Scottish Research Innovation Futures

Economic Development and Enterprise: The Future of Work in Scotland

Event Report | 15th June 2021

"Today's two themes are critical for our economic recovery and the future of how we work: the first is manufacturing and green economic recovery; the second is digital infrastructure."

Dr Alicia Greated, CEO of KTN and Event Chair

Scottish Research Innovation Futures is a challenge-focused workshop series, organised by Research Innovation Scotland (RIS) in collaboration with the Knowledge Transfer Network (KTN). The series aims to explore how collaborative research and innovation can tackle grand challenges and help Scotland build back better from Covid-19.

This second workshop in the series, 'The Future of Work in Scotland', focused on two areas critical to the future socio-economic growth and prosperity of Scotland: 'Manufacturing and Green Economic Recovery' and 'Digital Infrastructure'.

The workshop was led by two Scottish Research Pools – SRPe (Scottish Research Partnership in Engineering) and SICSA (Scottish Informatics and Computer Science Alliance) – in collaboration with KTN, and focused on economic development and enterprise.

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1. Introduction

"This is an opportunity-rich period for researchers, innovators and industrial investors."

Workshop speaker

The recovery period from the pandemic offers a compelling opportunity to shift to a more productive economy, and digitalisation and sustainability will be at the heart of that shift. This second Scottish Research Innovation Futures (SRIF) workshop explored how collaborative research and innovation can support the Scottish Government's vision of Scotland's digital future and green economic recovery.

The initial scoping exercise brought together experts from research, industry, government and funders to consider how research and innovation can accelerate digitalisation in two key areas:

- manufacturing and green economic recovery
- digital infrastructure

Participants discussed the main challenges, opportunities and priority areas, including how to build and strengthen the required skills pipeline, and what should be the next steps for RIS partners and their wider networks.

2. Setting the Scene

"We should bear in mind that it's easy to develop corporate and national amnesia, forgetting what's been created and what value lies in it. There's always an attraction to create new stuff, and that's right and proper where there's a gap. But I always suggest we reflect on the value of what we have, and see where the greater degree of interconnectivity is."

Workshop speaker

The starting-point was an introduction by event chair Dr Alicia Greated, CEO of KTN, and a panel and Q&A session featuring:

Professor Sir Jim McDonald, President of the Royal Academy of Engineering, and Principal and Vice Chancellor of the University of Strathclyde

Alistair Forbes, Fellow in Mathematical Modelling and Experimental Data Analysis at NPL

Gillian Docherty OBE, CEO of The Data Lab

The plenary sessions generated a number of threads that were then woven throughout the workshop, including discussions of how to translate them into action and change.

Scotland should build on its research and innovation assets, including the Research Pools, Innovation Centres and Interface. This should include seeking greater interconnectivity and offering them wider opportunities to leverage their knowledge and innovation capabilities.

Scotland should exploit its size and connectivity, making best use of its "fabulous networks of organisations, people, and businesses" in order to capture opportunities and dismantle barriers.

The research and innovation community and industry should be "super-ambitious" in their pursuit of opportunities emerging post-pandemic, such as the acceleration of digitalisation, and the funding and support coming from governments. They should also offer constructive challenge to governments to follow through on commitments.

The voice of business and industry is critical. Increasing Scotland and the UK's investment in research and innovation requires major engagement from businesses, and they also have a vital role in articulating skills needs and supporting skills development. RIS partners (Research Pools, Innovation Centres, Interface), universities, colleges and policymakers should "make sure businesses and industry are at the heart of their plans".

Scotland's research and innovation community should continually build its evidence base, data and advocacy, to show the impacts of its work. Industry is an important partner in telling this story.

Locality is important in skills and economic development. Universities and colleges can play a strong role in supporting local industries and local needs.

Digital innovation must be inclusive, and diversity of ideas and perspectives is crucial. Not only will diversity help to identify problems and solutions, it will protect against possible negative impacts, such as digital exclusion or the use of biased algorithms in artificial intelligence.

The "quality infrastructure" is vital to help businesses and society reap the benefits of industry 4.0 and build trust in digital systems – just as it was in previous industrial transitions.

3. Insights for the Future of Work: Breakout Sessions

"The way we get more people being ambitious is to be really motivational, using success stories and examples …. And then follow this up with action, resource, effort, assets."

Workshop speaker

Following the plenary sessions, six breakout groups discussed the opportunities and challenges for manufacturing and green economic recovery, and digital infrastructure, and identified potential research and innovation actions. Some themes were specific to manufacturing or digital infrastructure, while others were consistent across both areas, such as the need to:

- fill skills gaps, and anticipate skills needs as well as respond to them
- capture post-Covid opportunities, such as policy focus and funding, before windows close
- break down any existing silos to extend collaboration across disciplines and with industry and public sector

Therefore, in summarising opportunities and priorities, we have divided them into three groups:

- cross-cutting themes
- manufacturing and green economic recovery themes
- digital infrastructure themes

Note, however, that these different themes are firmly interconnected. For example, innovation in digital infrastructure will facilitate innovation in manufacturing and green economic recovery.

4. Cross-Cutting Themes

"Challenges don't live in disciplinary silos."

Workshop speaker

4.1 SKILLS AND TALENT

Strengths and opportunities: Though most discussion focused on the gaps and challenges in relation to skills, there was also some positivity about strengths. Across the manufacturing and digital breakout groups, there was praise for Scotland's "learning infrastructure", the "good structure of players" around skills and innovation, including the Research Pools and Innovation Centres, and the very able home-grown talent coming into projects.

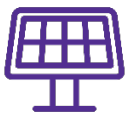
Scotland's apprenticeship system was also commended, with Foundation, Modern and Graduate Apprenticeships fuelling industry-academic collaboration and offering work-based learning opportunities right down to schools level. Some wanted evolution in the teaching of computer science and other STEM subjects to increase the talent pipeline coming into industry.

Challenges: There was wide agreement about the scale of the skills challenge. In the manufacturing groups came repeated comments that skills gaps or mismatches in engineering, construction, hydrogen and renewables could hinder Scotland's progress on green economic recovery and full exploitation of the opportunities around the digitalisation of manufacturing, and digital infrastructure. The digital infrastructure discussions lamented gaps in computer science and data science knowledge.

Another recurrent theme was a lack of connectivity and strategic thinking on skills, with calls for more industry input on *longer-term* skills requirements so that educators can develop and align courses accordingly – from secondary school teaching right through to doctoral level.

Priorities: Two areas of focus for the research and innovation community were flagged, both overlapping with the policy theme (below):

- Collaboration with industry and public sector to fill and anticipate skills gaps in manufacturing and digital infrastructure, and raise understanding of different career pathways and options.
- Work with government and local authorities to make Scotland an appealing place to live, study and work, so we continue to retain talent and attract it from elsewhere.



4.2 POLICY AND FUNDING FOR RESEARCH AND INNOVATION

Strengths and opportunities: Several participants referred to the good levels of interaction with the Scottish Government, and its commitment to green economic recovery and digital.

Challenges in relation to policymaking and funding included: a lack of funding available for evidence-gathering and case studies on innovation impacts; funders and agencies lacking resources for networking and collaboration; and the short timeframes for government funding.

Priorities: Based on these discussions, the priorities for policy and funding were identified as:

- Greater availability of resources (time as well as funding) for building case studies and strengthening networks.
- Covid-19 has propelled certain sectors and themes into the limelight – among them, digital, data, manufacturing and green economic recovery – bringing new opportunities around funding and policy focus. These opportunities should be maximised before they wane.

4.3 COLLABORATION AND NETWORKS

Strengths and opportunities: Scotland has a strong collaboration culture and an effective innovation ecosystem, including the Research Pools and Innovation Centres, which will underpin progress on digital infrastructure, manufacturing and Scotland's green economic recovery.

Challenges: Some believed collaboration must go further. Examples included better communication between industry, academia and policymakers on issues such as long-term skills needs (see above) and digital infrastructure. The RIS partners can help to broker this collaboration.

Secondly, it was pointed out that Scotland has "fantastic" natural assets and research and innovation capabilities, but that innovative start-ups struggle to scale up. One problem here is a dearth of long-term investment, an issue that neither private nor public sector can address in isolation.

Priorities: Specific priorities highlighted on collaboration and networks were:

- Collaboration across the research and innovation community and enterprise agencies to help start-ups and scale-ups engage with investors outside Scotland. This chimes with discussions in the first SRIF workshop.
- Stepping up collaborative activity on communicating stories and case studies to inspire potential innovators, entrepreneurs and funders, and convince industry of the benefits of investing in R&D.
- Aligning activity to the new UK Innovation Strategy and the technology "families" it highlights.

5. Manufacturing and Green Economic Recovery Themes

"How do we enable the [innovation] organisations that we have to take on more, do more – to drive more opportunity by leveraging their capability to do things and the way they do things?"

Workshop speaker

5.1 EDUCATION AND SKILLS DEVELOPMENT FOR MANUFACTURING

The issue of skills development was high on the agenda in all the manufacturing and green economic recovery breakouts. Many of the issues spotlighted – such as current and long-term skills gaps and the need for strategic thinking – have been covered above, under 'Cross-Cutting Themes'. There were also some points specific to manufacturing and green economic recovery.

Strengths and opportunities: The increasing focus on meta-skills in apprenticeship design was welcomed: while technical skills are clearly important, there is a strong need among learners and

employers alike for transferrable skills to support growth. There was some optimism around the National Manufacturing Institute Scotland's (NMIS) Manufacturing Skills Academy's intent to develop the "continuum of skills needs in manufacturing", from school to lifelong learning, to address the need for "national connected skills provision in manufacturing".

To increase the flow of talent into manufacturing, participants advocated better communication of the scope of engineering careers. One contributor signposted the opportunity to build understanding of how life sciences can link into careers in sustainable manufacturing and the circular economy.

A third strand of discussion highlighted the role of universities and colleges in supporting green economic recovery in rural and remote areas, with the University of the Highlands and Islands (UHI) campus in Inverness and the UHI / Scottish Association for Marine Science (SAMS) campus in Oban named as good examples of tertiary education supporting economically vibrant communities.

Challenges: The discussions around skills gaps pinpointed specific industries where skills barriers are a risk to green economic recovery, notably construction and renewables.

Priorities: Based on these discussions, participants saw a number of priority action areas:

- Developing the suggestions above about increasing understanding of engineering and the continuum of skills needs and pathways in manufacturing.
- Exploring further how government can better support universities and colleges to build clusters of expertise to fuel local and regional growth.

5.2 DECARBONISATION, ADAPTATION AND TRANSFORMATION

Strengths and opportunities: Participants signposted a number of compelling opportunities:

- Accelerating the transition to a zero-carbon built environment and to supply chains based on locally sourced, sustainable timber. The challenges highlighted here included how to leverage our research capabilities to develop solutions that can be scaled, and how to develop a workforce and supply chain able to deploy them. However, the opportunity is immense: over 1 million assets need to be retrofitted in Scotland to decarbonise the built environment.
- Capturing Scotland's unique opportunities around hydrogen, all the way from production to storage to distribution and use, and building upon the Scottish Government's investment. It was proposed that Scotland's capabilities in hydrogen need to be demonstrated at scale, rather than through small, regional projects, in order to compete globally.
- Demystifying the Net Zero 2045 transition for SMEs, in line with the Manufacturing Recovery Plan, with, e.g., clear guides on how businesses can improve energy performance, and the financial case for doing so, focusing on what's already possible as well as more advanced technologies.

Challenges: The skills gap was the recurrent theme in all these discussions. One group also questioned whether Scotland was doing enough "shouting about how we are at the centre of renewables".

Priorities: All the opportunities above were seen as priorities; in addition, groups called for:

- The manufacturing sector to "step up and be visible in how it can support a green economy", and to be "outrageously ambitious about climate emergency targets".

5.3 SUPPLY CHAIN RESILIENCE AND COMPETITIVENESS

Strengths and opportunities: Contributors noted the opportunity – or imperative – to build local supply chains in specific sectors and technology areas such as construction and hydrogen (see above).

This should involve multi-party collaboration between industry, policymakers, enterprise agencies, academia and the RIS partners. One suggestion was to explore with Scottish Development International (SDI) how its activity to attract inward investment in sectors such as space or quantum could better support local supply chain resilience and competitiveness. Another suggested avenue for exploration was the example of US federal contracts that require a certain percentage of spend to go to the local supply chain.

Challenges: These involved the familiar themes of skills needs, SMEs' access to investment, and whether supply chains were ready to scale at the required pace. One contributor raised the need for policy support for manufacturing sectors hit hard by Brexit (e.g. food processing).

Priorities: Across the three groups, the priorities decided upon were:

- Exploring further the opportunities outlined above.
- Policy discussions on how to transform the make-up of Scotland's economy, boosting the number of sustainable businesses with 300-400+ employees able to drive R&D, innovation and growth.

5.4 GENERAL PRIORITIES IN MANUFACTURING AND GREEN ECONOMIC RECOVERY

- Identifying which areas of activity will truly differentiate Scotland in terms of the transition to Net Zero 2045 and make Scotland a world leader in decarbonisation.
- Further activity on storytelling and case studies to galvanise investment in R&D and innovation.
- A focus on the war for talent.
- Developing the Manufacturing Recovery Plan into smart, deliverable actions, especially on skills.

6. Digital Infrastructure Themes

"If you start looking at digital infrastructure, you start taking cost out of companies, you start making start-ups more viable, you start making it possible to get more competition into the system, there's more possibility to provide services that are good and connected."

Workshop participant

6.1 GOVERNANCE OF DIGITAL INFRASTRUCTURE FOR INNOVATION

Strengths and opportunities: Participants pointed to the wide range of data sets and data streams available (or potentially available), and the public sector's increasing openness to experimenting with the release of data.

The Scottish Government's dual role as consumer and producer of data was seen as an opportunity, though discussion of how to manage and govern that dual role is critical. In addition, Covid-19 and the

Logan Review have stimulated the Scottish Government's appetite for investment in digital infrastructure.

Challenges: The group highlighted the challenges around the lack of awareness of the possibilities for data innovation in public and private sector, and of what data sets and streams are available, and/or have value; and the lack of know-how around digital innovation / entrepreneurship. All these could hinder making a case for further investment.

Priorities in governance were seen to be:

- Developing a competition mechanism for funding the creation (including proof of concept and commercialisation) of high-value, reusable datasets.
- Developing mechanisms for exchanging / internalising learning in the public / private sector.

6.2 DATA INFRASTRUCTURE TO SUPPORT AND PROMOTE INNOVATION

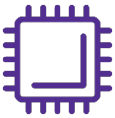
Strengths and opportunities: Among public and private sector alike, Covid-19 has raised awareness of data, its uses and the potential benefits from sharing it. There was a call for more data sharing with industry / SMEs – sparing them from having to re-create elements that should be infrastructural.

Challenges include how to persuade organisations to share their data. It was thought the Scottish Government could and should lead by example here.

While the high level of data available is a positive, there are issues around its use. The example given was IoT and footfall monitoring via smartphones and the large volumes of data this would provide to local authorities, raising questions around data ownership and usage.

Priorities on data infrastructure were:

- The Scottish Government initiating a Data Manifesto to clarify and guide on key issues.
- Developing an ambitious and top-down Connected System of Systems, beginning with a storyboard of what this would look like.



6.3 DESIGNING PUBLIC SECTOR DIGITAL INFRASTRUCTURE FOR INNOVATION

Strengths and opportunities: Opportunities to harness our strengths include digitally enabling and transforming SMEs and microbusinesses; using digital innovation in sectors such as manufacturing, energy, health, culture and tourism; and further developing the digital infrastructure in hospitals.

Challenges: Among those cited were connectivity in rural Scotland; and issues around the sharing of data across the public sector, e.g. the availability and interconnectivity of data in health and social care.

Priorities for policymakers and the research and innovation community should be:

- Putting collaboration and data sharing at the heart of any government initiative (e.g. procurement), and taking up a joined-up view in policymaking.
- Learning from other countries (e.g. Estonia, Singapore) in areas where Scotland is lagging.

- Exploring ownership of infrastructure development and integration.
- Management of and security around people's data.

6.4 OVERARCHING PRIORITIES FOR DIGITAL INFRASTRUCTURE

- Full scoping of what is mean by digital infrastructure, beyond the narrow definition of networks / hardware, and defining a vision of the digital infrastructure needed and wanted in Scotland, encompassing the whole stack including services and data.
- Exploring how to incentivise investment, and how to measure return on investment.
- Exploring data as an asset, and identifying opportunities, e.g. in IoT; also looking at the option to treat data as an asset for accounting purposes.
- Exploring the public sector's dual role as producer and consumer of services and data assets; also building trust in the digital infrastructure, and examining the role of the public sector here.
- Discussion of open systems, such as open banking.

7. Final Points and Next Steps

> *"There isn't much money in the system, we [in the research and innovation community] need to create an offer, an argument, to be really clear about the value proposition."*
>
> Workshop participant

Synthesising the breakout discussions were Dr Caroline Cantley, Executive Director of SRPe, and Professor Stuart Anderson, Director of SICSA, who then reviewed some of the conclusions with the workshop chair Dr Alicia Greated and other participants. As a result, some additional actions and advice emerged.

The funding landscape: The research and innovation community should generate clear value propositions to government and other funders that satisfy the objectives of its strategy and aspirations – e.g. just transition to Net Zero 2045 and green economic recovery – and clearly establish the return on investment or gains.

Storytelling: A return to the storytelling theme included recommendations that "large-scale stories" are needed. It was noted that utilities businesses have a strong R&D obligation and culture and good links with universities, and do significant work on driving innovation into the SME supply chain; a "helicopter view" of such activity could be inspirational in driving interest in decarbonisation and digitalisation across other industries. It was also noted that universities have "mountains of stories" available from the recent REF Exercise, and could develop these for other audiences and purposes.

Proactivity: There was a strong recommendation for Scotland's research and innovation community to try to "drive the conversation". Representatives from funders suggested proactively informing funders about ideas, rather than "waiting for the money to drop". Consortia in the rest of the UK have seen success from doing this (in combination with storytelling), and it also helps funders to advise government on where to put investment.

Collaboration: Throughout all the sessions of the workshop, collaborative working was seen as one of Scotland's strengths, but also an opportunity for further action. Signposts for where it should go further included building trust in digital systems, requiring wider multidisciplinary collaboration with social sciences and humanities as well as the public; extending activity with colleges on skills; and bringing industry into the heart of the innovation and skills ecosystem. One participant stated that Scotland's research and innovation community could do more in utilising its connectivity to "challenge against those conglomerates that are elsewhere in the UK and show what makes Scotland the place for [UK funders'] investment".

NEXT STEPS

The Scottish Research Pools continue to have a key role here, with their experience in collaborative, multi-disciplinary, multi-partner working, which responds to global and local challenges and promotes economic development and enterprise. The RIS forum formed in partnership with the Innovation Centres and Interface can extend this further, bringing in new collaborators, disciplines and sectors to support Scotland's green economic recovery and future prosperity.

This workshop on 'The Future of Work in Scotland' helped to signpost the future priorities and direction for this work. The Research Pools will continue to work in collaboration with other RIS partners and the wider research and innovation community in Scotland to make this happen.

> *"Working in more of a connected way requires coordination, which at the core requires people. It isn't actually a huge investment to coordinate when the counterparts are already in place."*
>
> Workshop participant

Be Part of Scottish Research Innovation Futures

Scottish Research Innovation Futures is a series of workshops and other activities, organised by Research Innovation Scotland (RIS) with KTN, exploring how collaborative research and innovation can tackle grand challenges and help Scotland build back better from Covid-19. The series themes include Health & Wellbeing, Economic Development and Enterprise: The Future of Work in Scotland ('Manufacturing and Green Economic Recovery' and 'Digital Infrastructure'), Just Transition to a Net Zero Carbon Society, and Climate & Environment.

To register your interest in any of these themes, please visit:

www.research-innovation-scotland.co.uk/ris-ktn-workshops