range of services, adult social care is delivered by various providers, including health boards, local authorities, private companies, and voluntary or not-for-profit institutions.

Figure 1: Adults supported by social care in Scotland



Source: Public Health Scotland

Adults across Scotland draw on a wide range of services, often drawing on more than one service at a time. However, data on multiple service use is not currently reported. Social care is provided on a temporary and long-term basis with services covering care home placement, care at home, telecare/community alarms, day care, the provision of meals, and social work services. According to Public Health Scotland's Insights in Social Care dashboard, around 110,000 adults were supported by telecare or community alarms, 90,000 supported by care at home and close to 45,000 supported by care homes in 2021/2022.

Figure 1 shows the proportion of support received by a range of ages for each service. It's clear from the data that social care plays a critical role for many adults at all ages. As would be expected, care home support is mostly provided to those aged over 65. There is, however, a significant jump in occupancy when going from the 65–74-year-old bracket to the 75–84-year-old bracket.

The latest quarterly statistical summary report from the Care Inspectorate shows that in Q1 2023, across all services drawn on by adults, Private companies and Voluntary or Not for profit institutions each accounted for 41% of the 3800 registered adult social care services as can be seen in Table 1. **See Table 1**.

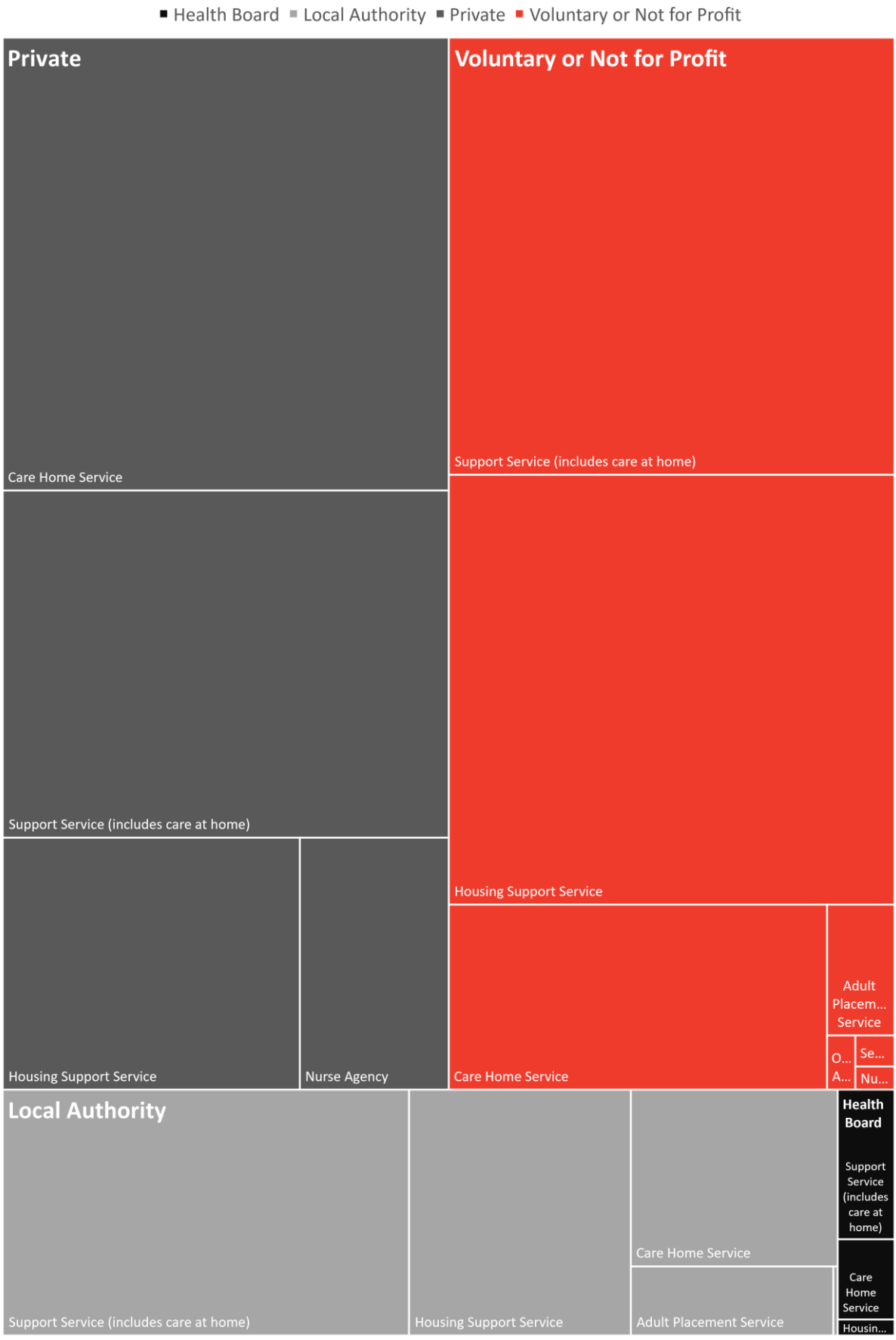
Table 1: Adult social care services in Scotland by provider

	Health Board	Local Authority	Private	Voluntary or Not-for-Profit
Adult Placement Service	0	46	0	29
Care Home Service	15	120	663	230
Housing Support Service	3	179	246	629
Nurse Agency	0	0	123	3
Offender Accommodation Service	0	1	0	5
Secure Accommodation Service	0	0	0	4
Support Service (includes care at home)	28	328	508	640
Total	46	674	1540	1540

Source: *Care Inspectorate and FAI calculations*

Health Boards and Local Authorities account for 1% and 18% of adult social care services in Scotland respectively. Most registered care home services are provided by the private sector (64%). Figure 2 presents the information in Table 1 in a tree map to visualise the distribution of registered adult social care services by provider type.

Figure 2: Tree map of registered adult social care services – not including services related to children and young people Q1 2023

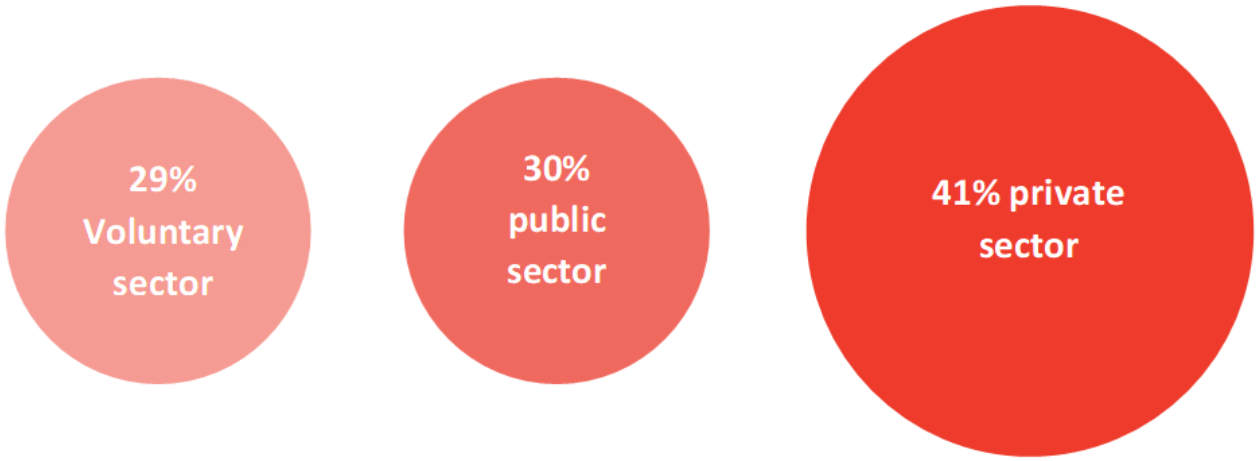


Source: *Care Inspectorate and FAI calculations*

Adult Social Care employment

Based on the latest figures from the Scottish Social Services Council (SSSC) for the year 2021, the Adult Social Care sector employs approximately 146,500 individuals in Scotland. It's worth noting that these figures are headcounts and do not reflect full-time equivalent (FTE) jobs. To arrive at FTE estimates, we've applied the headcount to FTE ratios provided by the SSSC. Our estimates show that approximately 113,500 full-time equivalent employees are directly employed in the sector. Private firms employ the largest share of workers at 41%, while the public and voluntary sectors account for 30% and 29%, respectively.

Figure 3: Employment of adult social care sector by provider (%)



Source: Scottish Social Services Council

Public sector employees are most likely to work in the delivery of care at home services (44%) as are voluntary sector employees (75%). The care homes for adults sub-sector accounts for the largest share of private sector employees (64%) and is the second largest subsector for both public and voluntary employment.

The definitions used by the Care Inspectorate and the Scottish Social Services Council can be found in Annex 2.

2 Summary of evidence on social care innovation and procurement outwith Scotland

This section provides a summary of the key findings from a review of the literature on social care innovation. A fuller write-up is provided in Annex 3.

Our review of the literature focused on the challenges and best practices associated with innovative procurement, including specifically within the context of social care services where possible. There is no single term that is in use internationally that describes "adult social care" as we understand it here in Scotland which complicates evidence gathering in this area. For example, the term "welfare technology" is used in Nordic countries to encompass various technologies aimed at assisting older adults and individuals at risk of disability.

The literature emphasises the positive role that public sector procurement can play in promoting innovation within the private sector. However, it also identifies several barriers that hinder effective innovative procurement. These barriers include a lack of risk management, inadequate expertise among procurers, and rigid specifications. For example, Uyarra et al.'s research analyses a UK survey of public sector contract managers and identifies key barriers to innovative procurement, such as poor interaction with procurers, overly specific tenders, and insufficient feedback following unsuccessful bids.

The literature discusses the importance of collaboration, leadership, knowledge and evidence, resources, and culture in driving successful innovation within adult social care. Collaboration is highlighted as essential for fostering innovation, whether through formal partnerships or informal networks. Leadership is seen as crucial for creating an environment that encourages experimentation and risk-taking, while effective leadership styles are discussed in the context of various innovation types.

Knowledge and evidence are identified as pivotal for developing conditions conducive to innovation. Market analysis is essential for understanding supplier options and pricing. Resources, including funding and staff, are critical for implementing innovative solutions. Culture is discussed as an enabler of innovation, with a positive and open environment fostering experimentation and learning.

The literature also delves into the challenges of procuring care technologies. It notes issues related to financial constraints, legal and ethical concerns, and resistance within organisations. The procurement process is explored through three stages: planning and mapping, procurement, and implementation and management. The importance of market analysis and economic, technical, juridical, and ethical competence in requirement specification is emphasised.

The review provides examples of international best practices in innovative procurement. These examples include Kampen Omsorg's strategy of extensive dialogue with the market to foster innovation and THALEA, a German project that uses telemedicine to improve intensive care units. The European Innovation Procurement Awards recognize organisations promoting innovative procurement, such as the Galician Health Service in Spain.

Conclusions drawn from the literature

There is growing consensus that public-sector procurement can spur economy-wide innovation however, the impact of public-sector procurement on innovation is hindered by a number of key challenges. These key challenges highlighted throughout this literature review include –

Funding: a lack of sufficient funding limits risk-taking needed for innovation.

Contract size: small contracts do not incentivise firms to innovate and do not provide enough security for SMEs and social enterprises.

Competence of procurers: requirement specifications require significant economic, technical, juridical, and ethical competence.

Valuable feedback: a lack of feedback from unsuccessful bids limits the ability of firms, particularly SMEs, to learn from previous bids.

Government innovation policy: government policy to improve innovation fails to address challenges throughout the whole cycle of innovation from identification to deployment. A lack of a standardised national policy on care technology use also hinders deployment.

Government procurement policy: government procurement is typically rigid, old-school, and applies a one-size-fits-all policy. Additionally, the legalities of public sector procurement can often be time-consuming and unnecessary.

A lack of interaction with procurers, over-specified tenders, and poor risk management were among other key barriers identified by our review of the literature. Also, the challenges facing the success of public procurement's ability to drive innovation are sector-dependent therefore, social care innovators will likely face different challenges than entrepreneurs in other industries. These findings motivate the need for research primarily within the social care sector to better understand the challenges and opportunities of innovative social care procurement.

It is important to note the practical challenges in finding relevant literature. Beyond the fact that innovative social care procurement is a niche research area, there are difficulties that arise due to the nature of terminology used internationally to describe social care and social care innovations. Future research should be mindful of these differences before conducting desk-based research on this topic.

Despite these challenges, this research identified a number of key challenges to welfare technology innovations through the lens of planning and mapping, procurement, and management and implementation. However, whilst this evidence corroborates findings from across the whole public sector, the sample size used by Kuoppamäki (2021) was small. This justifies the need for a bigger-scale qualitative piece of analysis of the barriers to innovative procurement in the social care sector.

Additionally, this review highlighted some international examples of innovative procurement in the social care space however, as found in this research, and highlighted by Zigante et al. (2022) examples of best practices are primarily based on weak qualitative analysis. Therefore, there is a need for more quantitative analysis in this research area to better evaluate social care innovations. Nevertheless, through their meta-analysis of the adult social care innovation literature, Zigante et al. (2022) identified five key themes needed for successfully developing and scaling up adult social care innovations. These five key themes are collaboration, leadership, knowledge and evidence, resources, and culture.

Overall, this literature review outlined key challenges that apply broadly to the success of innovative procurement, with some evidence in the social care sector more specifically. It also highlighted key themes needed for successful adult social care innovation development and scale-up however, it is clear from our research and that of others, that more analysis, particularly those employing quantitative methods, is required in this area.

3 Evidence on the capacity for social care innovation within Scotland

Understanding the current status and capacity for social care innovation in Scotland from currently available data is frustrated by the system of sector classifications which currently do not identify subject-specific innovations.

Business data in the UK is classified by Standard Industrial Classification (SIC) codes, which classify businesses according to their primary activity. In the case of companies that focus on social care technology solutions, they tend to be classified as computing or software companies, rather than companies that have a link to social care.

In our research, we first focussed on mapping companies and skills associated with digital administrative systems, and within that focused on case and care management software solutions. This built on the work already completed as part of the Care Services in Scotland: A Review of the Technology Landscape produced by Socitm Advisory (from here on referred to the Landscape Review), and shared with our project team ahead of its publication.

We then turned our focus towards understanding the market for assistive technology companies operating in Scotland to provide us with a comprehensive map of firms engaged with this technology across Scotland and a further list of SIC codes that are associated with these firms.

The method we used in the second stage replicates the England-only analysis carried out by Dr Peter Bloomfield (2022) on behalf of Future Care Capital in a series of papers that were designed to map out start-ups and SME technology providers in adult care in England.

The detailed analysis (including the methodology we used to identify clusters) for both phases of our research can be found in Annex 4. We summarise the findings of this analysis in this section.

Identification of clusters relevant to social care innovation is challenging

We are able, through our detailed analysis, to partially map companies that are active in social care innovation to the SIC codes of relevance.

On the software solutions side, there is a clear clustering in SIC 62, which is "Computer Programming, Consultancy and related activities". Assistive Technology is much more difficult to identify specifically, although the majority we were able to identify which were technology focussed were also classified into SIC 62. Even for software solutions, where we were able to identify particular companies in Scotland, only 7 companies were identified.

Clusters in data and digital definitely exist in Scotland and tend to cluster around the largest cities

We were then able to go on to look at clusters in the data and digital field to identify potential companies who may be interested in innovating in the social care space, with the caveat that there is no evidence that they are working in this sector specifically.

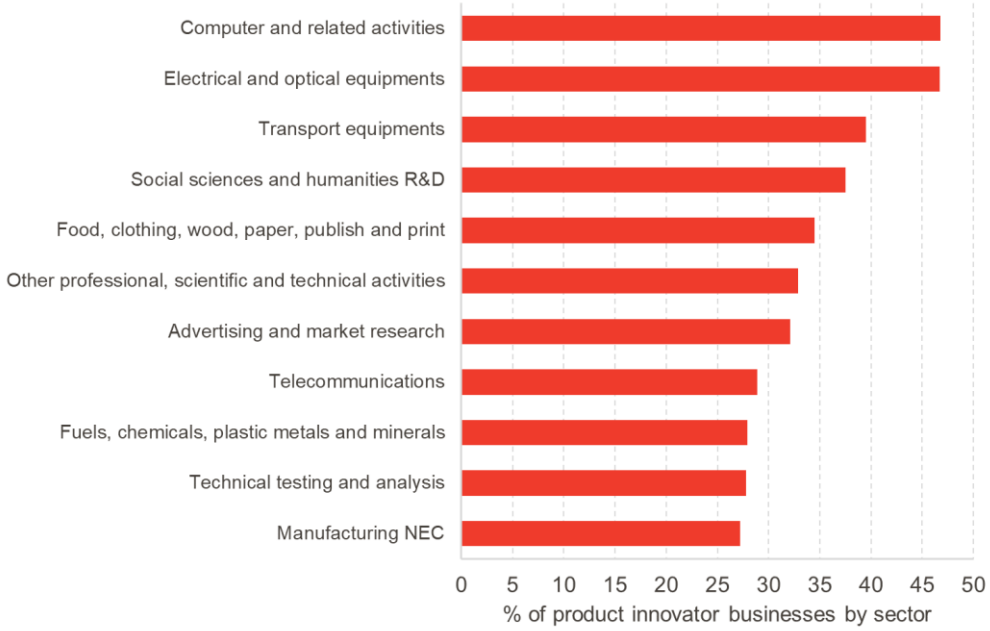
In our cluster analysis, we include both SIC 62 which has already been mentioned, but also SIC 63, "Information Service Activities", as some companies that we have specifically engaged with, such as Mydex CIC, are classified into this sector.

Edinburgh, Livingston, Glasgow, and Falkirk and Stirling, are all areas of the country where there is a specialisation in these areas.

Box 1: Are data and digital companies more innovative?

The UK Innovation Survey is the main data source for understanding the innovative capacity of businesses in the UK. The survey – conducted biannually by the ONS - surveys firms' innovation activities such as R&D activities and different types of innovation engaged in.
The latest data published in 2021 covering innovation activities between 2018 – 2020 shows that the computing and related activities sector was among the top 20% of innovation-active sectors within the UK economy.
Chart 1 shows that among businesses bringing new products to market, the computing and related activities sector is top of the rankings with approximately 47% of firms innovating. See chart 1.

Chart 1: Businesses who are product innovators by sector (%), UK, 2018 - 2020



Source: UK Innovation Survey

The sector is a leading innovator in the UK economy adding further reason to focus in on the industrial classification code SIC_{62} when thinking about adult social care innovation as this is the likely classification for those innovative activities.

Clusters in central belt cities persist when looking at Scotland's labour and skills pipeline

We also found that there are clusters of employment in the Travel to Work Areas (TTWAs) of Edinburgh and Glasgow, with each region having the 9th and 12th highest employment of SIC_{62} and SIC_{63} out of 218 TTWAs in Great Britain respectively.

On top of evaluating the business base and labour stock of the digital and technology sector in Scotland, we looked at Scotland's skills pipeline. We found that Scotland has the highest number of higher education students studying computing and engineering (and technology) per head than any other region in the UK, with over 36,000 computing students and over 44,000 engineering students enrolled in 2021/22. Universities in Edinburgh and Glasgow ranked at the top in Scotland for enrolments in these subjects, with universities like Strathclyde enrolling the highest number of engineering students in Scotland, and Glasgow University enrolling the most computing students.

Further education also plays an important role in this skills pipeline. In 2021/22 there were almost 42,000 engineering students and over 28,000 Information Technology and Information students enrolled in Scottish colleges.

University research in Scotland is limited in the field of social care

The academic experts we talked to about social care innovation tended to be in the rest of the UK rather than in Scotland. Indeed, examining the most impactful research projects in Scotland through the Research Excellence Framework (covering the period 2014-2021) yields only 4 examples that are relevant to social care at three academic institutions in Scotland.

These were:

- **Changing professional practice in design, modification and adaptation of spaces and places for people living with dementia**: Research in Social Work and Social Policy at the University of Stirling has identified how spaces and places can be designed to improve the quality of life for people living with dementia. Because of research at Stirling, commercial and professional design practice has changed across the world to respond to the needs of people living with dementia. Care facilities are now designed and being remodelled, and public and green spaces are being adapted and used so that they support people to live better with dementia and to be socially and physically active in their communities. These impacts are across the world, in Australia, Cambodia, Canada, India, Japan, New Zealand, Singapore and USA, as well as throughout the UK. *University of Stirling*
- **Enhancing policy, services and public perception to benefit people living with dementia**: Dementia research and public engagement by Edinburgh researchers has challenged societal views of people with dementia, and brought to light the value of peer support and social networks by:
    - Influencing ministerial views and UK Government recommendations to support new 'dementia-friendly' community policies in England.
    - Leading to 91% of Commissioners of Social Services in England implementing the recommended dementia services, benefitting an estimated 1 million people.
    - Informing policies, strategies and practices in Wales and Scotland to improve dementia support services in devolved administrations.
    - Increasing awareness among the public, and health and social care practitioners, of the challenges and opportunities of living with dementia through a series of influential performing art outputs. *University of Edinburgh*
- **Improving access to health and social care for the homeless**: Multidisciplinary research at the University of Dundee brought together expertise in Dental Public Health, Oral Health Inclusion, and Community Education to address the health and psycho-social wellbeing of homeless people. Among the key impacts were changes in local policy design and service delivery for homeless people, which led directly to recommendations at national and international levels. Insights and tools from the research have directly informed service improvement, professional education and policy-making for health services, governments and civil society initiatives. Impact was generated locally (Dundee), nationally (Scotland), and internationally (Brazil). *University of Dundee*
- **Transforming social work education and professional learning in Scotland**: Impact on public policy, education and workforce development: Research led by Dr McCulloch has directly underpinned national and local policy development, policy implementation, social work education and workforce development practice across Scotland. Key impacts to date include:

- Headline recommendations in the National Health and Social Care Workforce Plan to improve social work education and develop career pathways; serving 1,899 students and 10,913 social workers.
- Implementation of a national Social Work Education Partnership providing national collaborative leadership and accountability for social work education; benefiting nine HEIs, all practice providers, 2086 students and service users.
- Three pilots of a Supported and Assessed Year in Practice (SAYP) across three locality sites, benefiting 90+ Newly Qualified Social Workers (NQSWs) in 2019/20; creation of an NQSW implementation group to support national rollout of a SAYP; and development and publication of NQSW benchmark standards for practice. *University of Dundee*

Supply chains of digital and data companies are not embedded in Scotland

We have discussed the innovative nature of the companies in these sectors, but the stimulation of new companies also has the potential to generate activity in the wider economy, as they purchase goods and services in their supply chain.

The Scottish Government publish detailed economic accounts every year which allow us to track the linkages between different sectors of the economy. They also estimate the so-called "multiplier effects" that are generated by different industries in terms of the wages, employment and GVA that are generated.

Examination of the structure of these supply chains has revealed that:

- Income and GVA **effects** of these industries are large, in the top 25% of companies in Scotland;
- Income and GVA **multiplier effects** are very low, in the bottom 10% of companies in Scotland.

What the first of these means is that these industries generate a high degree of value-added compared to their inputs, and also support relatively high wages. However, the second point means that there is a high degree of leakage out of the Scottish economy, so their supply chains tend to be imported from other countries rather than generating activity in Scotland. This is particularly true for the rest of the UK, which is the biggest source of importing for this industry.

4 Evidence from those involved in social care tech innovation in Scotland

The limitations of the evidence in our review of the literature and available data on innovation in adult social care have motivated a series of conversations with people in Scotland who have expertise to draw on.

Over the course of May – August 2023, we spoke to over 20 individuals and organisations representing care sector bodies and regulators, medical experts, technology companies, care providers and 'innovation assets' including universities, innovation centres and incubators. The calls were recorded, transcribed and analysed. We coded up key themes from our qualitative research which we outline throughout this section.

Ethics approval was obtained from the departmental ethics committee at the University of Strathclyde. All participants were given the option to be attributed or remain anonymous, and all were provided with an advanced copy of the report to check they were content with how their views had been represented.

A full list of participants (including organisation names where permitted) is included in Annex 5.

As noted in previous sections, finding common terminology is not always easy, and this was noted by our participants too. However, through our interviews, we were able to guide participants to ensure an understanding of what was meant by the "term social care tech innovation". This section provides a summary of the key themes that came up in the interviews.

The main purpose of our interviews was to probe the type of changes that the new NCS needs to address if technological innovation is to become more widespread through social care and social work. Three key areas where specific new initiatives were required came through in the discussions:

- Addressing underlying infrastructure
- Building skills amongst the workforce and those who draw on social care
- Addressing the challenges with data storage and sharing, including considering new approaches

These are explored further here.

Building infrastructure is a pre-requisite for widespread adoption

We heard from participants involved in health innovation that there was often a mismatch between the needs of the service and the interests of innovators. This was echoed by others who had a more general overview of innovation (including within health and social care) who felt that there was not enough focus on the layers underneath the 'new shiny stuff' that were required to support innovation.

"It's still innovation, even if it's boring. And so, a lot of our work in innovation centres is tackling systemic issues. And that means that we spend a lot of time working on plumbing. And most notably, we work on plumbing as an opportunity to not just connect that story up better, but also to reorient the system to be more person-centred."

Participant I, University/Innovation Centre

In terms of physical infrastructure, we heard that ensuring that social workers and other care professionals have access to devices to allow them to record and access digital services was a minimum requirement, but one that remains some distance away from being realised. Participants

shared similar views around a lack of basic internet connectivity, both for workers on the move, and Wi-Fi within care settings, that are needed for most technological innovations to work. Basic video conferencing software was another suggestion for what should constitute a minimum requirement that should be available across the sector.

Existing software infrastructure was also highlighted as an issue for the emergence of new products and services; however good an innovation, if it doesn't integrate with the systems that are already in use, then adoption will be limited or significantly slowed down.

Related to skills issues (which are discussed next) there is no basis for an expectation that staff will engage with a digital device during their working day, making it a very different proposition to rolling out new tech for office-based staff, where it can be assumed all have a certain level of digital proficiency as part of their business as usual duties.

"...say like if you were trying to put an improvement into a university system or something. Everyone just expects it as part of their daily work as there'll be a computer, but it's not the same in social care. And that hence, it's not just firms that have to come up with a solution, there's a lot of training and adoption required to take it forward."

Participant N, Innovation Sector Body

The absence of infrastructure in some cases and the variability of systems in use, make this a difficult market for innovators and their ability to successfully commercialise scale up. One participant, spoke about innovators needing to have much more of a focus on building around a customer, rather than expecting a customer to be able to simply adopt a product that has already been developed although they noted that this was a feature of other markets and not just social care.

Solutions may be relatively simple in some cases, for example rolling out new hardware along with a new software product. Others are more complicated and involve finding workarounds such as switching systems to work on 3G networks where broadband is not available. Whilst feasible to overcome in these cases, this may not always be the case and is almost always introduces more cost.

Workforce digital skills

Closely related to issues around infrastructure are issues around skills for the workforce. As with physical infrastructure, participants found that there was a huge variation in the digital skills of those in frontline roles, and within management structures.

The skills required are also wide-ranging. As well as basic digital literacy to allow workers to use devices and software products, some staff also need to be able to help train others and can be called on to help fix hardware issues and deal with other issues for clients such as ensuring software updates are installed. It was felt as more technological products are rolled out and relied on in care settings, staff will need to be able to be more proficient in being able to maintain and fix systems on the go.

Participants who spoke about skills overwhelmingly told us that the social care workforce and social workers will require a lot of training to meet the needs of future tech innovation and many are starting from a low base. Some participants talked about the possibility of more mandatory training when staff are working towards qualifications but have faced legitimate questions from skills providers and qualification bodies over how to make space for this learning in an already full curriculum. Even this would not resolve the issue for the existing, already qualified, workforce.

An idea that has been trialled in Scotland in recent years is the creation of a new 'care technologist', or similar, roles that specialise in supporting the adoption of new technologies. Although piloted

successfully, we heard that rollout of these new roles requires a lot of thought (including potential changes to legislation to formally recognise the role). Funding for the post and the commitment to fund continuing professional development to ensure skills are up to date felt unlikely given the funding environment.

"...there are a lot of challenges around this. In some ways we may need this to happen to make a case for it. So, we are doing things through care technologists' work to try and show the business case and return on investment for doing it that way but we have not managed to do it yet."

Participant K, Care Sector Body

A couple of participants were more optimistic and felt that in a lot of cases, fear can be overcome and on the job training can be effective if invested in. Many spoke about either seeing, or expecting to see, resistance to adoption by the workforce reducing if workers are able to see a reduction in time spent on administrative tasks or unnecessary tasks with time freed up to interact more with their clients.

Digital skills for those who draw on social care

Whilst we were not asked to engage with people who draw on the social care system as part of this work some of the organisations we spoke to had some insights. It was felt that many of the same issues that are faced by the workforce exist for those who draw on social care, although there are some additional factors to overcome.

The most complex issue is around those who have a cognitive impairment, either due to a lifelong (in the case of a learning disability) or a degenerative condition such as dementia. The need for products to be usable by these groups of people presents challenges for those producing products and services that are designed for independent use. As well as skills, there are significant issues around maintaining trust:

"And just general people lacking those digital skills, but the confidence as well, because I think there's a lot of... it's not fear-mongering because it's a real fear but almost everybody has mentioned that they're just terrified of being caught out in a scam."

Participant L, Representative Body for People with a Learning Disability

The average age of those drawing on social care is also higher than the average age for the social care/work workforce, and will include people who have little prior experience of using technology routinely in their day-to-day life.

There were participants who were more optimistic and felt once the fear factor was overcome, many users were able to work with new products well. Others may already be capable of more than they realise – for example, people may say when questioned that they do not use the internet, but are actually proficiently using apps on their smartphone.

Ensuring that users are supported to use new products and technologies, even for very simple voice-based products, was cited as being key:

"You can't just go in and set an Alexa up and walk away. It takes two or three visits."

Participant Q, Tech Company

As noted in the previous section, this requires existing workforce training or the creation of new roles.

A particular issue for those trying to develop products on the more consumer tech side was the fact that the intended user may not be the person purchasing the product and confusion over how buying products as a consumer interacts with other care provided. We heard that companies often start with the intention of the business-to-consumer (B2C) and end up switching to work directly with providers (B2B) where the route to market was simpler: this was borne out in a conversation with a company set up in 2014 who made this pivot partly for this reason:

"...we started with primarily the remit of looking at it from a B2C, a business-to-consumer type model. Is there an opportunity to sell this directly to family, family members, the specifically massive untapped market in terms of unpaid care caregivers and families' knowledge, challenges related to that? And people loved it, all the other elements, but people wouldn't pay for it, because of the social care models and all the other elements that currently exist where the expectation is on the state to pay for a lot of this and all the other things. Or if I take this in, I might get other services and all the other things. All those challenges came into play."

Participant P, Tech Company

A critical issue raised, which needs a lot of further engagement to ensure the voices of those who draw on social care are heard, is the issue of consent and control, particularly if cost savings, rather than improving outcomes, become the driving force behind changes.

"...when you don't talk about it as technology-enabled care and if you don't frame it as just taking away people, people do get quite excited about what it could mean. But as soon as it's presented in a way that it's actually really a cost-saving exercise in lots of ways. And you wouldn't have as much one-to-one time with people then people really, really don't like it. And I think people are really afraid of that. And yeah, I do think that people in government I think they did get that. I think we do understand that. But it's whether that matters to them, I suppose."

Participant L, Representative Body for People with a Learning Disability

Rethinking data

Conversations around data focused on a few different aspects, but broadly fall into two categories: data that is already collected and stored that could be better used and data that could be generated from the implementation of technology.

With regards to existing data that is collected routinely and stored (for example, patient records), the plethora of different systems (including the continued use of paper records) was felt to be a significant barrier to providing the best care for those who draw on care services. This issue is already well documented, with the Scottish Government already committed to improving the sharing of health and social care data.

Participants who were aware of the Scottish Government work in this area acknowledged the many and varied issues to be resolved (for example, ethical and cybersecurity) but many challenged the perceived government mindset that the data sharing would be managed and controlled centrally (i.e., by the Scottish Government or the NCS).

A number of participants were keen for the idea of personal data stores to be explored as a way forward whereby the user is at the centre of the process, with all data available to them to see, with the ability for them to control and consent to use of that data by, for example, their care provider or social worker. These participants had awareness of Mydex CIC as a potential provider of a product that could provide a personal data store. **See Box 2.**

Box 2: Mydex CIC

Mydex CIC are a community interest company and offer a platform that grants individuals access to a personal data store and a unique ID. Data is hosted on Amazon Web Services which links to a Personal Data Exchange API, a set-up that they believe minimises the hassle, risk and cost associated with delivering a public service. If users consent, 'subscribers' (such as the Scottish Government, social workers or medical practitioners) can send or collect data from the personal data store.

As well as ensuring that the individual has access to their records, this reduces the need for duplication of effort in collecting and storing data, and means that data sharing agreements are not required to be in place for data to be shared as long as the individual has consented.

Mydex CIC's initiatives extend to enabling individuals and subscribers to participate in surveys and projects with anonymity preserved.

Mydex CIC have run a number of small projects with numerous partners around Scotland, but are yet to access the type of contracts that would allow them to operate at the scale they would like.

The Scottish Government has written on page 3 in the Vision for Recovery of Covid Recovery Strategy : for a fairer future that by working together we will ' Accelerate inclusive, person centred public services '. To equip citizens and organisations to achieve this, personal data stores are a Scottish solution that delivers the vision. As with all possible solutions, there are benefits and risks to be managed. Participants were not necessarily advocating for this as a solution, but an option that they would like the Scottish Government to engage with and explore, as opposed to the default 'organisation first' approach (discussed later). The failure of previous government IT projects was cited by a number of participants for justification as to why different approaches need to be considered as well as the potential to remove a significant amount of duplication, which will benefit the person at the centre of the care the most of all.

"...the citizen wants to tell their story once. The professionals want to spend less time collecting data and more time adding value, planning, actioning, listening. The system owners want those professionals to be able to do more with their time.... So, we do have a bunch of aligned incentives and we've got a model that says, the way to data sharing in this model is not trying to create a massive network of data sharing agreements between all these different organisations."

Participant I, University/Innovation Centre

Beyond existing data, the potential for the creation of new data was cited as an opportunity that will arise from the adoption of technology in care settings. For example, remote monitoring systems integrating the Internet of Things can record patterns of regular activities and be used to alert care providers if there is unusual activity (e.g., the kettle not being put on at the normal time in the morning could mean a person has fallen and needs assistance) or to help design a better care experience:

"I've seen where we've put stuff in to actually understand how a person is operating during a day with their permission and said to them, this is going to give us a much better insight and discovering that they could do X really well, but they couldn't do Y...And how do we help you support you with this? And just opening up that conversation."

Participant H, Public Sector

One participant raised the issue of being able to convince enough people to be part of such monitoring systems, and how this is different from similar interventions in the health space:

"The basic problem is that most of the data that the NHS needs to drive its processes come from patients who are on pathways. Who have a health concern and they will cooperate to do the thing. Most of the things in social care are trying to get people to share something about themselves when they don't think they've got a problem."

Participant I, University/Innovation Centre

Another note of caution was also raised about what happens to the data that such systems create, and there is a role for the regulator here that needs to be worked through. One of the participants we spoke to who has been successful in driving forward innovation in a digital telecare system in their care settings was aware that regulatory approval for the new systems they were adopting would not be in place in sufficient time, and had to proceed with the risk that they may need to roll back changes they were making once the regulator caught up.

Mindset was cited as a barrier to effective data sharing at various organisational layers, with many people requiring to be bought into the benefits of data sharing, and the need for these benefits to outweigh perceived risks and/or the cost of investing in systems (e.g. cyber security) that mitigate these risks, as well as the ambiguity around future regulatory requirements. However, others noted that the current systems used are not ideal, and can be vulnerable:

"*I can see why they're very cautious about data access and they should be, and you can see why they get stuck into systems because updating them, you face the possibility of breakage, but then you get things like people keeping huge stores of data on Excel sheets, which is terrible…There's also incredibly outdated machinery, like they're running Vista and XP which got hacked years ago."*

Participant R, Tech Company

One participant who had built up a sophisticated system using Excel was aware that it was not ideal, but had not yet been able to find a partner to shift the system onto a web-based platform. This relates to an issue discussed later around the ability to connect to the right people to move work forward.

"…accessing someone who has that level of knowledge and detail to be able to understand the data that's being shared, and then turn it into something further still in terms of the algorithm and that join-up work, I've really struggled to find someone in that space."

Participant T, Care Provider

The ability of the user to be able to control and consent to the data being used was also highlighted by a number of participants. Personal data stores were to some extent seen as a solution to this issue, albeit the ability of people with, for example, a learning disability, to give informed consent was noted as a concern. Beyond the storage and sharing of data, opportunities were noted by participants for data to be used more effectively, with future developments such as predictive analytics and AI being important for unlocking some of the challenges facing the sector in providing effective care with limited resources. Some participants spoke about needing a clear rationale for collecting data:

"…if we're trying to transform and look at the national care strategy, we really need to have a very critical view of what we measure and why we measure it. And what does success look like?"

Participant G, University/Innovation Centre

Aligned with this, we heard that there is a need for a minimum data set that those within the care sector can actually use and one participant talked about the need for statutory APIs (a common interface that different software programmes can access) to eliminate issues of interoperability of systems.

Allowing this data to be available for third parties, including companies looking to develop solutions and researchers such as universities, was cited as an important opportunity to support innovation. Issues around data security could be resolved by building synthetic of highly anonymised data.

"It's all well and good creating something that's trained on semi-similar but there can be massive shifts when you put it on actual data. You have synthetic sets or highly, highly anonymised sets ready and available. It does make it a bit easier because you can test something on there and then be like, oh it works this well. Which I think would give people more confidence because they're like, okay, this is a really well-working thing… that would be great because I don't want tons of people's information."

Participant R, Tech Company

As well as the opportunities that the NCS may bring, there were a number of issues raised that are relevant with or without the changes that the NCS may bring, and may well persist even with the new reorganisation due to embedded mindsets. This section covers these issues.

- Consistency of central government (including the Scottish Government) with regard to supporting innovation
- Open procurement rules disrupting the flow of innovation
- Mindset amongst those in senior operational positions and in commissioning bodies
- The nature of social care and the appropriateness for venture capital investors vs scale-up funding
- The need for forums that allow more joining up of clients and innovators

The Scottish Government's approach to date with supporting health and care technological innovation has caused issues

We heard from more than one participant that they found the Scottish Government itself exhibited a mindset that excluded third parties from selling in new digital products, preferring instead to build digital systems themselves in-house. The same participants, and others, shared a feeling that public sector data and digital products tended to to focus on organisational needs first, and this could be at the expense of the user (public) experience of interacting with the system.

"I think in a current direction of travel with the NCS to centralise everything, I think the gaps that are there can be relatively easily filled. And the great thing about Scotland is there are lots of policy statements about citizens in control, there is the National Performance Framework….but for some reason every time they come out to do something it's organisation-centric. And we don't understand why."

Participant B, Tech Company

There were a number of participants who spoke about issues with the Scottish Government and Scottish Enterprise involvement. For some, it was a lack of consistency (both over time, and between different areas of the organisation(s)) that made it very difficult to maintain the interest and the engagement required to effectively embed innovation.

We also heard issues raised around those in central government not understanding the sector sufficiently, and being too distant from the operations to be able to put in place the right transformations:

"...when I talk to people inside the Scottish government about care, they will talk about it from their perspective only. They never think about the owners of care companies."

Participant S, Innovation Sector Body

Most participants spoke about the need for the Scottish Government to be part of the social care innovation journey and this was not an issue that could be resolved by the private sector alone. A key part of the support required is funding which we return to later in the report.

However, alongside this there was a feeling that the government should know when to not involve themselves to avoid crowding out other activities. This goes beyond funding. For example, a couple of respondents talked about the success of CodeBase and the credibility it has because it was a grassroots industry initiative rather than a government backed body.

It was acknowledged that knowing when to be involved and when to step away is a difficult balance to strike.

Box 3: Techscaler

Techscaler is a Scottish Government funded tech startup support programme delivered by CodeBase. The purpose of Techscaler is to fill an important gap in Scotland as a key part of the startup infrastructure guiding businesses from startup basics to scaling up. Membership is free of charge and provides access to mentorship, education and community for people looking to start and scale up existing businesses in Scotland.

Techscaler work closely with a wide range of public and private partner institutions including Barclays Eagle Labs, Scottish Enterprise, Reforge and The Data Lab.

Open procurement disrupts and challenges the viability of innovation

A number of participants spoke about their frustrations with the requirement for open procurement once products are ready to be launched at scale. One participant spoke about the issue when companies spend time developing solutions either in pilots or other schemes and then have to stop in order to go through lengthy bureaucratic procurement processes. Getting on to approved supplier list was a problem cited by some participants.

This disruption is problematic, as is the real risk of losing out on the contract to other firms, including those outwith Scotland. One participant questioned whether this is optimal if supporting the Scottish economy is part of the rationale for supporting innovation.

Others felt that the involvement of non-Scottish firms was a good thing, both in terms of the need to be open to the best solutions (wherever they emerge) and due to the externalities that come from of having these firms operate in Scotland. For example, we heard of non-Scottish-based firms who have set- Scotland-based spinouts in order to be close to new customers.

Leadership mindset within delivery organisations needs to shift to encourage more technological innovation

Instances of successful technological innovation in delivery bodies that we heard about were clearly linked to leaders who push forward on new initiatives. This involved putting time and effort into finding partners, building networks and funding to enable this to happen, with this effort often required to be above and beyond the day job.

One way to embed technological innovation in the social care sector is to rely on leaders to push the agenda across enough of the industry that others follow Many participants felt that leadership for innovation in social care was a key problem that would not be resolved on its own at the scale required, for a variety of reasons.

One issue is the risk-averse mindset was true amongst those making decisions across health and social care with no political will to push innovation forward:

- Lack of evidence on what works and what provides good value for money for the case to be made to senior decision-makers.
- The need for a 'firefighting' mentality, particularly at times of high demand for the service, makes prolonged efforts to do things differently difficult to sustain. Stress and exhaustion were cited as reasons for why both senior management and the workforce could not always be enthusiastic enough to sustain the embedding of new practices.

Broadly, two possible ways forward were noted. The first is to equip leaders in delivery bodies to understand the benefits of technological innovation and empower adoption (K). The Accelerated National Innovation Adoption (ANIA) pathway coordinated by the NHS Golden Jubilee's National Centre for Sustainable Delivery was mentioned by multiple participants as part of the solution. **See Box 4** below for more information on ANIA.

Box 4: The Accelerated National Innovation Adoption (ANIA) pathway

The Accelerated National Innovation Adoption (ANIA) Pathway is a new initiative aimed at speeding up the adoption of validated technological innovations within NHS Scotland. The pathway has been put in place to identify, evaluate, and implement technological innovations consistently throughout Scotland.

This followed an inquiry by the Health and Sport Committee at Holyrood, which highlighted the difficulty of innovation adoption and diffusion in the NHS. ANIA is governed by an Innovation Design Authority which brings together senior leaders from within the NHS in Scotland and the Scottish Government to take collective decisions on which innovations to prioritise for national adoption.

The proposed benefits of ANIA are:

- Swift and safe national adoption of high impact technological innovations.
- Enhanced patient outcomes.
- Reduction in waiting times.
- Improved experiences for both patients and staff.

Only those innovations that have a substantial impact, are backed by evidence, and align with the Scottish Government's priorities are approved for adoption. There should be solid evidence of the innovation's impact and value, with potential transformative effects, having undergone trials within NHS.

Importantly, the innovations considered through ANIA must have a technological element (i.e., innovations in service delivery without a technological element will not be considered)

ANIA is at an early stage, with the first innovations approved for adoption in June 2023 including a £1.8 million investment in a national dermatology programme.

A second route to embed technology into business-as-usual processes for social care providers is through the commissioning process, with requirements and support for technological innovations included in contracts. A number of participants spoke about the constraints of the current model and the necessity to move away from paying on the basis of hours of care and instead focus on outcomes as a minimum requirement for making innovation workable in the sector.

Commissioners, wherever they sit in the organisational structure, also need to be more willing to take on risk

Similar to the comments around leadership within delivery bodies, a mindset change for senior decision makers in commissioning bodies was also needed if the commissioning model is to be an effective signal for encouraging innovation. Genuine understanding and enthusiasm for developing technological innovation were not felt to be common among commissioners at the moment.

We heard that underpinning a lot of this are financial constraints that contribute to the issues above and tend to bite even when the issues above can be overcome.

"Commissioners can see the benefits even, but nobody has the money to do anything. Yes, that's a lovely product. Yes, it does wonderful things. Yes, we'd love to have it, we can see where it can benefit the service, but we don't have any money."

Participant P, Tech Company

Box 5: Carezapp

Carezapp is a care technology platform for people delivering care and support in homes and other social care settings. Carezapp connects and informs people who care through technology and data that delivers real-time information via sensors and for individuals to contact care teams when support is required.

Carezapp initially started with a focus on selling to private households but was met with confusion from consumers over how it interacted with state-provided care provision (e.g., who should pay for it, would it lead to less care being provided by their care provider?) This led to a shift to focusing on a more straightforward business-to-business model selling to care providers.

For example, the Carezapp bed sensor technology monitors data and sends alert signals to a receiving device. The bed sensor is placed under the mattress and monitors heart rate, breathing and movement. The sensor sends the readings to a data aggregation platform where the information is used intelligently to follow sets of rules that are set personally for the individual the equipment is supporting. Once a rule is set then the system will create an alarm whenever the data received is outwith the parameters of each rule. For example, an alarm could be set to go off if the sensor is reporting a heart rate of over 120 bpm for more than 2 minutes, or if the person is out of bed.

This has been trialled with care providers in Dumfries and Galloway, with care recipients who would normally require frequent overnight monitoring with a care provider present and awake.

The ability to monitor whether care recipients need support without having to physically pop into the room every 15 minutes prevented disrupting sleep. There has been a noted improvement in the recipient's demeanour during the day with carers commenting that they witness less agitation and more motivation to take part in activities.

From a service management perspective, the introduction of technology has made it easier to find overnight cover, as more staff are willing to do a sleepover than to do a waking night shift. It has also freed up significant numbers of hours of care per week that can be utilised elsewhere in the system.

Carezapp's funding model is based on financing from strategic partners with their majority funder the Dundee-based company INSIGHT. This model of raising funds was seen as preferable to VC or private equity routes where they felt there was less support for the long-time horizons for return on investment.

Economic Impact Analysis carried out by Carezapp attempts to quantify the benefit that these hours "freed up" by such technology saves, to demonstrate from their perspective that in the end investing in such technology is likely to save significant sums of money. However, the trials to date have been small-scale, reflecting the pilot-heavy nature of evidence to date, and mindset change from commissioners as well as government investment is likely to be required to do larger-scale trials and to be commercially viable long term.

We also heard about the need for a shift in mindset to allow for better partnership working so it is not a case of a commissioning body simply telling a provider what to do, but opening up about the challenges and seeking shared solutions, particularly given the resource constraints that are ongoing.

"*It's much more about opening up anything new to the sector in a way of, okay, here's what we think the challenge is. Do you agree that this is a challenge you face? Yes. We absolutely say that's where our challenges lie. Okay, so what do you think you should do about it? And when you know what you want to do about it, how can we support you to do that?*"

Participant T, Care Provider

Many participants noted the Covid pandemic as an example of when some of these issues were temporarily removed due to more decision makers willing to try new approaches, and a quicker streamlined process put in place. One participant, although agreeing that there was more appetite for new approaches, the speed of changes may have been at the expense of thorough consideration of all ethical issues. All agreed that the momentum and enthusiasm for new, more innovative, ways of delivering services has waned since Covid, albeit not to pre-2019 levels.

Funding for early-stage development not the only issue

We specifically asked participants for their views on the potential for venture capital (VC) to support social care tech innovation. Participants on the whole felt that VC wasn't the answer for the sector with the 'messiness' of the sector a key factor. There are a number of layers to this, and some that relate to issues already raised:

- The customer journey is hard to map, particularly with consumer tech i.e., the person buying the product may not be the end user.

- It is a highly regulatory environment, but with regulation likely to change as regulators catch-up with new innovations.

Other issues raised are around the timescales that VCs typically work to. Although social care is likely to have a steady flow of new users, particularly as the population ages, the size of the current market may mean that the 8–10-year expectation of a return on investment is unfeasible.

"If we had gone a VC route or gone some other equity routes and that as well, we would have many challenges in that space, particularly in this space in social care often referred to as glacier, the way and the speed at which it moves."

Participant P, Tech Company

Relatedly, the size of the return may be relatively low, especially given a customer base who is likely to be on fixed incomes, or in the case of providers reliant on public money that over the last decade or so has been in limited supply when it comes to the social care sector.

We heard from those who have experience in bringing more VC and other private monies into the health sector in Scotland. Various factors had to be overcome, including the lack of typical C-suite (e.g., Chief Financial Officers) types that VCs were more used to engaging with. We heard a similar issue raised from those who have observed the influx of monies into the health sector, noting the emergence of a certain type of clinician, who has often through a link-up with a university, developed skills in informatics data science and has the status, confidence and professional networks to bring in significant private monies. This participant felt it was difficult for the equivalent type of person from the social care sector to have the same route paved for them without a lot of dedicated effort.

Other points of view were put across. We heard that there is money for start-ups and that trying to attract VC money was the wrong place to focus with scalability the major issue (and related to the points raised already around infrastructure, skills and mindset). Examples were given of firms that had been well capitalised but failed because of the difficulties with operating within the sector. If resolved, there was optimism that there could be potential for significant inflows of private investment, although caution that these models may not be win-win for workers in the sector (i.e., an Uber-type model for care workers would be innovative, but problematic for other reasons).

It was felt that grant funding would always need to be part of the mix, but related to earlier comments about the government knowing when to step out, giving the same types of grants to the same type of companies was unlikely to be effective without industry involvement:

"I think that you just end up chasing someone else's vision time and time again. And it's not the way to build a good software company. Whereas the beauty of money from a client is you're following the need and you're just trying to build something that works for a group of people. You're solving for that general need in a way where just the alignment I think, is better. You see so many things where just the alignment is 5% off due to grant funding but it misses as good as a mile."

Participant R, Tech Company

Similarly, some we spoke to felt that the government was stuck in a cycle of pilot after pilot that does not embed widespread change and adoption: for example, if a pilot is successful, why aren't public bodies procuring at scale for these solutions:

"...we've demonstrated the economic impacts at the ones to tens. How do we demonstrate an impact from the tens to one hundreds? When you start to bring 10x that, and then the opportunity beyond that is obviously national procurements or other opportunities in terms of 10x and that again, so that's where it sits, the one-offs have been proven. How many times do we have to keep proving the one-offs?"

Participant P, Tech Company

Joining up the dots

Despite the issues raised in this report, with financial constraints a feature throughout, there are examples of where the current funding environment has allowed for significant technological innovations to take hold. Blackwood Homes has shown what is possible (**Box 6**).

Box 6: Blackwood Homes

Blackwood Homes are a housing association and care provider operating throughout mainland Scotland. They manage around 1,700 houses across102 developments, delivering 10,000 hours of care-at-home services weekly, alongside three specialised care homes for individuals with physical disabilities. Their tech innovation started about a decade ago when they sought to upgrade technology and digitalise their operations, partly driven by the requirement to switch from analogue to digital telecare systems as telephony systems across the UK are upgraded.
In making these changes, Blackwood Homes also knew they had to address low digital inclusion levels among their customers and, in some cases, staff. They described their commitment to co-design and co-creation, involving stakeholders in the process of developing solutions. This inclusive strategy aimed to understand the needs of both customers and staff before designing suitable solutions.

One of their key innovations is CleverCogs, a software product that can be used on a tablet device. The system incorporates many features which can be varied depending on the customer. Features include calendars to manage and alert customers about appointments, care note recording, warden call systems and interactive content such as internet access and video calling functionality.

There have been bumps along the way, including connectivity issues for some clients which had to be resolved by moving to multiple network providers rather than one, and needing to reassess the training required to get staff onboard. Initially, there were concerns about adoption among customers due to their demographic, but they addressed this by leveraging people's hobbies and interests as hooks to encourage them to engage with the product.

CleverCogs was developed by a Netherlands based company Care Builder. The relationship with Care Builder was the result of going out to procurement for a solution. Care Builder came forward and were able to work with Blackwood Homes to create the bespoke system they needed. They have been working with the company for over 10 years in a partnership that was described as "win-win"

"… we get a product that works really well for us and frankly, they've got a better product that they can take out to the market. That's the only way that we could make that stack up for us financially. "

The importance of an innovation focus within the leadership team at Blackwood Homes has clearly been instrumental in the progress they have made. However, the financial constraints of the housing and care sectors made external funding sources, including Scottish Government grants and Innovate UK Grants, essential for advancing innovation initiatives.

Why is the example of Blackwood Homes the exception rather than the rule? Overwhelmingly, we heard that the difficult to make and sustain networks amongst the various partners who are required to innovate acts as a significant barrier. Blackwood have been able to work with many of Scotland's innovation assets, such as DHI, NESTA, The Data Lab and Universities. However, others we spoke to, although keen to make these connections, felt they had no idea where to go and who to speak to. The need for spaces to share ideas, build connections and start collaborations was shared by many participants.

"...all of this is driven by individuals with an ambition, a passion, and a drive to make change happen. And actually, whether you have the skills or not, or you have those direct skills, unfortunately, even still in this day and age, it is down to who you know, what you know and how you work with the people that you do know to make things happen."

Participant T, Care Provider

Box 7: Digital Health and Care Innovation Centre

The Digital Health and Care Innovation Centre (DHI) is hosted by the University of Strathclyde and is one of seven innovation centres funded by the Scottish Funding Council. DHI work with academia, industry, third sector, public sector and the general public, taking forward collaborative research and knowledge exchange.

DHI describe the work of innovation centres in tackling systemic issues: in other words, the plumbing that helps connect up the system and to reorientate the system to be more person-centred.

One of the platforms that they have worked on in the health sector is the Health Data Exchange which allows the public to have a common login, a common consent process and a common way of sharing files and data.

The DHI covers health and social care, but they have found the success of health-based work into social care to be difficult for a number of reasons, including:

•Funding sources are much more limited because the reaction time for social care innovations is longer, and less dramatic than health innovation breakthrough

• Medical clinicians have a status that doesn't really translate across to social care. There are also more support structures (e.g. affiliations with universities) that provide opportunities to become clinical informaticians. The combination of clinical status, and being able to 'speak the language' of tech makes them effective at attracting funding and being able to move innovations forward.

• The NHS has made more progress in seeing IT as integral to operations rather than something one department, or an external contractor, does and few front line workers interact with.

• Care requirements change and build over time, and being able to monitor where intervention is needed is less straightforward and may involve issues that are harder to monitor.

•The multitude of people involved in one person's social care journey makes it harder to join up and align incentives than people who are on a health pathway.

These are all issues that the DHI has recognised and is working to resolve, but there were a number of places where the NCS could also play a role in helping change attitudes and norms, particularly around the status of social care professionals, and supporting and equipping them to play more of a role in driving innovation in the sector forward.

We heard mixed views on whether or not a physical cluster of companies working together on solutions was the way forward and would provide a focal point. Many of the companies we spoke to who were building tech solutions had an element of remote working, often for those involved in the more technical aspects. For those engaged in more of the development of ideas and client facing functions, there was a feeling that being together in co-located spaces was helpful for driving the innovation process, but not necessarily an operating model that fits well with people's lifestyles and preferences following the pandemic. Most had not yet made their mind up on what the best way forward was.

Even if companies producing products and services are in the same location, the nature of social care means that clients will be dispersed, and if there needs to be close interaction between client and developer, there either needs to be multiple cluster sites or a strong reliance on remote technologies to make connections.

Whatever the means by which this type of networking occurs, the other factor that needs to be appreciated is the time demands this brings for care providers and workers, and this limits the number of those who are able to engage:

"I think the people who I can see in our social care industry in Scotland who are driving, pushing, and encouraging change and new thinking are all people who others may class as workaholics or people who just don't stop….how many of the people who are being really innovative and creative are now going to get to a point of saturation or burnout because they're committing to a lot of things that are out of their scope of ability in their day-to-day."

Participant T, Care Provider

One care at home provider was very mindful of the need for funding to enable them to step away from their operational role in order to have time to consider, plan and implement tech and digital solutions. Having the time and space to work through the problem and potential solutions was noted as a particular benefit for innovation and change. However, for independent sector or third sector care provider require financial compensation, especially as margins have been squeezed over the years and a lack of available grant funding. Finding ways to allow sufficient time and funding for this is clearly a challenge:

"We've just applied for some funding. If successful this would allow us to get some dedicated funding for us to take backfill time away from day-to-day operations to properly scope out a test of change, investigate technology and engage with customers and stakeholders in this journey. The fund would allow dedicated planning and implementation time to properly fund test of change. There is very little opportunity for the company to apply or receive funding."

Participant Q, Care Provider

Box 8: CivTech

CivTech is an innovative project that is run out of the Scottish Government's digital directorate and is part-funded by the economy directorate.

The program typically follows a structured process that includes open challenges, a selection phase, an exploration phase, an accelerator program, and a pre-commercialisation stage. The goal is to leverage the expertise and creativity of the tech community to develop effective, efficient, and user-friendly solutions for public sector challenges. Both the public sector and third sector are in scope to come forward with challenges, but not private sector organsiations involved in public service delivery.

The CivTech programme started in 2016 and they have recently launched its ninth set of challenges, roughly running one set per year. In 2023 over £10 million in funding from the Scottish Government was earmarked for the ninth set of CivTech challenges.

Previous challenges have been wide ranging in focus. In the latest round, increasing efficiency in public procurement using technology was selected as Challenge 9.5.

One idea raised in conversations to improve information exchange in order to facilitate conversations is a database that is almost like a product catalogue. A couple of participants mentioned the ALISS directory currently funded by the Scottish Government and maintained by the ALLIANCE. This includes information on digital products as well as signposting to other services. Both felt that it needed to either be adopted into other systems or incorporated into some form of shared service, that ISmuch bigger than something just operated by a single third sector body.

One participant spoke about examples of catalogues in the broader digital space that have been successful, potentially because of how they have been set up:

"So often the ideas come back to let's build a directory and 99 times out of 100, they don't work. And then if the reason g2.com and Product Hunt do work, I don't know if it's just the level of sustained focus that a startup can give to it compared to so many of these directories you see here. Someone's got 10 grands of funding or 50 grands worth of funding and they run it for a year. It's just all a bit half-assed and they kind of feel like they've got to include everyone."

Participant T, Tech Company

5 Reflections and conclusions

This grant was designed to investigate a number of research questions related to the development of innovation clusters in Scotland, with a focus on the role of public sector investment at scale in supporting this. In particular, we have focussed on social care innovations, to investigate the potential role of the National Care Service, in whatever form, in stimulating innovation in social care delivery.

Overall, we would summarise that the research for this project has been challenging. The academic literature on innovative procurement practices makes clear that approaches need to be very sector specific. The literature on innovation approaches in social care specifically is patchy at best and is not often underpinned by persuasive evaluative evidence. Pursuing tech solutions in the social care sector in Scotland must be accompanied by robust plans to monitor outcomes, particularly for those who draw on social care support.

The wider questions, about the scope for these innovations to stimulate clusters and achieve economic growth in Scotland, are also not well evidenced to date. Indeed, as our analysis of both literature and available data motivated us to explore more extensively with sector experts, this question was not generally considered as important. Rather – understandably - the focus from sector experts was on the quality and efficiency of delivery of services for care recipients and their families. Indeed, it was felt that focus on generating economic activity amongst domestic companies may not lead to optimal outcomes for providers or recipients of care.

In these conclusions, we set out some of the opportunities for Scotland to take the lead on the development of evidence in the field of (i) innovation adoption, and (ii) innovation in social care more specifically.

Although we were asked by the Scottish Government to consult widely with those involved in delivering social care and tech innovation, we were not asked to engage with those who draw on care, and so further engagement will be required to understand their perspectives and preferred solutions.

We take the research questions we set out to answer in turn, reframing some that have evolved as we have carried out this research. The original research questions as set out prior to project start are set out in Annex 1.

What does the international evidence tell us about the best processes to achieve rapid adoption and deployment of innovation in the delivery of public services?

In academic literature, there is growing consensus that public-sector procurement can spur private-sector innovation. However, the impact of public-sector procurement on innovation is hindered by a number of key challenges. These include funding, contract size, procurer mindset and government policy.

Importantly, the challenges facing the success of public procurement's ability to drive innovation are sector dependent. Therefore, social care innovators will likely face different challenges than entrepreneurs in other industries.

It is important to note the practical challenges we have had in this project in finding relevant literature. Innovation approaches, innovation procurement, and social care more generally appear to be underfunded and rather niche research areas. Interestingly, we also found that international

terminology differences complicate understanding social care and its innovations. For example, "welfare technology" was a common term used internationally for what we would call care technology in Scotland. In the literature review section, we have set out an analysis of these terminology differences.

Future research should be mindful of these differences before conducting desk-based research on this topic, and acknowledge the limitations of such research methodology.

The research that is available tends to focus on obstacles that exist to the adoption of technology, in terms of planning, procurement, and implementation. Some good examples are highlighted (Zigante et al., 2022). In all cases, however, we have found, however, the quality of the evidence is poor and based on weak qualitative analysis. For example, with small numbers of participants. For example, in the case of Kuoppamaki et al, (2021) around 8 participants were interviewed.

Our findings are supported by our more extensive qualitative interviews, in which experts on both health innovation and social care innovation did not point to international models of innovation adoption internationally that are likely to be feasible or instructive in the Scottish system. Specifically on social care, the experts we talked to did not think that there were international examples that were likely to be helpful.

Rather, several interview participants in the social care space were looking to the Accelerated National Innovation Adoption (ANIA) Pathway, established for the NHS, as a potential model for social care. More information about ANIA is given in Box 4 in Section 4.

Participants in this study were supportive of the ANIA model to be considered for social care. In discussions with officials, it seems that it was always the ambition that this programme would cover both Health and Social Care, and, that once established, the feasibility of extension of the programme is actively considered.

However, there will be some challenges in this space. All of the current literature and infrastructure for ANIA is very health-focused and is certainly not geared towards encouraging social care practitioners to bring forward innovative ideas. The whole process, from the consideration of innovations at the business case stage, to decisions around national priorities, will have to have different groups of experts from those who are making decisions about health innovations.

If this is the approach that is taken, investment will be required to ensure that social care is not seen as an afterthought. The pathway for social care must be distinct and supported by different skills and personnel.

The lack of good international examples of innovation adoption in public services and social care innovation provide a huge opportunity for Scotland to lead the way in this space. Robust monitoring of the approach through ANIA, and proper evaluation of every intervention invested in, will be required and can add greatly to international literature on innovation adoption in general. Continuing this through to any extension of ANIA to social care will also add significantly to the literature on social care innovation models.

As touched upon above, we understand that the extent to which the adoption of innovations generate economic activity specifically in Scotland is not a driving (or even a considered) factor for the innovations selected.

What are the product needs of the National Care Services that could be met by innovative companies?

From our primary research with participants, there has been a clearly articulated need around better use of data, with personal data stores a favoured solution of many (centring data around an individual rather than around organisational needs).

There has been little consensus around particular 'needs' beyond this because the lack of pre-requisites (such as digital skills among the workforce, access to devices and connectivity) mean that operationalising widespread use of tech in care settings, including low fidelity devices, is not seen as a realistic proposition until these issues have a chance of being resolved.

Box 9: Types of social care technology

Digital administrative systems

This covers digital systems used by social care providers in their delivery of care and reporting.

This report focuses on the bespoke systems used in the nature of social care delivery (care management), rather than software for more generic functions such as accounting and rostering staff, although some systems can manage all areas.

As well as the software components themselves, systems for collecting and storing of data inputted into these systems are in scope for this project. The IRASC stated clearly that better data arrangements to integrate systems was required, and the development to of electronic health and social care record is part of the draft National Care Service Bill.

Assistive technologies

This is a broad area, encompassing both hi and lo tech innovations, and designed for a multiplicity of situations. Assistive technologies aim to improve the quality of life for the user, and ideally augment (rather than replace) human-based care.

A key area for potential growth stem from remote care technologies which have developed out of analogue alarm-based 'telecare' systems and are designed to promote the safety and independence of people when they are outside formal care settings, including living at home. They can include sensors for monitoring health conditions, GPS-based tracking technologies and sensors that monitor whether routine household tasks have been missed, signifying an issue (e.g., whether a kettle has been boiled at the usual time in the morning). There can also be an overlap between systems set up for remote monitoring and the digital administrative systems described above.

Other technologies in scope include:

- Simplified devices (e.g., Doro mobile phones)
- Accessible communications (e.g., eye tracking, screen readers)
- Robotics
- Virtual Reality
- Gamification
- The Internet of Things (IoT)

The appropriateness of these technologies will depend on the personal circumstances, wants and needs of the client/consumer.

To what extent do these types of companies operate in Scotland?

Understanding the current status and capacity for social care innovation in Scotland from currently available data is frustrated by the system of sector classifications which currently do not identify subject-specific innovations. Our analysis has identified the potential for clusters of innovative companies in Scotland, including the labour and skills supply to support this.

However, the nature of data and digital companies more generally limits the extent to which it generates wider economic benefits. These companies tend to have high wages and generate high levels of GVA, but have shallow roots in Scotland and therefore economic multiplier effects are limited and tend to leak out of the Scottish economy.

Most of the successful tech companies that we have spoken to and heard about often did not emerge from Scotland, and have instead moved into the market from elsewhere (England, Ireland, or further afield). Some have set up bases here as their work has progressed, but many still rely on at least part of their workforce (often those with more technical skills) to be working remotely.

What is less clear is the extent to which this creates potential for Innovation clusters in social care specifically.

How does the existing social care infrastructure support and foster innovation adoption and diffusion?

Building infrastructure is essential for the widespread adoption of innovations, especially in the health and social care sectors. Participants involved in health innovation noted a mismatch between service needs and the interests of innovators. There is a lack of focus on the underlying infrastructure required to support innovations. Participants believe that innovation can still occur in less glamorous areas, such as improving systemic issues.

Physical infrastructure, like access to devices for social workers and care professionals, is crucial but not yet universally available. Basic internet connectivity and video conferencing systems are also needed for most technological innovations to work. Additionally, software infrastructure needs to be compatible with existing systems to facilitate the adoption of new products and services. However, there is no basis to expect staff in these sectors to have digital proficiency, so training is necessary.

Workforce digital skills are another challenge. There's significant variation in the digital skills of frontline workers and management. As technological products become more prevalent in care settings, staff will need to be proficient in maintenance issues. Training will be required, especially for those starting with low digital skills. The idea of a new 'care technologist' role has been piloted in Scotland to support technology adoption, but the rollout requires further consideration, including funding and legislative changes.

Despite these challenges, some participants are optimistic. Fear of technology can be overcome with on-the-job training, and resistance may decrease if workers see a reduction in administrative tasks. One care technology company, Carezapp, has not encountered staff skills and training as a barrier to adoption in trials, suggesting that the primary issue may be resistance from commissioners.

The skills and preferences of care recipients also need to be considered carefully. Better outcomes for care recipients must include agency and consent over the modes of delivery of care for both recipients and their families.

How are Scotland's innovation assets and entrepreneurial infrastructure supporting innovation in social care delivery?

There were good examples from our research of social care practitioners engaging with Scotland's innovation and entrepreneurship infrastructure. Particularly noted was engagement in some cases with DHI, The Data Lab, and Civtech.

However, these examples, like many aspects of social care innovation, were patchy and notable exceptions rather than a good representation of the experience of much of the sector. Participants cited in many cases a lack of knowledge of "where to go" or "where to start".

This suggests that some sort of gateway or hub for social care innovation, and the places to go for support, would be helpful for the sector. This could be through a process like ANIA, or an innovation hub through another model, such as an NCS-supported central system. Something new in this fragmented system is required to "join the dots" for social care innovation.

To what extent are Universities in Scotland engaged in the provision of skills and research in social care innovation?

Universities in Scotland have an important role in ensuring people in the labour market have the skills required to participate in innovative activity. As we discuss in section 5, Scotland has the highest number of engineering and computing higher education students per head out of all 12 UK regions, with universities like Strathclyde and Glasgow enrolling the highest number of engineering and computing students in Scotland, respectively.

However, what is less convincing is the extent to which University research is focussed on delivering innovations for adoption in the social care sector. Our engagement with academics in the social care and social care innovation field was exclusively outwith Scotland. The feedback we received highlighted the challenges of funding research in this field, and only a limited number of examples of impactful research can be found in Scotland.

What is the relevance of venture capital funds with regards to social care innovations?

Participants generally felt that venture capital (VC) was not a suitable solution for the social care sector, citing several challenges. These include the complexity of the customer journey, particularly in consumer tech, as the buyer may not be the end user.

The sector is also highly regulated, and regulations are prone to change as they catch up with new innovations. Other concerns include the typical 8-10-year VC investment horizon, which may not align with the slower pace of the social care industry, referred to as "glacial" by a participant. The sector is also characterized by a customer base with fixed incomes or reliance on public funds, which may limit potential returns on investment.

The lack of typical C-suite executives and the need for a different skill set, such as informatics data science expertise, were also cited as barriers to attracting VC funding. Some argued that the focus should be on scalability and addressing sector-specific challenges rather than attracting VC investment. There were examples of well-capitalized firms that failed due to sector difficulties.

Ultimately, grant funding was seen as a necessary component, but participants argued that government support should be more targeted and include industry involvement.

There is more research that could be done on the funding landscape in social care, However this was beyond the scope of this project. A product such as Pitchbook could be used to do further analysis and gain additional insights.

Annex 1 – Original Grant Objectives

1. The Fraser of Allander will undertake a review of International best practice in relation to the public sector processes and investment necessary to achieve rapid adoption and integration of innovation in a way that improves public services and allows the emerging cluster to achieve growth from public spending. Such analysis will include:

- Effective procedures for the new service to articulate its innovation needs.
- Innovative procurement practices, including pre-commercial procurement.
- Public/private collaboration to solve problems and test solutions. This should encompass the full range of innovation from early-stage R&D through to pre-commercial testing of products and services.
- Clear, effective and fast routes to adoption for the best products and services.

2. The Fraser of Allander will identify the product needs of the National Care Service that could be met appropriately by data and digital companies. These requirements may include: cyber security (e.g., safe transfer of data), data translation, health and care system integration, accessibility tools, assisted communication tools (this is not exhaustive), low fidelity devices. This should cover gaps and opportunities for improvement.

3. The Fraser of Allander will review the social care landscape in Scotland. This part will develop following the completion of the first two parts of work and in consultation with the Scottish Government, but will include

- Identifying the current spread, capability and capacity of private sector and social enterprises within Scotland in relation to these needs
- Particular technological, product or service strengths and weaknesses, including gaps in the domestic supply chain.
- Analysis of trends in venture capital funds that are shifting to challenges around social care and the opportunity for Scotland here.
- Analysis of Scotland's innovation assets (e.g., the Bayes Centre) and entrepreneurial infrastructure (e.g., Civtech and the new Techscaler network) in building build a stronger pipeline of promising companies.
- The extent to which the Scottish university sector is currently engaged in the research and development of technologies and products that could be rapidly commercialised and deployed in the National Care Service.

Any actions necessary to grow the size and capability of the emerging social care sector e.g., venture studios, funding environment, appetite of investors to support collaboration between the public and private sectors and investing in physical infrastructure.

Annex 2 – Social Care Definitions

Table 2: Adult Social Care sector definition from Care Inspectorate data

Included in Adult Social Care	Not included in Adult Social Care definition
Adult Placement Service	Adoption Service
Care Home Service - Alcohol & Drug Misuse	Care Home Service - Children & Young People
Care Home Service - Blood Borne Virus	Child Care Agency
Care Home Service - Learning Disabilities	Child Minding
Care Home Service - Mental Health Problems	Day Care of Children
Care Home Service - Older People	Fostering Service
Care Home Service - Physical and Sensory Impairment	School Care Accommodation Service - Mainstream Residential School
Care Home Service - Respite Care and Short Breaks	School Care Accommodation Service - Residential Special School
Housing Support Service	School Care Accommodation Service - School Hostel
Nurse Agency	
Offender Accommodation Service	
Secure Accommodation Service	
Support Service - Care at Home	
Support Service - Other than Care at home	

Source: Care Inspectorate

Table 3: Adult social care sector definition in SSSC data

Included in Adult Social Care	Not included in Adult Social Care definition
Adult day care	Adoption services
Adult placement service	Childcare agencies
Care homes for adults	Childminding
Central and strategic staff	Day care of children
Fieldwork services (adults)	Fieldwork services (children)
Fieldwork services (generic)	Fostering services
Fieldwork services (offenders)	Residential childcare
Housing support/care at home	School care accommodation
Nurse agencies	
Offender accommodation services	

Source: Scottish Social Services Council

Annex 3 – Literature Review

This literature review synthesises key findings, methodologies, and themes surrounding the challenges with innovative procurement and international best practices in innovative procurement, with a focus, where possible, on innovative social care procurement.

Terminology

The terminology used to describe "adult social care" in the UK varies among different English-speaking countries and across the European Union. There are even differences within regions of the same country. Below, we highlight some terminologies from a selection of countries alongside the European Union –

Table 4: International Terminology for Adult Social Care

United States	▪ Long-term Care Services and Supports (LTSS) - includes children, adults, and seniors needing long-term care for disabling conditions, ranging from institutional care to community-based care. ▪ Elder Care – includes care for the elderly.

Canada	▪ Long-term Care (LTC) – includes individuals with disabilities requiring continued care and elderly people with disabilities.
	▪ Home and Continuing Care includes:
	  ▪ Home and community care, providing services to help people receive care at home rather than at a hospital; and,
	  ▪ Long-term facilities-based care, providing care through facilities such as nursing homes.

New Zealand	▪ Home and Community Support Services (HCSS) – includes care for those typically under the age of 65 who have disabilities. ▪ Aged Care – includes care for the elderly.

European Union	Within the EU, terminology can differ between member states, but common terms include:
	▪ Long-Term Care (LTC) – includes healthcare and social care services for elderly people and/or people with disabilities. LTC includes:
	  ▪ Home Care, formally/informally involves helping people receive care at home rather than at a hospital; and,
	  ▪ Residential Care, providing care through facilities such as nursing homes.

Source: Fraser of Allander Institute

It is important to note that the terms noted above are also used interchangeably by different researchers making it challenging to find literature on innovative procurement in the social care sector. Additionally, health and social care are often combined in the literature, therefore, there is a lack of isolated social care analysis. Finally, in Nordic countries 'welfare technology' is an umbrella term used to cover a range of technologies that we could call social care technology, adding another layer of complexity.

Kuoppamäki (2021) describes welfare technology as assistive technologies that provide "physical, social, and cognitive assistance for older adults and persons at risk of disability, designed to increase their safety, participation and independence, and to improve care delivery and the work environment of healthcare professionals". These technologies include digital devices such as care robots, telecare, monitoring systems, etc., and may take the form of GPS alarms, virtual doctors, or mobile access to patient documents.

Public sector procurement and innovation

There is a growing consensus on the positive role public sector procurement can play in supporting innovation in the private sector (Lenderink, Halman, and Voordijk, 2022; Georghiou et al., 2014; Uyarra et al., 2014). However, there are a number of barriers impeding the public sector from "acting as an intelligent and informed customer" (Uyarra et al., 2014). A lack of risk management, inadequate skills among procurers, and rigid specifications are quoted as the key barriers in the research of Uyarra et al.

Uyarra et al.'s paper sets out to understand the barriers to innovative procurement by analysing a UK survey, carried out in 2011, of around 800 general managers or heads of public sector contracts of public sector suppliers. Uyarra et al. use a probit model to estimate the influence of perceived barriers to suppliers. Just over half of the buyers analysed in this paper belong in the NHS, while the other half are made up of central government and local government clients. There is not any detail on whether this study included social care however, this report gives an overview of public sector procurement and the challenges faced by suppliers in the UK. It is important to note that there is an acknowledged lack of research in the area of public procurement of welfare technologies (Dahn, 2020)

Uyarra et al. found that the key barriers to innovative procurement were: a lack of interaction with procuring organisations; the use of over-specified tenders instead of outcome-based specifications; low competence of procurers; and, poor risk management. A lack of sufficient feedback following unsuccessful bids was also highlighted as a key barrier.

Expectedly, the size of an innovative firm plays an important role. Small firms particularly feel like there is a lack of feedback from unsuccessful bids which limits lessons being learned for future bids. They also find the procurement process extremely time-consuming, putting a lot of pressure on their firm. Social enterprises find the switch from grant aid to public sector procurement a culture shock and also experience difficulties understanding public sector procurement processes. Uyarra et al. find that small or short contract sizes may disincentive innovation - that is, demand is not great enough to foster significant innovation – for large and R&D-intensive firms and estimate small contracts as a significant barrier to small firms and social enterprises which could be explained as the risk of survival through engaging in small contract work. While longer contracts (i.e., around three years) would provide security to these smaller firms, large, bundled contracts were estimated to be a barrier to entry.

Georghiou et al. (2014) note that policy instruments in the UK typically address procurement but do not engage with "the whole cycle from identification of need to adoption and diffusion of the innovation" despite barriers existing throughout the process. Whyles (2018) notes that both public and private parties in an innovative procurement process need risk financing to allow for risk-taking and the prioritisation of longer-term innovation projects. Funding is not limited to grants and increasingly competitions are gaining the interest of policymakers, where winners of innovation competitions secure funding through channels such as equity investments.

Respondents in the survey analysed by Uyarra et al. also noted that there is a lack of coherence among government bodies and that government can be "old school", failing to understand the benefits of commercial innovation. It was also noted that government typically applies a rigid "one-size-fits-all" procurement policy whether it is procuring a paperclip or a specialist fleet.

Overall, Uyarra et al. find that barriers are specific to different suppliers in different sectors, each having their own perception of public sector procurement. Therefore, social care innovation procurement suppliers should have their own unique perspective on public sector procurement.

Challenges in procuring care technologies

Frennert and Baudin (2021) note that the success of digital evolution within care is hindered by a lack of finances and infrastructure, high staff turnover, resistance within organisations, and legal and ethical concerns. On the latter, Cuesta et al. (2020) noted the important role ethical analysis plays in the successful implementation of welfare technology when evaluating the deployment of care technology in Sweden.

Kuoppamäki (2021) carried out a qualitative study of procurement practices among municipal actors in Sweden to evaluate the application and deployment of welfare technology. Kuoppamäki finds that procurement plays an important role in impeding the deployment of welfare technologies. Their paper aims to explore how welfare technology is adopted and utilised from a procurement perspective. Kuoppamäki carried out a number of qualitative interviews with actors in three Swedish municipalities, interviewing eight procurement managers, IT developments managers, and social administration managers. Kuoppamäki highlights the challenges of procurement practices in adopting welfare technologies through three stages: planning and mapping; procurements; and, implementation and management. The sample size of this qualitative analysis is low however, it still provides insight into the challenges around care technology procurement in Sweden, providing understanding of how to overcome some of these challenges to achieve clearer, faster, and more effective routes for adopting care technology.

Planning and mapping

Within planning and mapping, Kuoppamäki found that it is difficult to meet end-users' demands and needs, particularly when ethical aspects of technologies are considered. For example, it is very difficult to get consent for the use of a night camera from someone with dementia. It was also noted by Kuoppamäki that actors had little or no support in how they should analyse the needs of end-users of welfare technologies. Additionally, these technologies need to be easy to use for end-users but usability varies for each user, therefore, making it difficult to procure.

Market analysis was highlighted as crucial in understanding which suppliers exist, and how much is reasonable to pay for different technologies, and this analysis requires the economic and technical competence of procurers. Uyarra et al. (2014) find that a lack of procurer skills limits effective dialogue between procurers and suppliers while Edler et al. (2005) also highlight the need for market intelligence to effectively procure innovations. Their international case study analysis shows the need for procurement teams to have sufficient technological knowledge to assess solutions offered in the market. When internal intelligence lacks, procurement teams could rely on external experts for this market analysis. Overall, Kuoppamäki argued that requirement specification requires significant economic, technical, juridical, and ethical competence.

Edler et al. (2005) analysed nine procurement cases internationally - across Italy, Germany, the UK, Austria, Norway, and the Netherlands -, highlighting a series of general lessons for innovative procurement. None of these case studies relate to social care innovations however, they provide insight into innovative procurement requirements through an international case study piece of research. All of the examples outlined by Edler et al. highlight the important role effective identification of requirements plays in the success of innovative technology. Design competitions, as seen in the UK's case study on 'Variable Message Signage for UK Motorway Network', were highlighted as being supportive of the identification of requirements and that users are also crucial in identifying technology requirements.

Through a care lens, it has been argued that 'Deep Personalisation' of social care has the potential to change the way we create and deliver public services. For example, personalisation could mean

social care users are both consumers and co-producers of services (Leadbeater, 2004). In Australia, older people told Australia's productivity commission that they "did not want to be passive recipients of services". A Consumer-Directed Care (CDC) approach allows older individuals to have a say in the types of care and services they access (Australian Government, 2011).

Procurement stage

During the procurement stage, Kuoppamäki notes that economic resources are a key barrier. That is, some demanded technologies are simply too expensive and organisations cannot afford them. Therefore, there is a role increased funding for these technologies can play in the adoption of care innovations. Additionally, a lack of an adequate national strategy on how to make use of elderly care technologies was highlighted as a barrier to the deployment of welfare technologies. "From an organisational perspective, many of the challenges in the procurement of welfare technology can be associated with governmental aspects, including the juridical, legislation and political issues of organising and providing elderly care."

Kuoppamäki outlines that juridical and legislation issues often delay the procurement process, with issues often arising when procurement procedures need to be followed despite only one supplier being available. The legality of suppliers submitting bids in these cases is time-consuming and unnecessary. "In a 'niche' market like welfare technology, bureaucratic procurement legislation makes it time-consuming to procure already established welfare technology". Therefore, more flexibility in the procurement process is needed for faster adoption of these care technologies.

Implementation and management

Swedish municipality procurement actors noted that collaboration between municipalities and suppliers, and collaboration between different municipalities drives knowledge exchange, the sharing of best practices, and unlocks new routes for care technologies (Kuoppamäki, 2021). However, the collaboration between municipalities can be hindered by insufficient political strategies to standardise welfare technology implementation. Kuoppamäki (2021) notes that Scandinavian models such as that in Norway and Denmark are recognised as examples of best practice where technology deployment is standardised across regions.

International best practice of innovative procurement practices

OECD (2017) highlight a few examples of best practice in health and social care procurement:

- Kampen Omsorg is an assisted living residence in Oslo, Norway, which has a procurement strategy that demonstrates the importance of "extensive dialogue with the market" in fostering innovation in welfare technologies which both save costs and improve services. These dialogue activities included presenting procurement plans and gathering intel on which solutions were available on the market. Interactions included one-to-one meetings with potential suppliers. The Norwegian care home exemplifies the innovation opportunities that can be unlocked as a result of collaboration between government, business, and service beneficiaries.
- THALEA, a research project that enables intensive care units to improve care for acutely life-threatened patients via telemedicine and telemedicine, is an example of innovative best practices from Germany concerning management which supports strategic procurement of innovations. In this case, early internal communication across departments occurred and this strategy was supported by the procurement team.

Each year, the European Innovation Procurement Awards recognise public and private buyers in promoting and implementing innovative procurement across Europe:

- In 2021, the Galician Health Service, based in Spain, won this award for their project which "identifies, transforms, and implements innovative solutions to new health system challenges, to guarantee active and healthy ageing" (European Innovation Council, 2021).
- In 2022, the runner-up was Iniciativa Social Integral, a home care SME in Valencia, Spain. committed to care innovation.

While not exactly focussed on care innovations, OECD (2017) note Canada's Build in Canada Innovation Programme (BCIP) as an example of best practice when it comes to bridging the pre-commercialisation gap by supporting innovations in the move "from the lab to the marketplace". BCIP supported pre-commercial innovations through testing in operational environments across Europe. BCIP awards contracts to innovators through "an open, transparent, competitive and fair procurement process for their testing within the Canadian federal government". This approach prioritises feedback to entrepreneurs on their innovations, whether a product or service. This supports innovators in entering the market with a successful good or service.

While desk-based research identified some examples of innovative procurement best practices, there was a real lack of evidence that actually evaluates the effectiveness of these practices. That is, examples of best practices are primarily spotlighted through case studies without quantitative analysis. This is something that Zigante et al. (2022) also found in their meta-analysis of Adult Social Care (ASC) literature.

Zigante et al. (2022) reviewed the literature on ASC to evaluate how care innovations can be developed, scaled-up, and grown. Zigante et al. (2022) found that most of the literature here covered the UK (England and Scotland mostly), Australia, the United States, and certain European countries like Norway and the Netherlands. The majority of the literature covered service delivery innovations, followed by ICT innovations. Less frequent innovations include those focussed on workforce and learning, and those centred around the ASC system such as governance, policy, and financing innovations. Zigante et al. (2022) notes that the majority of ASC innovation evaluations take the form of exploratory case studies, drawing on typically weak qualitative evidence. Their report finds that just two papers use quantitative methods to evaluate ASC innovations.

Through their meta-analysis, Zigante et al. (2022) outline five key themes used to answer their main research question on the capabilities organisations need for successfully developing, scaling, and growing ASC innovations. These five themes, and the number of articles found to discuss these themes as supportive of ASC innovations, are:

- Collaboration (25 articles)
- Leadership (16 articles)
- Knowledge and Evidence (13 articles)
- Resources (17 articles)
- Culture (12 articles)

Collaboration

Collaboration capabilities are found to be crucial in fostering innovation across organisations, ranging from formal partnerships to informal networks involving diverse staff groups, other organisations, and care service stakeholders. Irrespective of the collaboration type, maintaining respect, common understanding, open communication, and ongoing relationships are consistently highlighted. While leveraging existing relationships can facilitate innovation easily and quickly, time is essential for developing new relationships. Investing in long-term networks and ongoing funding, as well as gaining support from policymakers was noted as crucial elements of driving innovation through collaboration, with "active conversations" highlighted as a key tool when engaging with different groups of people.

Leadership

The articles within the leadership theme include leadership styles, formal and informal roles tied to innovation, and collaborative change management. These articles explored a diverse range of topics, ranging from ICT to specialised dementia care. Effective leadership styles for innovation in ASC involve giving staff room for experimentation and risk-taking, having role models of resilience and positivity, and ensuring staff inclusion in communication. For successful innovation, leadership should occur at various organisational levels, and there is a need for informal leaders, termed "institutional entrepreneurs". The interplay between leadership and collaboration themes was evident; collaborative change management involved shared understanding, open communication, and a common vision. Collective leadership was also promoted to avoid dependency on individuals and ensure continuity.

Knowledge and evidence

Many innovations discussed in the knowledge and evidence theme were interventions designed to foster conditions conducive to generating and sustaining further innovations. Various approaches were explored, ranging from peer challenge interventions to researcher-in-residence models. Market analysis also played a role in innovation development, particularly in UK and US contexts with private provision of ASC.

Resources

Deploying and organising resources within an organisation is essential for innovation. Alongside knowledge, finances and staff emerged as vital resources for innovation. Although few articles primarily focused on these resources, many acknowledged constraints like time, money, and staff as barriers. Strategies used by ASC organisations included adopting innovative organisational forms or financing structures like micro-providers and social investment bonds to improve resource deployment. Findings also emphasise the importance of sustained funding given its impact on innovation continuity.

Culture

A positive culture is seen as an enabler of innovation however, it is an ambiguous term across the literature. Some refer to culture as building a common culture among organisations, others refer to a learning culture, and finally, some refer to culture as a way of working within an organisation, i.e., organisational culture. An open communication, 'no blame, and safe culture is seen to foster innovation, particularly since it allows for experimenting, learning, and risk-taking which are key to innovation.

Conclusions

There is growing consensus that public-sector procurement can spur private-sector innovation however, the impact of public-sector procurement on innovation is hindered by a number of key challenges. These key challenges highlighted throughout this literature review include –

- **Funding:** a lack of sufficient funding limits risk-taking needed for innovation.
- **Contract size:** Small contracts do not incentivise firms to innovate and do not provide enough security for SMEs and social enterprises.
- **Competence of procurers:** requirement specifications require significant economic, technical, juridical, and ethical competence.
- **Valuable feedback:** a lack of feedback from unsuccessful bids limits the ability of firms, particularly SMEs, to learn from previous bids.
- **Government innovation policy**: government policy to improve innovation fails to address challenges throughout the whole cycle of innovation from identification to

deployment. A lack of a standardised national policy on care technology use also hinders deployment.

- **Government procurement policy:** government procurement is typically rigid, old-school, and applies a one-size-fits-all policy. Additionally, the legalities of public sector procurement can often be time-consuming and unnecessary.

A lack of interaction with procurers, over-specified tenders, and poor risk management were among other key barriers identified by this review of the literature. Also, the challenges facing the success of public procurement's ability to drive innovation are sector-dependent therefore, social care innovators will likely face different challenges than entrepreneurs in other industries. These findings motivate the need for research primarily within the social care sector to better understand the challenges and opportunities of innovative social care procurement.

It is important to note the practical challenges in finding relevant literature. Beyond the fact that innovative social care procurement is a niche research area, there are difficulties that arise due to the nature of terminology used internationally to describe social care and social care innovations. Future research should be mindful of these differences before conducting desk-based research on this topic.

Despite these challenges, this research identified a number of key challenges to welfare technology innovations through the lens of planning and mapping, procurement, and management and implementation. However, whilst this evidence corroborates findings from across the whole public sector, the sample size used by Kuoppamäki (2021) was small. This justifies the need for a bigger-scale qualitative piece of analysis of the barriers to innovative procurement in the social care sector.

Additionally, this review highlighted some international examples of innovative procurement in the social care space however, as found in this research, and highlighted by Zigante et al.(2022), examples of best practices are primarily based on weak qualitative analysis. Therefore, there is a need for more quantitative analysis in this research area to better evaluate social care innovations. Nevertheless, through their meta-analysis of the ASC innovation literature, Zigante et al. (2022) identified five key themes needed for successfully developing and scaling-up ASC innovations. These five key themes are collaboration, leadership, knowledge and evidence, resources, and culture.

Overall, this literature review outlined key challenges that apply broadly to the success of innovative procurement, with some evidence in the social care sector more specifically. It also highlighted key themes needed for successful ASC innovation development and scale-up however, it is clear from our research and that of others, that more analysis, particularly those employing quantitative methods, are required in this area.

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Annex 4: Cluster Potential detailed analysis

This section first focuses primarily on mapping companies and skills associated with digital administrative systems, and within that focuses on case and care management software solutions. This builds on the work already completed as part of the Care Services in Scotland: A Review of the Technology Landscape produced by Socitm Advisory (from here on refereed to the Landscape Review), and shared with our project team ahead of its publication.

Locating firms in the SIC code framework

In this section we look at the care and case management systems identified in the Landscape Review and how they are classified under the Standard Industrial Classification (SIC) framework and where they are located within the UK.

The Landscape Review lists approximately 100 care management systems and case management systems – with some companies producing more than one system, leaving around 60 unique firms in our sample. Using publicly available information from Companies House, 57 companies were identified as being registered within the UK. This does not mean that the firms are UK 'born and bred', but it does tell us that they have a physical presence and workforce within the UK.

SIC codes generally capture the main economic activity of a company. Therefore, we would expect that most software providers would be registered under SIC_{62} which covers computer programming, consultancy, and related activities. This was broadly the case as 36 of the 57 companies (63%) were found to be registered under SIC_{62}.

The remaining 37% were classified under SIC_{58} (Publishing activities), SIC_{63} (Information service activities), SIC_{64} (Financial service activities, except insurance and pension funding), SIC_{68} (Real estate activities), SIC_{70} (Activities of head offices; management consultancy activities), SIC_{72} (Scientific research and development) SIC_{74} (Other professional, scientific, and technical activities), SIC_{78} (Employment activities), SIC_{82} (Office administrative, office support and other business support activities), SIC_{87} (Residential care activities), and SIC_{94} (Activities of membership organisations). **See Table 5**.

Table 5 – SIC codes of companies providing software solutions for care listed in the Landscape Review

SIC code	Count	Percantage
SIC58 (Publishing activities)	1	2%
SIC62 (Computer programming, consultancy, and related activities)	36	63%
SIC63 (Information service activities)	1	2%
SIC64 (Financial service activities, except insurance and pension funding)	1	2%
SIC68 (Real estate activities)	1	2%
SIC70 (Activities of head offices; management consultancy activities)	1	2%
SIC72 (Scientific research and development)	1	2%
SIC74 (Other professional, scientific and technical activities)	1	2%
SIC78 (Employment activities)	1	2%
SIC82 (Office administrative, office support and other business support activities)	10	18%
SIC87 (Residential care activities)	1	2%
SIC94 (Activities of membership organisations)	2	4%

Source: FAI calculations, Companies House

Table 6: Head office location of companies providing software solutions for care listed in the Landscape Review

City/town	Region	Number of companies	Percentag
London	England	18	32%
Surrey	England	3	5%
Birmingham	England	2	4%
Watford	England	2	4%
Bournemouth	England	2	4%
Manchester	England	2	4%
Edinburgh	Scotland	2	4%
Glasgow	Scotland	2	4%
Berkshire	England	2	4%
Loughborough	England	1	2%
Warwick	England	1	2%
Devon	England	1	2%
Bridgwater	England	1	2%
Chester	England	1	2%
Middlesex	England	1	2%
Sussex	England	1	2%
Hertfordshire	England	1	2%
North Yorkshire	England	1	2%
Slough	England	1	2%
Rochdale	England	1	2%
Crieff	Scotland	1	2%
Kent	England	1	2%
Aberdeen	Scotland	1	2%
Fife	Scotland	1	2%
Ormskirk	England	1	2%
East Sussex	England	1	2%
Farnborough	England	1	2%
Richmond	England	1	2%
Lancashire	England	1	2%
Leicestershire	England	1	2%
Essex	England	1	2%

Source: FAI calculations, Companies House

Cluster analysis

First, we examine the existence or potential for a cluster of firms within the social care tech sector based on the physical location of firms.

While the Landscape Review provided detailed coverage of the software solutions used in Scotland's social care sector, we were especially interested in understanding where these companies are located within the UK. Of the 57 companies, 50 have their head offices registered in England (88%) while only 7 are in Scotland (12%). London alone accounts for over a third of the registered addresses of software providers on our list. **See Table 6.**

The Landscape Review provides a list of software providers who are selling into the social care sector in Scotland, but this does not mean that there are not other firms with the capability and potential to provide these types of services in the market in the market.

The analysis in the next section combines SIC_{62} and SIC_{63} to present a broad picture of the digital and data capacity of Scotland relative to that of the UK. We include SIC_{63} as our initial intelligence form stakeholder discussion suggests significant potential for firms in this sector to have the capability to innovate for wider tech solutions (e.g., Mydex CIC are registered in SIC_{63}). For the remainder of this report, the term 'digital and data industry' we will refer to the aggregation of the industries SIC_{62} and SIC_{63}.

The Department for Business, Energy & Industrial Strategy (BEIS) defines a 'competitive economic cluster' as a concentration of related industries, their supply chains, a related knowledge economy – i.e., education institutions, research, etc. -, and government agencies.

We use location quotients (LQ) to analyse the industrial capacity for innovation in digital and data technologies within Scotland and the UK. This is a traditional method used to identify high concentrations of industry activity across geographies.

In this context, a location quotient is a ratio of how specialised an area is relative to how specialised the nation is in a particular industry. Areas with a location quotient greater than one can be considered as specialised in a particular industry - with higher LQ's indicating higher levels of specialisation. **See equation 1**.

Equation 1: Location quotient equation

$$LQ_i^R = \frac{business\ count\ of\ industry\ i\ in\ region\ R \Big/ total\ business\ count\ in\ region\ R}{business\ count\ of\ industy\ i\ in\ economy\ N \Big/ total\ business\ count\ in\ economy\ N}$$

Example: $LQ_{SIC62+63}^{Glasgow} = \frac{0.04}{0.05} = 0.87$

SIC_{62+63} accounts for 4% of the businesses operating in Glasgow. However, at the UK level, SIC_{62+63} accounts for 5% of national business count. The resulting LQ, which is less than one, indicates that Glasgow is less specialised than the UK as a whole in the digital and data industry.

We will see that that the denominator plays an important role in assessing the relative strength of a region's specialisation.

UK location quotients:

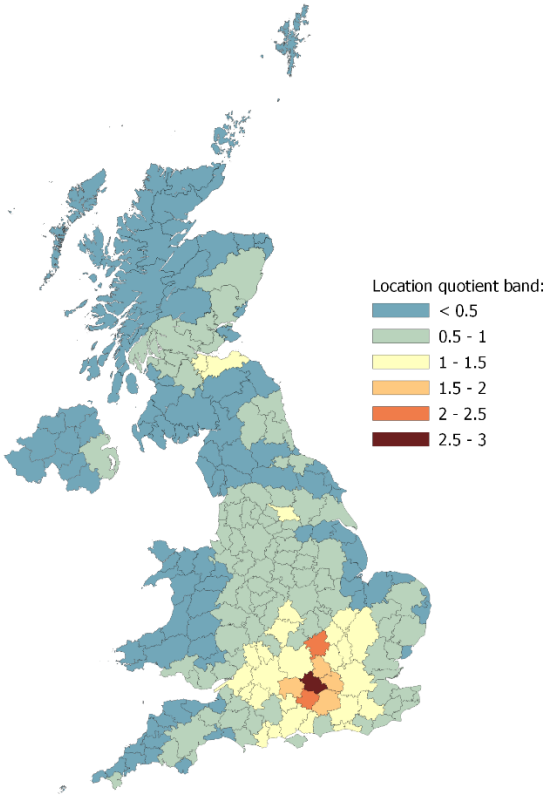
At the UK level, data from the Inter Departmental Business Register (IDBR) shows that in 2022 there were approximately 142,700 businesses operating in the digital and data industry (SIC_{62+63}).

In this section we use the geographical measure Travel to Work Areas (TTWA) used by the ONS to capture labour market areas. TTWA are currently defined as having at least 75% of the working population living in an area, working in the area and 75% of those working in an area, also living in the same area. There are 45 TTWA covering Scotland and 160 which cover the whole of the UK.

Using TTWAs provides us with meaningful economic conurbations to analyse. They capture the functional economic geography of labour markets more accurately than administrative boundaries, such as city or county lines, which may not fully reflect commuting patterns. They also provide a more accurate view of labour market conditions and dynamics which are more meaningful for businesses when considering investment and location decisions.

The TTWA in the UK with the largest business count location quotients are closely geographically grouped in the south of England with Reading at the heart of the cluster. **See Figure 3.**

Figure 3: UK TTWA digital and data location quotient bands



Source IDBR and FAI calculations

Reading, Milton Keynes and Basingstoke have location quotient scores LQ > 2, suggesting that they are highly specialised relative to the UK economy when it comes to digital and data companies. It is noteworthy that while specialised relative to the UK, two of the three 'Golden Triangle' members, Oxford and Cambridge **do not** feature within the top 10 most specialised regions. Both regions are outperformed by Edinburgh - the only Scottish TTWA to make the top 20 ($LQ_{SIC62+63}^{Edinburgh} = 1.32$).

The result shown in **Table 7** are interesting and may suggest that for many digital and data businesses, locating in a physical office space in a major city could be a weak strategy compared to operating in a residential area with good transport links to major cities.

However, assuming that a digital and data innovation cluster may emerge in Scotland, data at the UK level suggests any cluster would be most likely develop around the Edinburgh TTWA.

Table 7: UK TTWA digital and data location quotients

TTWA	LQ
Reading	2.66
Milton Keynes	2.11
Basingstoke	2.06
Slough and Heathrow	1.88
Guildford and Aldershot	1.65
Newbury	1.58
High Wycombe and Aylesbury	1.58
Luton	1.49
London	1.47
Cheltenham	1.41
Brighton	1.36
Stevenage and Welwyn Garden City	1.36
Edinburgh	1.32
Swindon	1.30
Oxford	1.29
Crawley	1.25
Bristol	1.24
Cambridge	1.24
Andover	1.19
Leamington Spa	1.15

Source IDBR and FAI calculations

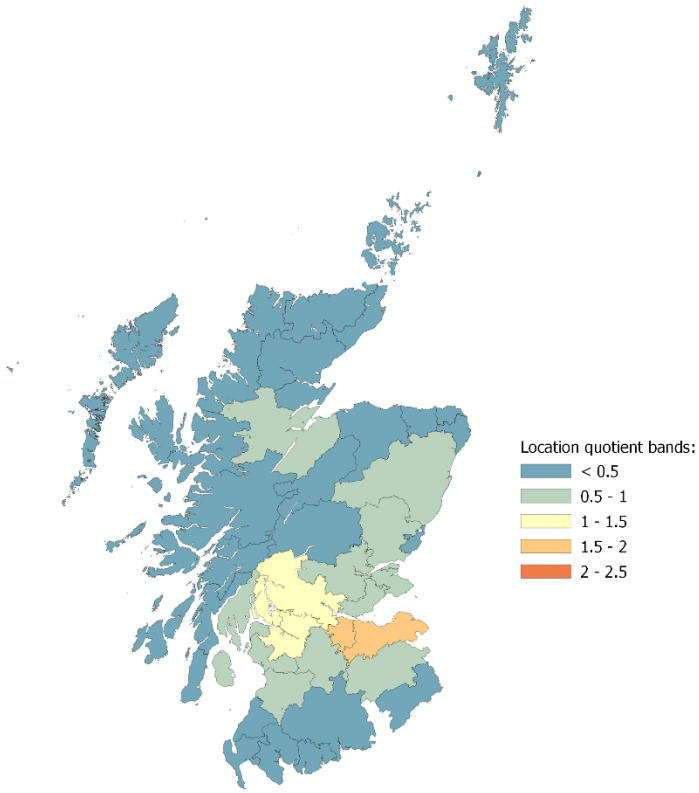
Scotland Location Quotients:

At the Scotland level, business count data presents a similar picture. However, with the LQ denominator being the ratio of Scottish digital and data businesses and all Scottish businesses, we see higher location quotients across the central belt. **See Figure 4.**

We can see from **Table 8** that Edinburgh, Livingston, Glasgow, Falkirk and Stirling, and Dumbarton and Helensburgh all have a LQ > 1, suggesting they specialise in digital and data businesses relative to Scotland as a whole.

When we dig deeper into SIC_{63} location quotients we find that Dundee is highly specialised in the leisure and entertainment software industry (SIC_{632011}) - with a location quotient of 4.75. However, at the broader level, Dundee can be seen to underperform nationally in the digital and data industry. It appears that specialisation Dundee has in computer game design does not seem to be a catalyst for further development in similar industries.

Figure 4: Scottish TTWA digital and data location quotient bands



Source IDBR and FAI calculations

Table 8: Scottish TTWA location quotients

TTWA	LQ
Edinburgh	1.93
Livingston	1.60
Glasgow	1.27
Falkirk and Stirling	1.11
Dumbarton and Helensburgh	1.06

Source IDBR and FAI calculations

Crunchbase Analysis

Previously, we focussed on understanding the range of digital administrative systems i.e., care management systems and case management systems that are used in the delivery of social care in Scotland and the extent to which the Scottish market was innovating in this space.

We now turn our focus towards understanding the market for assistive technology companies operating in Scotland to provide us with a comprehensive map of firms engaged with this technology across Scotland and a further list of SIC codes that are associated with these firms.

The method we will use replicates England-only analysis carried out by Dr Peter Bloomfield (2022) on behalf of Future Care Capital in a series of papers that were designed to map out start-ups and SME technology providers in adult care in England.

Our method was to use an online platform called CrunchBase Pro to conduct a broad search for companies in Scotland that are involved in assistive technology for social care.

CrunchBase is an online platform which catalogues business information i.e., business name, estimated turnover, description, employee count, financial data, etc, for approximately 225,000 companies registered in the UK.

Unfortunately, Scotland is not currently included as a searchable region withing the site's functionality. To address this issue, we manually entered a list of cities and towns based on Scotland's Travel to Work Areas (TTWAs). We found that approximately 9,000 Scottish companies are included on the site.

Our search for assistive technologies firms based in Scotland was carried out using the keywords presented in Box 9. **See Box 9**. The search identified 94 companies in Scotland categorised by one or more of the industry descriptions.

Box 9: Keywords for assistive technology search

"social care, residential care, elderly care, geriatric care, independent living, nursing home, dementia care, care homes, adult care, care provision, domiciliary care, nursing home, long term care, short stay care, respite care, supported care, supported housing, 24 hour care, live-in care, convalescent care, hospice care, palliative care, rehabilitation, rehab, fall alarms, remote monitoring, care platform, telehealth, space management, telecare, assistive tech, assistive technology, assistive technologies."

Data cleaning involved removing firms which were no longer trading, and firms registered as a charity where a company number could not be found – leaving 73 companies. Unfortunately, our search for assistive technology companies failed to identify any company based in Scotland that could reasonably be defined as an assistive technology company. Approximately 63% of the companies identified were classified as providing human health activities (SIC86), residential care activities (SIC87), and social work activities (SIC88) but were not involved in assistive technology.

Only a handful of firms were technology focused. One was classified under health and biotech 4% (SIC_{72}), while three companies were found to be classified under Computer programming, consultancy, and related activities (SIC_{62}) – none of which fit our definition of an assistive technology firm.

Cluster requirements - Labour supply and skills

As noted, industrial clusters need sufficient industry specialism but they also need a sufficient supply of labour to work for the businesses within the cluster. This next section looks at labour and skills.

London's TTWA has the highest number of employment in SIC_{62} and SIC_{63}, making up almost a third of Great Britain's (GB's) employment within these industries.

Employment in Edinburgh and Glasgow only make up 2% and 1.7% of GB's employment in these industries, respectively but they are the 9th and 12th highest TTWA for employment in these industries out of 218 TTWAs. Therefore, and as highlighted in previous subsections, there are clusters in the central belt cities of Scotland. **See Table 9**

Table 9: Top 20 Travel to Work Areas, by Employment in $SIC_{62\&63}$,

Top 20 TTWA	Employment SIC62&63
London	252,000
Slough and Heathrow	38,500
Reading	35,250
Manchester	31,000
Birmingham	22,400
Leeds	19,600
Guildford and Aldershot	19,450
Cambridge	18,450
Edinburgh	17,000
Luton	14,450
Bristol	14,000
Glasgow	13,800
Newcastle	10,700
Nottingham	10,500
Crawley	10,000
Milton Keynes	9,900
Oxford	9,500
Leamington Spa	9,125
Sheffield	8,250
Leicester	8,250

Source: BRES

Skills Capacity

On top of evaluating the business base and labour stock of the digital and technology sector in Scotland, it is important to understand the skills pipeline.

Mark Logan's review of the Scottish technology ecosystem mostly focussed on computing sciences and engineering education. Therefore, this section highlights the number of higher education students in the UK studying computing or engineering and technology, with some analysis of which Scottish institutions these students study at.

Computing, Engineering, and Technology Higher Education

Firstly, how do we define computing and engineering and technology higher education?

The Common Aggregation Hierarchy (CAH) provides a standardised hierarchical group of subjects. **Tables 10** and **11** outline the most and least aggregated groupings for the two subjects of focus for this subsection.

Table 10: Common Aggregation Hierarchy (CAH), Computing, UK

CAH 1	11 Computing
CAH 3	11-01-01 Computer science
	11-01-02 Information technology
	11-01-03 Information systems
	11-01-04 Software engineering
	11-01-05 Artificial intelligence
	11-01-06 Computer games and animation
	11-01-07 Business computing
	11-01-08 Others in computing

Source: HESA

Table 11: Common Aggregation Hierarchy (CAH), Engineering and Technology, UK

CAH 1	10 Engineering and technology
CAH 3	10-01-01 Engineering (non-specific)
	10-01-02 Mechanical engineering
	10-01-03 Production and manufacturing engineering
	10-01-04 Aeronautical and aerospace engineering
	10-01-05 Naval architecture
	10-01-06 Bioengineering, medical and biomedical engineering
	10-01-07 Civil engineering
	10-01-08 Electrical and electronic engineering
	10-01-09 Chemical, process and energy engineering
	10-01-10 Others in engineering
	10-03-01 Minerals technology
	10-03-02 Materials technology
	10-03-03 Polymers and textiles
	10-03-04 Maritime technology
	10-03-05 Biotechnology
	10-03-06 Others in technology
	10-03-07 Materials science

Note: CAH 3 subjects highlighted in orange are subjects that are likely not relevant to this research.
Source: HESA

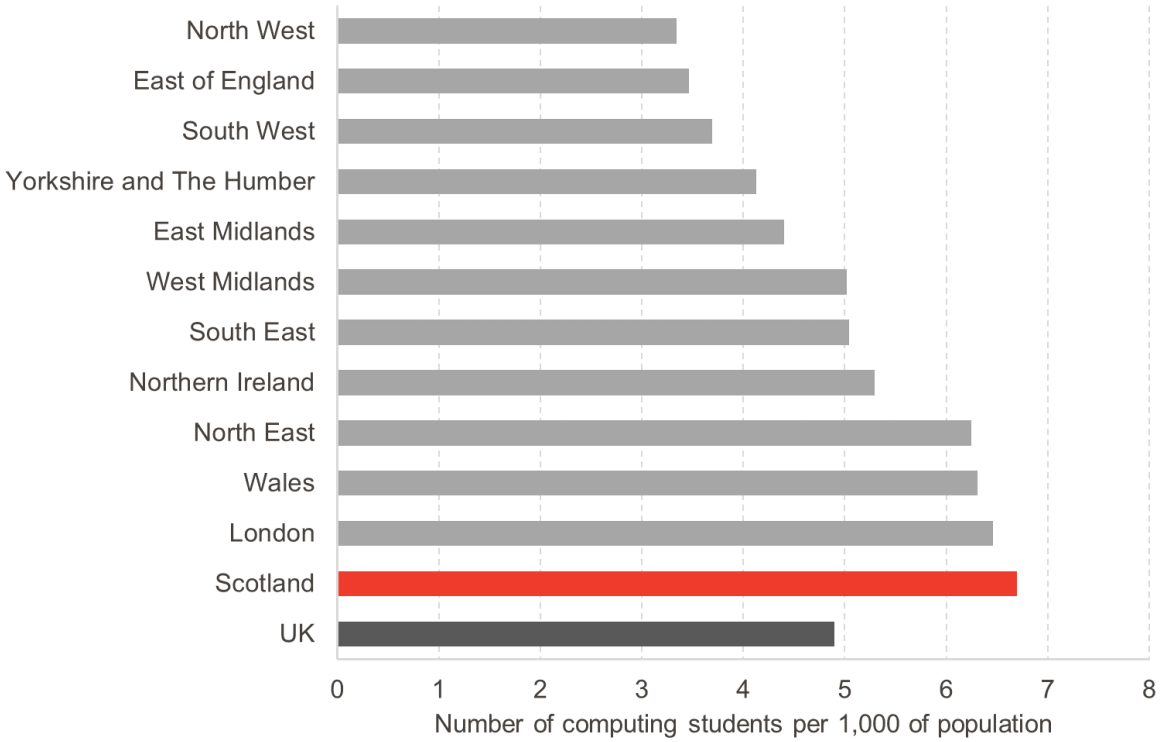
While all subjects within computing appear relevant to digital and technology innovation in a social care setting, the majority of subjects within engineering and technology may not be as relevant.

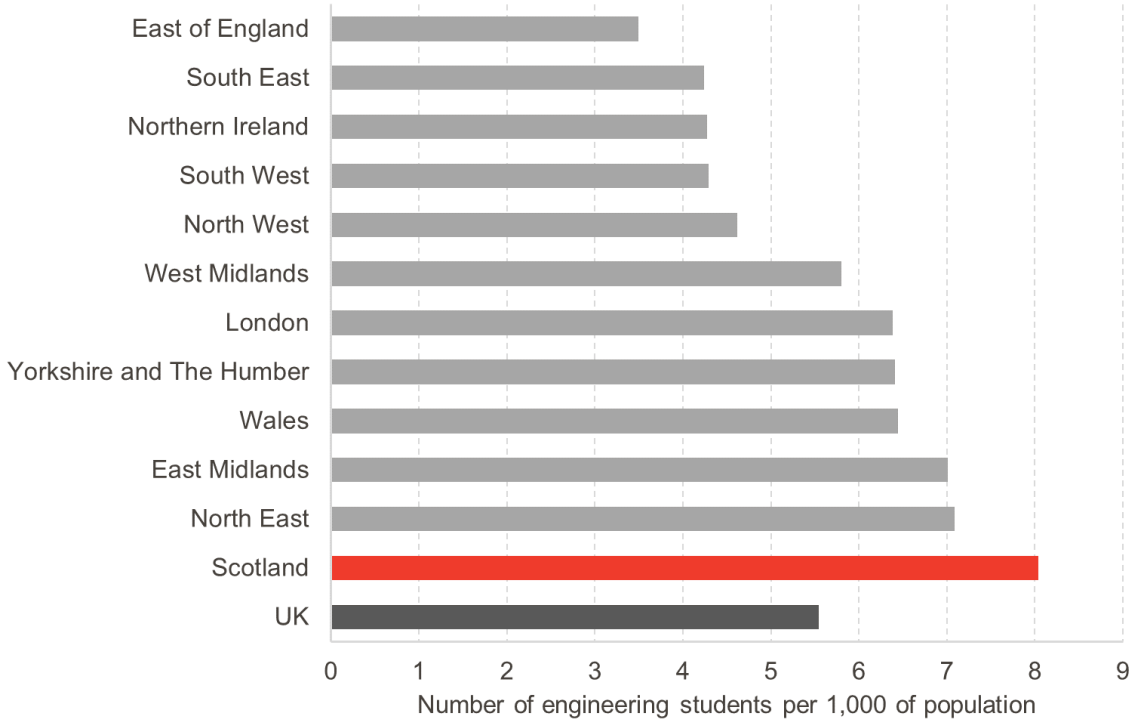
However, at the UK level, these less-relevant subjects make up a minority of total engineering students, whilst non-specific engineering, mechanical engineering, production and manufacturing engineering, and electrical and electronic engineering make up 57%.

Scotland has the highest number of higher education (HE) students studying computing and engineering (and technology) per head than any other region in the UK. **See Chart 2.**

In 2021/22, over 36,000 students in Scotland were studying computing, and over 44,000 studied engineering and technology.

Chart 2: Number of computing (top chart) and engineering (bottom chart) HE students, by UK Region 2021/22





Source: ONS; HESA; FAI Calculations

Scottish Universities

Glasgow and Edinburgh host the most computing and engineering (and technology) higher education students studying at Scottish institutions. 36% of Scotland's computing HE students study at institutions in the Glasgow area,[1] while 25% study at universities in Edinburgh[2]. Under 8% of computing students in Scotland study in Dundee[3] and Aberdeen[4], respectively. **Chart 3.**

While Abertay University does not rank highly among Scottish universities for computing, it is the 8th most popular university *in the UK* for computer games and animation studies, with 400 enrolled in 2021/22.

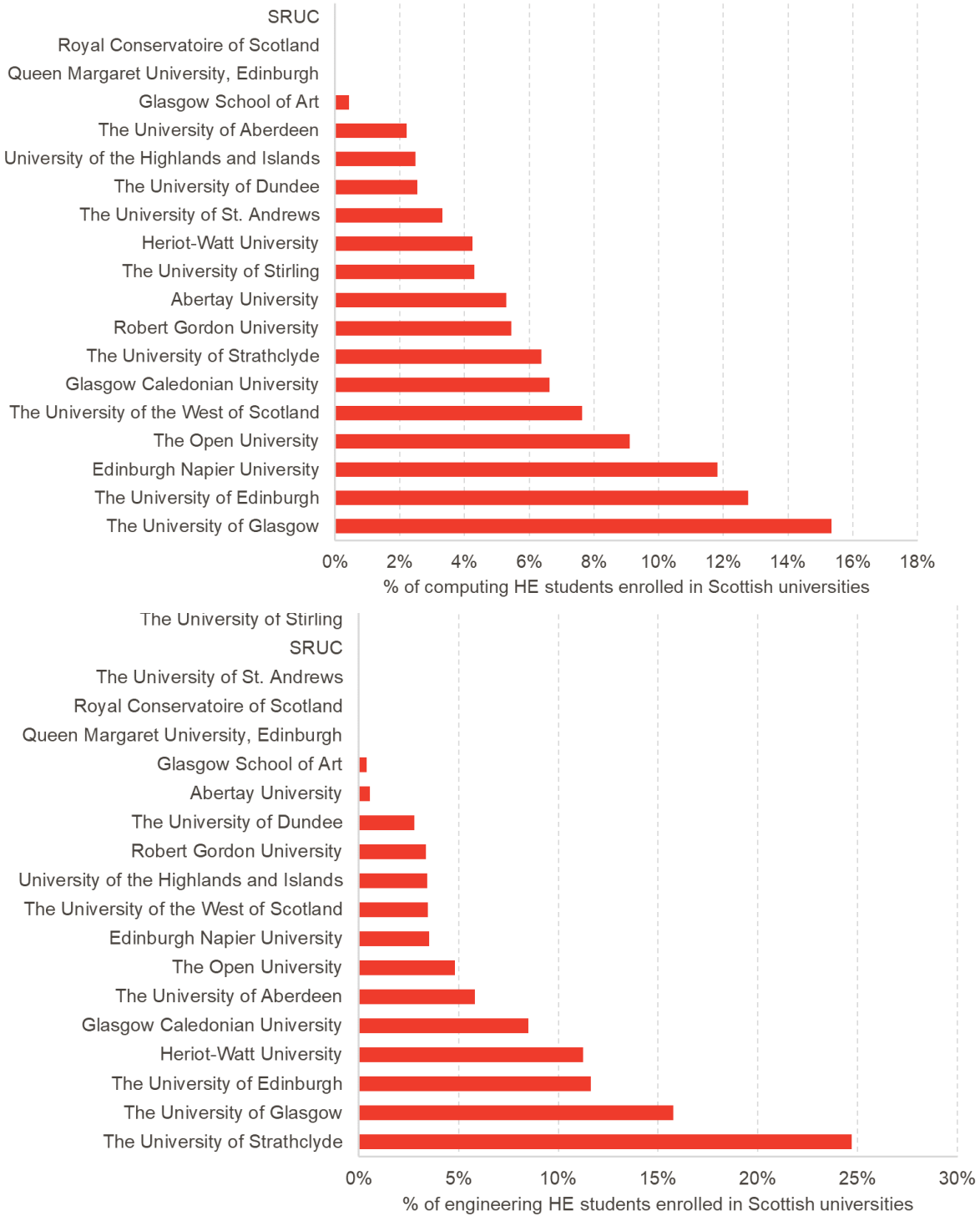
When it comes to engineering, almost half of the students studying engineering in Scotland study in the Glasgow area. 23% of engineering students are in Edinburgh, while 9% study in Aberdeen. Just 3% of engineers study in Dundee. **See Chart 3.**

Further Education

We cannot forget the important role further education plays in ensuring the technology skills pipeline is in the right shape to support digital and technology innovations in Scotland. Data from the Scottish Funding Council shows that in 2021/22 there were almost 42,000 engineering[5] and over 28,000 Information Technology and Information[6] college students enrolled in Scottish institutions.

[1] Includes: The University of Glasgow, Glasgow Caledonian University, The University of Strathclyde, and Glasgow School of Art. The University of the West of Scotland is not included as it hosts computing students in its Dumfries campus.
[2] Includes: The University of Edinburgh and Heriot-Watt University.
[3] Includes: The University of Dundee and Abertay University.
[4] Includes: The University of Aberdeen and Robert Gordon University.
[5] This subject includes courses from electronic and mechanical engineering to ship building so not all courses will be relevant to technological innovations.
[6] This subject includes courses from computer science to librarianship so not all courses will be relevant to technological innovations.

Chart 3: Share of computing (top chart) and engineering (bottom chart) HE students in Scotland, by Scottish university, 2021/22



Source: HESA

Annex 5: Research Participants

Table 12: Research participants

	Organisation	Descriptor
Participant A	Professor Dave Newby, University of Edinburgh	University/Innovation Centre
Participant B	Mydex CIC	Tech company
Participant C	Professor Jonathan Seckl, University of Edinburgh	University/Innovation Centre
Participant D	Professor Timothy Walsh, University of Edinburgh	NHS & University/Innovation Centre
Participant E	Social Work Scotland	Care sector body
Participant F	Techscaler (CodeBase)	Innovation sector body
Participant G	Health and Care Futures Initiative, University of Strathclyde	University/Innovation Centre
Participant H	Anonymised	Public sector
Participant I	Digital Health and Care Innovation Centre (DHI), University of Strathclyde	University/Innovation Centre
Participant J	Anonymous	Public Sector
Participant K	Scottish Care	Care sector body
Participant L	Scottish Commission for People with a Learning Disability (SCLD)	Representative body for people with a learning disability
Participant M	Blackwood homes	Care Provider
Participant N	Anonymised	Innovation sector body
Participant O	Care Policy and Evaluation Centre (CPEC), LSE	University/Innovation Centre
Participant P	Carezapp	Tech company
Participant Q	HRM Home Care	Care provider
Participant R	HelpFirst	Tech Company
Participant S	Anonymised	Innovation sector body
Participant T	Abbottsford Care	Care provider
Participant U	Associate Professor Mauro Dragone, Heriot Watt University	University/Innovation Centre
Participant V	Care Inspectorate	Public Sector

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