Digital, Data and AI Skills sector in Scotland

Problem discovery report

on behalf of Scotland's Digital Strategy, STER, and the Scottish AI Alliance

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1.   Introduction and context

This report is a summary of a problem discovery process initiated by the Scottish AI Alliance and the Scottish Government in 2021 to explore what interventions (if any) might be required at strategy level from the Scottish AI Strategy, Scottish Tech Ecosystem Review (STER) and the Scottish Digital Strategy to support data, digital and AI skills and careers pathways.

The project was commissioned in response to an earlier process which had identified the need for the project to fully understand, gaps, overlaps and challenges for bodies working at strategic, and delivery levels to support the delivery of skills and careers pathways related to data, digital and AI-focused skills and career pathways.

Specifically, the project was tasked with delivering a workshop and follow-up report to:

1. Identify what the current problems/barriers/bottlenecks are in the digital, data and AI skills space.

2. What efforts are currently being taken across key organisations such as Skills Development Scotland and Education Scotland are to address these problems/barriers/bottlenecks.

3. Where can government strategies/initiatives like STER, Digital Strategy and AI Strategy intervene and what can they do to support the expert organisations to solve these problems/overcome these barriers/unblock these bottlenecks?

The Scottish skills landscape for delivering on data, digital and AI

The skills landscape in Scotland is a busy space, with many organisations delivering formal and informal learning across a range of platforms. Institutionally, the Scottish Education Reform process is under way and is likely to impact on the shape and nature of the sector and so it is important to recognise that this report takes a snapshot of the issues prior to the education reforms being implemented.

Some of the issues identified through this project are related to the institutional arrangements at play in the education and skills sector generally and while they intersect with issues specific to the data, digital and AI space, they are broader and are therefore not the direct focus of this work. This includes core funding arrangements, governance of the sector, regional divisions and resource allocations and general curriculum drivers.

Method

The project included three elements:

- Interviews and background research
- Problem discovery workshop with stakeholders
- Framing the final report.

Interviews and background research

We conducted a series of background interviews with a limited number of representatives from core strategic and delivery bodies including STER, Skills Development Scotland (SDS), Colleges Scotland, Education Scotland, Scottish Information and Computing Science Alliance (SICSA) and the Scottish AI Alliance.

The interviews, along with a limited review of background material including the three strategies and relevant reports and guidance focused within the skills and careers sector, provided a clear sense of the landscape in delivering skills and career pathways in Scotland (from school age children through to post graduate study) and informed the finetuning of the problem definition workshop methodology.

Problem discovery workshop with stakeholders

Stakeholders were invited to participate in the workshop and were sent in advance a short questionnaire to prepare them for their involvement in the workshop. This included asking participants to consider what problems, 'asks' and 'offers' they could highlight during the workshop.

Stakeholders from the following organisations participated in the 2.5 hour workshop:

- Scotland's AI Strategy
- Scottish Digital Strategy
- Scottish Tech Ecosystem Review
- CodeClan
- Colleges Scotland
- The Data Lab
- DDI
- Education Scotland
- Royal Society of Edinburgh
- ScotlandIS
- Scottish Digital Academy
- SICSA
- Skills Development Scotland

2.   Workshop outputs

Problem definition

Some clear themes emerged from the problem definition phase and several dimensions or elements were also identified as important factors. These are summarised below.

- Understanding and demystifying digital, data and AI

- Collaboration gaps

- Regional challenges

- Upskilling and reskilling

- Hybrid and wider skills

- Industry involvement

- Diversity and inclusion

- Responsiveness (horizon, agility, capacity, funding)

Understanding and demystifying digital, data and AI

There is a significant problem set around the level of basic understanding through to literacy on what digital, data and AI variously mean in all walks of life. The problem is corrosive in that it impacts on what learners understand and what they are being offered, as well as what educators understand and are prepared to offer. The problem extends into industry (both at SME and micro scale and in corporate culture) and in government.

The digital, data and AI 'world' is itself growing at an extremely fast rate. This creates on the one hand a skills shortage crunch, and on the other, yet more innovation and new knowledge which needs to be absorbed into a pipeline of skills packages for learners of all ages.

In the workshop, the problem was highlighted in relation to the following elements:

Branding / description of courses – they do not necessarily reflect how the knowledge and skills can be applied and remain very 'dry'. Consequently, there can be a lack of interest from learners in undertaking them as they do not appreciate how they could apply them in real careers.

There is lack of a lingua franca around basic and more complex terms. Definitions lack plain English meanings and, in some cases, there are multiple definitions. This is confusing to learners.

Teachers can find themselves in a difficult situation in making selections on courses to teach. Some new courses may be deemed not relevant or perhaps not easily teachable, while some existing courses may no longer be fit-for-purpose due to the rapidly evolving environment.

Careers and roles in the industry are not being promoted in the context of everyday applications. As people don't tend to promote roles or careers that don't benefit the family or the community these courses are under-promoted.

Visibility of the power of digital, data and AI (and therefore why they are good learning choices) is particularly low for people who influence students around their choices - parents, early teachers, mentors

People working in the field in highly mature areas are used to communicating in complex terms, not realising that their language actively excludes less advanced learners. This can put off people from embarking on learning pathways who are intimidated by what they perceive are the threshold requirements in terms of aptitude etc.

In relation to AI in particular, people don't understand it and there is a perception that it is only for the 'smart' people of the world.

Collaboration gaps

The sector is not an island and digital, data and AI skills are required across the board in all walks of life. The challenge in a skills context is to embed these skills as part of a wider context-rich knowledge and skills set. More and better collaboration is also called for in relation to bodies that are working in the same or similar spaces to resolve the duplications and gaps that persist.

Key points and questions raised include:

How to embed digital, data and AI skills in other areas? Part of the secret is how to contextualise – i.e. how to make these skills relevant and attractive in the context of their health and social applications for example.

Do we know what a strong skills set encompasses in the context of digital, data and AI when applied in a broader context (what do these frameworks which take in context-specific applications look like?)

We should make our courses available across a wider student set - a lot of concern is about perceptions (concerns about whether programming etc is needed). This perception that programming or other core skills are a prerequisite can be off-putting. It makes AI a thing where it is seen as only for the gamers and geeks. From undergraduates through to post-graduate and upskilling – we need to recognise that the skills pertaining to digital, data and AI are not only the core skills, but also wider contextualised skills including creativity, communications and so on.

There are lots of good interventions in the space - but how do we identify the good elements – so that we are not just adding, but also joining up existing good work?

The funding situation makes it difficult to think long term. It is not mainstreamed but pockets of money are often annualised. We need a longer-term frame for financing learning - collaboration is key.

Regional challenges

Regional challenges were highlighted, not only in the context of the need for collaboration, but also in terms of the impact of regionality on getting resources from one region to another, including teachers matching demand.

Regional engagement with technology is not uniform. There has been some good engagement but some areas have little uptake and engagement. We need to understand better about the regional-specific picture.

What's offered in schools for computing science is perhaps not as bad as we initially thought - but there are definitely issues across the board in the regions. There seems to be a high drop off rate at teacher training. There is a mismatch between offers and demand for positions from teachers. It is costly for teachers to move region and these issues combined to create challenges for appropriately supporting computing science in all regions.

Within regions there are frustrations about what can and cannot be funded from a regional perspective.

The impact of the COVID pandemic in terms of moving to online access has resulted in an unexpected benefit particularly in the central belt. It offers the potential to use the limited resources we have in terms of experienced teachers to create accessibility across Scotland via online delivery.

While there has been a recent increase in resourcing in the skills programme - it has also become a complex and difficult landscape to navigate particularly in the regional versus national context. There is a risk of pockets of isolation - more knowledge-sharing and collaboration is needed.

Upskilling and reskilling

Moving up the skills ladder from basic computing science into data science, AI (and beyond) is seen as a particular challenge within the industry. Reskilling educators and other workers is also challenging in such a fast-moving environment. There were a myriad of sub-issues identified in the workshop, summarised below.

There is a need to have leadership on board at employer and more senior levels within industry generally in understanding the nature of the problem and how they can be part of the solution. Who needs to be upskilled and why?

Lack of funding longevity as well as regionality can create barriers in this area for education institutions. It is hard to resource courses at short notice with additional staffing (for example where re-funding a course designed from the previous year is only confirmed close to semester commencement).

There is a need to work earlier in the education process to capture the upskilling requirements of learners as they begin to make career defining choices.

There is a need to match requirements with fast-moving skills for SME communities as well as for teachers. Trying to identify ways for industry to update knowledge and skills in short sharp hits. A continuous learning approach might be appropriate.

Within government, digital and data skills are a very specific area (defined in terms of skills and roles). AI in the public sector is addressed in a brief way as part of this skills offering but is still in its infancy. Broader questions will apply equally in government as in the wider industry.

Sometimes we forget about employers' needs at mid-level within their organisations – how do we help mid-career upskilling occur? There is a related question of understanding – branding and demystifying is also relevant for mid-life careers – how do employers and teachers help employees to recognise the need and upskill accordingly?

There is a lack of focus on careers advisors as key conduits to students with which communication about upskilling and reskilling can occur. Careers advisors need to be aware of the upskilling/reskilling opportunities available.

There is a need for educators to be able to highlight the application of AI even if they aren't equipped to teach it. This leap from being an advocate for, and an expert in, is something which holds many back from speaking about the area.

There is a lack of educators with the right qualifications to teach upskilling and reskilling courses is a real problem.

Hybrid and wider skills

There was a recognition that most employees need far more skills than pure digital, data and AI core subjects to work in the field more broadly. These include communications, project management, innovation, engagement and so on. In reverse, there are many careers which will require a component of digital, data and AI skills set, but which are largely focused elsewhere. This links to the wider industry challenge of making leaders aware of the power of digital, data and AI to transform their existing products and services. As such, the hybrid skills sets might begin at basic literacy of some foundation concepts through to careers which have a foot planted deeply in more than one camp (as for example, in the gaming industry).

Understanding of what is possible within digital, data and AI and what is possible in combination with other skills is key. Here, PR and courses description and branding important. In addition, upskilling existing employees at mid-level and upwards is crucial as this is where the bottleneck exists. The bottleneck stops junior level staff from progressing. This needs top-down and bottom-up effort.

The challenge is to consider the whole education curriculum in the round as part of the whole educational reform agenda as the problem lies not in just one component (i.e. AI or digital). There are lots of different requirements across many streams - but how do they fit in to the overall curriculum? The question is what should young people be learning in the future (as opposed to designing a curriculum in response to the loudest voices)?

Actions in the digital strategy are they well-articulated. But perhaps more work that needs to be done that fleshes out what the high-level commitments mean – for example in relation to skills – seeking to drive more action at a strategic level.

Industry involvement

It was recognised that there were definite limits to industry time in getting involved in the skills effort, yet this created a double-edged sword effect – where on the one hand, industry had overblown expectations of what digital, data and AI could do, and on the other hand – were not able to articulate well what they needed from educational institutions in terms of course offerings. These issues are summarised below.

A challenge is in and of itself how to get industry represented within the skills environment in an ongoing way?

Universities experience overblown expectations and misconceptions particularly from SMEs about what is possible and, also on what AI is. There is a view that it provides black box solutions.

Digital maturity is low particularly among SMEs, but the opportunity is there for much greater involvement as companies mature digitally. For example, they take on people with digital skills and develop a range of jobs with different skills levels.

AI is perceived within Industry as a university level thing. The steps that lead up to that level are not clearly understood and therefore the accessibility of AI courses is an issue.

Certain recruitment barriers for smaller organisations are often in place. For example, targeting degree experience but they also looking for sector experience. Research notes that there are recruitment barriers to finding the right balance between these requirements. How do we lift that recruitment constraint so that individuals have both sides to the experience required?

Diversity and inclusion

Diversity and inclusion is a significant problem area right across the board, with actual and perceived barriers preventing girls, women and under-represented and otherwise marginalised groups from accessing skills and experience in order to pursue careers in the industry. Key issues highlighted are summarised below.

The gender imbalance and lack of diversity in representation creates problems for encouraging others to enter the industry. Inspirational role models with a balance of representation is required at all levels and roles.

While gender is a crucial diversity issue, wider diversity issues need also to be addressed - disabilities and minorities, but also to include socio-economic exclusion.

Diversity and inclusion in tech particularly for women needs to take account of particular life events and needs for example career breaks. We need to consider how better to support neuro-diverse people as well. There has been some good work done in the tech sector to plug skills gaps for example with Barclays. We need to be able to share these successes and build on the model.

Responsiveness (horizon, agility, capacity, funding)

Many of the problems raised throughout the workshop related in some way or another to the capacity for responsiveness in funding, resourcing or by other means. This is a selection of the comments that point to wider issues at work.

It is easy to focus on students in the context of skills and learning. However, the broader picture is that the level of literacy and basic understanding is low throughout society - making sure people are aware about what AI, digital and data is. Can we look at the role of colleges to provide short courses and pathways for students so that they are able to bridge understanding gaps easily?

We need good ways of exposing people to the value of data, digital and AI (from other subjects) – to be able to explain and see the value (without having to 'teach' it).

Teachers are having to prioritise their CPD hours and may not always prioritise them for upskilling in these areas. At a college, the teachers are challenged by having to upskill in this way. This is particularly important in areas with fast-moving skills requirements and tight budgets.

3. Current efforts

All organisations represented were able to point to considerable work that is ongoing or that has been completed in the sector addressing specific elements of the problem areas identified. It was generally agreed that genuine gaps in the sector are relatively rare, rather - that promulgating the best solutions is not necessarily coordinated, uniformly resourced, or well-advertised (accessible). There was also agreement that in some cases there is duplication and knowing where to focus effort is, in itself, a challenge. As one participant noted:

'It is sometimes important to know when to kill a programme as part of highlighting projects and programmes that work very well.'

While there is no suggestion that this report will comprehensively identify all the current efforts, this selection demonstrates that there is a range of work occurring right across the sector which may be useful if applied differently, more widely or with greater penetration.

ScotlandIS ran for a number of years a digital champions course for SG to help demystify some of the terminology and acronyms within the sector, helping them understand some of the conversations especially when looking to procure solutions/services.
Code Clan DIGITAL101 designed get lexicons, verbiage and processes on the same page.
Deep dive workshops in Scottish government to unpack what is there in the digital skills agenda
SDS – developing a digital economy skills plan just being commissioned that will hopefully develop a series of actions. Trying to join these conversations up. WIP Summer 2022
A wide range of activity relating to data skills across the DDI SG https://ddi.ac.uk/what-we-do/people/
Scottish Digital Academy have partnered with AWS training to deliver this course for SG/public sector people that helps demystify https://digitalacademy.gov.scot/courses/artificial-intelligence-and-machine-learning-aws/
Data focussed skills - data literacy pilot DDI SG is running at West Lothian College in partnership with The Donaldson Trust and which targets neurodiverse learners (limited by geography).
'Digital Start Fund '& 'Technology Apprenticeships'

Code Clan - we are looking at the resources Microsoft already have available to create level 6 courses.
Education Scotland – need to also work with other industry players to get courses designed and also to allow students to see companies in their work places
Interesting initiative for trainee teachers here: ttps://dataschools.education/digital-and-data-champions-in-education-edinburgh-award/
Institute of Physics work on teacher CPD https://www.iop.org/about/publications/subjects-matter
An interesting international example of a national effort to upskill the whole workforce – for non-IT professionals and particularly job seekers/unemployed in Japan. https://news.microsoft.com/apac/2022/01/21/microsoft-and-adecco-groups-modis-to-skill-200000-it-professionals-in-japan-by-2025/
Growing body of graduate apprenticeship courses. Seeing a lot more integration of AI into non-computing courses. Demand is huge for short courses.
Developing an amalgamation of various Microsoft online courses - taught across a range of institutions. Trying to get away from coding specifically. Hoping this will attract a completely different demographic - i.e. female students and those from a range of backgrounds.
Digital critical friend programme - schools programme. Just kicked off in Glasgow - starting to pull through success stories. Supporting teachers delivering ICT curriculum - trying to expose young people to the sector - in the sector as a whole. Highlighting all opportunities within the sector
https://wearefutures.com/report/
A free online course on Artificial Intelligence was launched in Finland a few years ago. The Elements of AI course seeks to demystify AI by making it more accessible - it is targeted to anyone who is interested in learning more about AI with no prior mathematical or programming skills required.
www.sqa.org.uk/sqa/91965.html
'Digital World' & 'Digital Champions'. 'Tech Experts in the Classroom' - co-developed and co-taught
March - mini conference - Dan Baker AI evangelist in Microsoft - demonstrated fast and practical uses. Taken the strategy that we do AI before we do data to introduce concepts. Combats perception that data is boring.
The DataLab and Interface to connect to industry - events like Datafest and other events run by SICSA. Showcasing success. A lot is focused on applications of AI.

Scotland IS worked with smart stems and gathered some information from P6-S2 girls and got some of their perceptions on digital careers and what they'd like to do in school in this space happy to share some of these

The Data Lab have leadership programme aimed at industry leaders
https://thedatalab.com/skills-talent/leadership-training/

STER / SDS National Transition Training Fund:
Digital Start Fund: Digital Start Fund - Open for Applications | Digital World
Digital Skills Pipeline: Digital Skills Pipeline - Open for Applications | Digital World

SDS: Digital World: https://www.digitalworld.net/

SICSA: https://thebrilliantclub.org/researchers-in-schools/
This organisation focuses on including research skills in pre-university education.
A similar "club" for AI might be useful as well.

4.   Strategic interventions

Several elegant ideas emerged from the workshop which respond on multiple levels to the problem clusters identified. These are supported by a number of core action areas – some of which are able to be achieved by collating existing resources, and others which will require fresh undertakings.

Following the desire lines for communities and individuals – to 'be' what we can 'see'.

An insight emerged around the way in which people engage with career choices and learning - recognising that people see themselves in the opportunities and activities around them. The phrase 'you can't be what you can't see' encapsulates the core challenge for jobs and skills in data, digital and AI. They can be difficult to market, because the application of these skills to real world situations is often not on show. To counter this, the link needs to be more apparent between real careers, people and communities and the skills required: – diverse, local, engaged role models and activities are what will draw young people and people looking for early to mid-career changes towards the digital economy.

This concept forms the spine of a number of core ideas:

- **Champions:** A public-facing campaign to highlight and inspire where people are working in or with digital, data and AI in local communities, and in inspirational positions (sports, leisure activities, hospitality etc). The campaign would identify individual role models/champions who are working with or in the field.

- **Understanding:** Building on the work of SDS and Scotland IS to demystify core concepts in data, digital and AI – to develop a common set of plain English definitions and descriptions that can be used widely.

- **Cheerleaders:** Build on the work with influencers (teachers, mentors, parents, senior managers and leaders) to inspire them to usher in young people into careers in data, digital and AI and to encourage young people to think about hybrid careers as well – based on the principle that people do not need to be experts to be advocates for change.

- **Empowered leadership:** Create and build on offerings in the market that address the skills bottleneck in senior leadership – enabling leaders to obtain the necessary skills, knowledge and understanding within data, digital and AI to engage with those more junior to them – and so that a shared literacy emerges at organisational level.

- **Proof:** Develop some compelling case studies that demonstrate how data, digital and AI skills impact on, and are at the heart of everyday, necessary activities.

Take an outcomes focused approach to areas which are fast-moving – following where industry and other experts need innovation

The digital economy is one of the fastest moving sectors globally. The rate of innovation means that emerging technology and knowledge can easily outpace existing understanding. This creates a category problem for educators where new courses struggle to remain up-to-date even when they are fairly fresh. In addition, students may be looking for skills profiles that match what they see at the cutting edge and are struggling to put this together for themselves as a skills and careers pathway.

One potential pathway is to partner with industry in creating learning opportunities that link directly to industry demand. There are already a range of examples of courses and packages being created in concert with specific industry players, or in response to the demand for hybrid skills as a way of increasing the literacy, confidence, and 'bench-ready' capabilities of job entrants. These approaches appear to have won support and interest from industry and candidates alike.

Key ideas which link to this include:

- **What do young people want:** Build on existing research on user requirements in particular for young people about the skills and career opportunities they are excited by, and those they see as barriers – focusing on what portfolios of skills do they want to assemble, how do they 'see' themselves into the future;

- **Challenge-led:** Explore the concept of challenge-led engagements – including around courses, industry experience, and innovation to enable individuals to better align their skills to the challenges at hand, the resources required to support a challenge-led approach – and the relative capacity to involve industry in this process;

- **Help people find what they need:** Focus and support the existing work of The Data Lab, STER and SDS to create/evolve directories that help people navigate the complex landscape for skills and careers.

Joined-up government – gaining strategic insight and steering critical interventions

It is clear that, in a fast-paced environment, government is one of the hardest establishments to move in an agile way. The problem is multi-faceted: governments focus well in specific areas, and sometimes struggle to reach out beyond their own 'patch' to other wings of government for fear of over-stepping remits and due to everyday challenges such as ongoing daily work pressures. In addition, identifying new knowledges and emerging innovation sufficiently quickly to absorb into governmental programmes and action requires an inherently risky engagement process (not all innovations make to mainstream or are inherently 'good'). Governments are also challenged to absorb learning into their own processes – data literacy and maturity being one simple but all-encompassing challenge facing all elements of government everywhere. It is noted that good work is occurring here – but the task is significant.

One way to help the Scottish government to improve its preparedness is to actively consider its role as a strategic insight curator. What does government need to do in order to be able to meaningfully engage and intervene at key points?

Some key elements to this that were identified include:

- **Shaping the future:** An overt deliberation on where the Scottish digital economy is going to be in 5-10 years? What does the government want to see happen in that timeframe and how can it help make that happen? Part of this approach needs to be considering the international picture – what is happening in other key centres and how does Scotland complement or compete?

- **Tending to the governance garden:** A review of how well joined-up government is in its data, digital and AI space – what needs attention and in particular where are the current gaps, and how can they be remedied. While there is a lot of good work occurring, it will be important to optimise this. (One suggestion was to start with a review simply from a data perspective recognising that trying to do everything by 'boiling the ocean' is a fruitless endeavour).

- **Collaboration and sharing the benefits:** While government at the centre can make strategic interventions, the regions are busy innovating in many cases, but due to the nature of regional responsibilities and funding arrangements, the benefits of these innovations are not shared equally (sitting within regional boundaries). How can regions better collaborate to share learnings, course designs, resources and innovations?

5. Conclusions and next steps

The workshop identified a number of strategic intervention areas and some specific tasks which might fall under these. The purpose of the report is not to identify a definitive list, but to highlight where interventions would be useful.

While it is unlikely that all of these will be able to be taken up at once, there is an opportunity and the will to take this forward, building on the momentum generated through the skills sector working groups and this workshop. The baton is now with these bodies and through the three policy strands of the Digital Strategy, STER and Scotland's AI Strategy to determine how they can take these strategic interventions forward.