Innovation nation:

Good Jobs for Scotland's Future

Daniel Turner
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Our Scottish Future

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- A Workforce Fit for the Future: Reforming Scottish skills and employability services to support growth
- The Case for Industry Sector Strategies
- Rewiring Britain: How Scotland Can Build the New National Grid
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Foreword from the Rt Hon Gordon Brown

Scotland has long been a nation of ideas. From the steam engine to the Higgs boson, from the birth of modern philosophy in the Scottish Enlightenment to, today, being at the frontiers of precision medicine, we have led when others have had to follow. But now we face a stark choice: to continue to drift into a future of low growth, low productivity and missed opportunity – or to act decisively to become a global leader in innovation once again.

This report – *Innovation Nation* – sets out a practical, ambitious, and above all deliverable plan to put innovation at the heart of Scotland's economic renewal. It builds on the argument first laid out in *From Growth to Good*: that we can – and must – deliver a decade of inclusive economic growth, creating 300,000 new jobs, lifting people out of poverty, and building a fairer, greener, more dynamic Scotland.

The report pulls no punches. It recognises that Scotland's current model is not delivering as it should. Our universities are world-class, our research output among the best in Europe – but we are failing to convert that strength into business investment, productivity, or prosperity. Every £1 of R&D in Scotland generates just £1.46 of business investment. In the UK it's double that. Across the OECD, it's three times higher. This is not just a shortfall; it is a squandered opportunity.

But it is not too late to change course.

Across life sciences, clean energy and advanced manufacturing, Scotland has the raw materials of success. The question is not whether we have the talent – we do. The question is whether we have the leadership, the coordination, and the will to turn promise into progress.

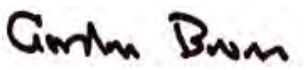
That is why this report is so important. It offers not just analysis, but a plan: a single, coherent Scottish industrial strategy; physical campuses in our great cities to anchor global innovation investment; new, empowered combined authorities to lead local transformation; and a reformed ecosystem that backs scale-ups, retains talent, and ties innovation to inclusion.

It calls for a win-win Scotland – one where we raise the roof and lift the floor. Where we create high-skill, high-wage jobs and at the same time tackle child poverty. Where the fruits of innovation are not hoarded by the few, but spread across our communities and regions. It shows how to make Scotland the easiest and fastest place in Europe to innovate – and why that matters not just for our economy, but for our national cohesion and pride.

In this decade, we have a once-in-a-generation chance to reset. As industries reorganise, as investment patterns shift, as governments around the world turn back to industrial policy – the opportunity for Scotland is real, and it is now.

The choice is ours. We can cling to the status quo, to a system that too often holds us back. Or we can seize the initiative, and once again lead the world in science, in enterprise, and in building a better society.

Let's take that chance. Let's build Scotland's future together – and become the innovation nation we were always meant to be.



Gordon Brown

Executive Summary

Scotland is at a pivotal moment. A generation after devolution, the country faces persistent economic challenges: sluggish productivity, high economic inactivity, and yawning inequalities across communities, regions and generations. Despite a strong education system, abundant renewable energy, and world-class research institutions, Scotland has yet to translate these strengths into sustained, inclusive prosperity.

In late 2023, Our Scottish Future published *From Growth to Good: A ten-year growth plan for Scotland*, setting out the interventions that could return Scotland to sustainable economy growth; ensure all of Scotland's people and communities could contribute to building that wealth; and use the proceeds of growth to meet Scotland's moral mission of an economy that is anti-poverty by design. The report called for a plan for 300,000 new jobs over a decade, including 120,000 in innovative clusters of growth, lifting hundreds of thousands into the workforce, out of the welfare system, and shifting Scotland's net fiscal position.

This paper dives into *From Growth to Good's* argument around innovation as a means to support Scotland's clusters and boost productivity. It focuses on **innovation-led growth** – a mission, as chartered in the 2019 Muscatelli Report, to make Scotland the best place in Europe to start, grow or invest in an innovation-driven business. By aligning public institutions and private investors; concentrating support on high-potential sectors and giving them physical expression in well-connected, attractive hubs; and spreading the benefits of innovation more widely, Scotland can chart a course toward a more productive and resilient economy.

Innovation – in the public and private sector – is the only sustainable route to long-term economic growth. But mismatched incentives mean markets will under-invest in innovation, and the public sector may not prioritise it. Realising the full benefits of innovation requires subsidy, coordination and co-location; and active efforts to ensure benefits reach all corners of society. That in turn requires active partnership between researchers, firms and the government. If it can address these challenges, Scotland can end fifteen years of productivity stagnation not by simply increasing spending or cutting taxes, but by generating and applying new ideas – especially in sectors where it already has strengths: clean energy, life sciences, and advanced manufacturing.

Scotland has world-leading research. It needs more scaling in Scotland, and concerted effort to bring R&D-intensive multinational investment into Scotland

Scotland's innovation ecosystem has real strengths:

- **World-leading universities:** Scotland has three of the world's top 100 universities and produces 12% of UK research output, despite being home to just 8% of the population.

- **Industrial assets to build on:** Scotland has deep sectoral excellence in life sciences, AI, renewables, and advanced manufacturing. Scotland hosts major research capabilities and globally respected institutions like the National Robotarium, NMIS, and multiple Catapult Centres.

- **A strong early-stage finance ecosystem:** Scotland hosts four of the UK's ten most active angel networks, and leads the UK on university spin-outs per capita (albeit not per pound of research funding).

But Scotland could be doing far more to convert these assets into a dynamic, innovation-led economy.

Scotland has the second-highest university R&D spend (as % of GDP) in the OECD – but the second-worst record for converting that public investment into private sector R&D. Every £1 of university R&D in Scotland leverages just £1.46 of business investment, compared to £3.07 in the UK and £4.73 across the OECD.

Just 1.45% of Scottish GDP is spent on business R&D – well below Sweden's 2.6%. This "private innovation gap" comes at a time when, across the OECD, business R&D is surging (to 74% of R&D spending, up from 66% in 2010). And we know that in some sectors – where Scotland has notable strengths, including in pharmaceuticals, food products, finance, and business services – multinationals play an outsized role in driving up innovation and anchoring a regional innovation ecosystem.

Scotland needs more, larger, more innovative firms if it is to create the numbers of jobs we desire (whether directly in research, or in associated professional services, or skilled craft and manufacturing jobs). To get there, Scotland's tasks are to **protect** its core innovation assets – at a time of global economic turmoil, and specific challenges in the higher education sector; to **progress** ongoing work to support spin-outs and scale-ups; to make sure Scottish success stories and multinationals are able to **plant** and take root in Scotland, rather than having to relocate to the US or elsewhere in the UK to expand.

The opportunities for innovation at scale: Scotland's sectoral strengths

To bring these challenges and opportunities to life, we then focus on three technologically sophisticated sectors where Scotland already leads, or has the potential to do so with more effective public support:

- **Life Sciences:** A £10.5bn sector employing nearly 47,000 people, with global strengths in genomics, regenerative medicine, and digital health. Scotland punches above its weight in research and early-stage innovation, but to make a success of initiatives like Edinburgh BioQuarter it will require closer partnership with global life sciences giants.

- **Energy:** With near-100% renewable electricity generation and major offshore wind potential, Scotland could become a global clean energy hub. Projects in hydrogen, carbon capture and tidal power show promise. But grid capacity, supply chains, and workforce planning are lagging. A just, balanced transition from oil and gas will depend on targeted reskilling and local industrial strategies – an opportunity that could be realised through the UK Government's Great British Energy, headquartered in Aberdeen, in partnership with existing Scotland-based energy multinationals.

- **Advanced Manufacturing:** While employment in Scottish manufacturing has declined over the last half century, productivity and innovation intensity remain high. Scotland has internationally competitive niches – in aerospace, semiconductors, and space tech – where shifting supply chains mean investment is more "up for grabs" than usual. Scotland needs to both scale up these emerging industries, and support the diffusion of activity elsewhere across Scotland (especially in communities across the Central Belt).

These cases are illustrative rather than exhaustive, and other parts of the report – particularly those looking at start-ups and scale-ups - identify Scotland's strengths in digital and creative industries (such as Dundee's 4J Studios), and professional services (including finance and insurance). Nor, as in our final recommendation, should we ignore the opportunities for innovation in Scotland's "everyday economy" of non-traded services.

Making Scotland the fastest, most efficient place to innovate in Europe

Scotland has strong foundations — including a mature institutional landscape and globally competitive research base — but its innovation policy remains fragmented across multiple agencies and levels of government. The result is a system that can be difficult to navigate, particularly for SMEs. Mixed responsibilities between governments, competing mandates, and strategy overload have hindered clarity and action.

Industry voices and parliamentary committees alike have called for fewer plans and more delivery, with the fleet-of-foot coordination and personal leadership to land deals with Scottish or international R&D investors – providing the alignment on skills, infrastructure, permissions and regulatory processes businesses need to have the confidence for investments in the hundreds of millions of pounds.

Scotland has a narrow window in which to act: just as trade wars mean scale-ups and multinationals everywhere are rethinking their business models, and the UK is lowering friction to innovation investment - re-entering the Horizon programme and resetting trade relations with Europe and the US; and within the UK, devolution offers Scotland the chance to go further in making it as fast and cost effective as possible to invest in innovation.

To move from potential to progress, Scotland needs a bold, unified strategy for innovation-led growth.

Our recommendations build on *From Growth to Good*, and set out a five-part plan to get there:

1. **FIRST**, set out a single **Scottish Industrial Strategy**, jointly owned by UK and Scottish governments and regional authorities as a test of refreshed intergovernmental relations. It should be focused on a handful of globally significant clusters – including life sciences, green manufacturing, and digital exports. For each sector, the Strategy should set out the steps it will take to make Scotland the fastest, most efficient and best connected place for innovative investment in Europe (e.g. looking at **clinical trial reform** in life sciences or **international flight connectivity** in professional services), seeking opportunities to go further than the UK industrial strategy where Scottish leaders are ambitious to lead.

2. **SECOND**, **Growth Zones** tied to these clusters should offer a physical campus for innovation investment in Scotland's main urban areas. These Zones should be small – we know that the benefits of co-location can drop off within a few minutes' walk – and anchored around public and private investment, including a sector-specific Catapult Centre and, crucially, **brokering flagship R&D intensive multinational investment to provide an anchor for these Growth Zones**.

3. **THIRD**, these zones must be governed locally by new **Scottish Combined Authorities**, empowered to integrate skills, housing, transport, and industrial development and provide clearer "place leadership" – cutting through a thicket of Scottish and UK agencies to provide clarity for innovations and investors. Devolved Jobcentre+ budgets, local infrastructure planning, and housing provision should align with economic priorities, so places have the tools they need to shape their future.

4. **FOURTH**, Scotland needs to maintain momentum in its innovation ecosystem, offering **further targeted support for spin-outs, start-ups, and scale-ups, building on existing success**. This includes a new Scottish Universities Fund, expanded Proof-of-Concept grants, consistent IP policies, and simpler support services. A single Innovation Scotland portal would help businesses navigate funding and advisory systems. And it means taking steps to maintain and build the global competitiveness of Scottish universities – at a time when financial worries at home and risks to academic freedom abroad create new perils and opportunities.

5. **FINALLY**, Scotland needs to do more to **tie together innovation and inclusion**, by linking Growth Zones with surrounding schools and colleges; using investment negotiations and public procurement to promote good jobs with strong worker voice and fair pay; and investing in innovation in public services. It makes economic sense: talent is found everywhere in Scotland, even if opportunity isn't. It makes financial sense, with support for labour-augmenting technologies in retail, hospitality and care helping raise economy-wide productivity. And it is central to Scotland's sense of social justice.

Innovation policy must be purposeful, inclusive, and disciplined (to deliver value for public funds and avoid 'capture' by incumbent firms). The public consistently supports growth that reduces poverty, improves wages, and strengthens public services. An innovation strategy for Scotland must be judged by how well it delivers these outcomes – not just patents or spinouts.

Scotland has the tools, talent, and public support to build a world-class innovation economy. But Scotland's elected and business leaders must act with focus and discipline. Innovation should not be the preserve of a few – it must become a national endeavour, designed to lift wages, reduce poverty, and support excellent public services. This is not about growth for its own sake, but about unlocking the country's full potential. With the right plan – and the architecture and leadership to deliver it – Scotland can become the inclusive innovation nation it aspires to be.

1. Introduction: Scotland's moment to lead again

Scotland is at a pivotal moment. A generation after devolution, the country faces persistent economic challenges: sluggish productivity, high economic inactivity, and yawning inequalities across communities, regions and generations. Despite a strong education system, abundant renewable energy, and world-class research institutions, Scotland has yet to translate these strengths into sustained, inclusive prosperity.

In late 2023, Our Scottish Future published *From Growth to Good: A ten-year growth plan for Scotland*, setting out the interventions that could return Scotland to sustainable economy growth; ensure all of Scotland's people and communities could contribute to building that wealth; and use the proceeds of growth to meet Scotland's moral mission. The report called for a plan for 300,000 new jobs over a decade, including 120,000 in innovative clusters of growth, lifting hundreds of thousands into the workforce, out of the welfare system, and pushing Scotland's public finances into the black.

This paper dives into *From Growth to Good*'s argument around innovation as a means to support Scotland's clusters and boost productivity. By aligning public institutions; concentrating support on high-potential sectors and giving them physical expression in well-connected, attractive hubs; and spreading the benefits of innovation more widely, Scotland can chart a course toward a more dynamic economy.

The need to act is greater than ever, as – across the world – businesses rethink their business models and innovators rethink their career plans as barriers to cooperation rise. Even if Scotland wanted it to be, the status quo isn't sustainable. Scotland should seize the opportunities that come with change, to lead again.

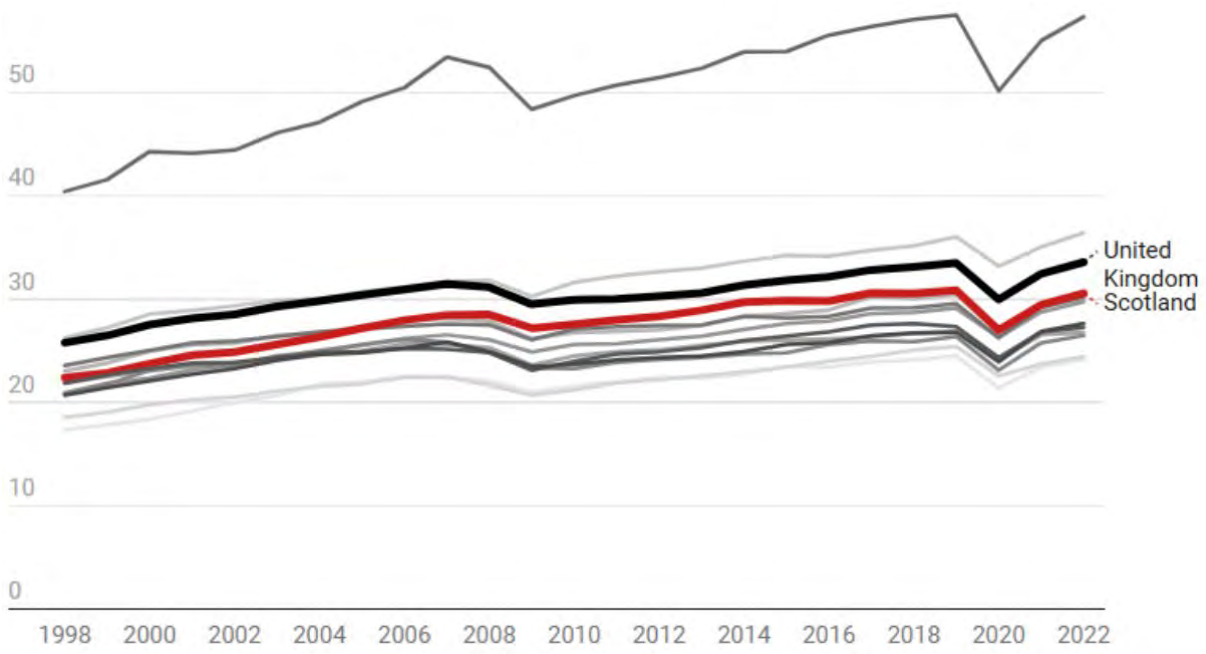
Scotland has been, at best, keeping pace. It's time to end the drift

Scotland is home to world-class universities, some of the highest educational attainment in Europe, vast renewable energy resources, an enduring global reputation, and a vibrant identity as a nation of innovators – from James Watt in the First Industrial Revolution; to Alexander Fleming at the tail end of the Second Industrial Revolution; to Sheila Rowan and her team directly detecting gravitational waves for the first time in 2015 at the University of Glasgow.

"SCOTLAND HAS BEEN, AT BEST, KEEPING PACE. IT'S TIME TO END THE DRIFT"

All of these strengths mean that, as figure 1 shows, Scotland has broadly kept up with the UK average in real output per head in recent decades despite the wrenching effects of deindustrialisation, supported by assets unlike those anywhere else beyond the South East of England elsewhere in the UK.[1]

Figure 1: Since the late 1990s, Scotland has kept pace with UK-wide income growth as the rest of the country – other than London and the South East – have fallen back.

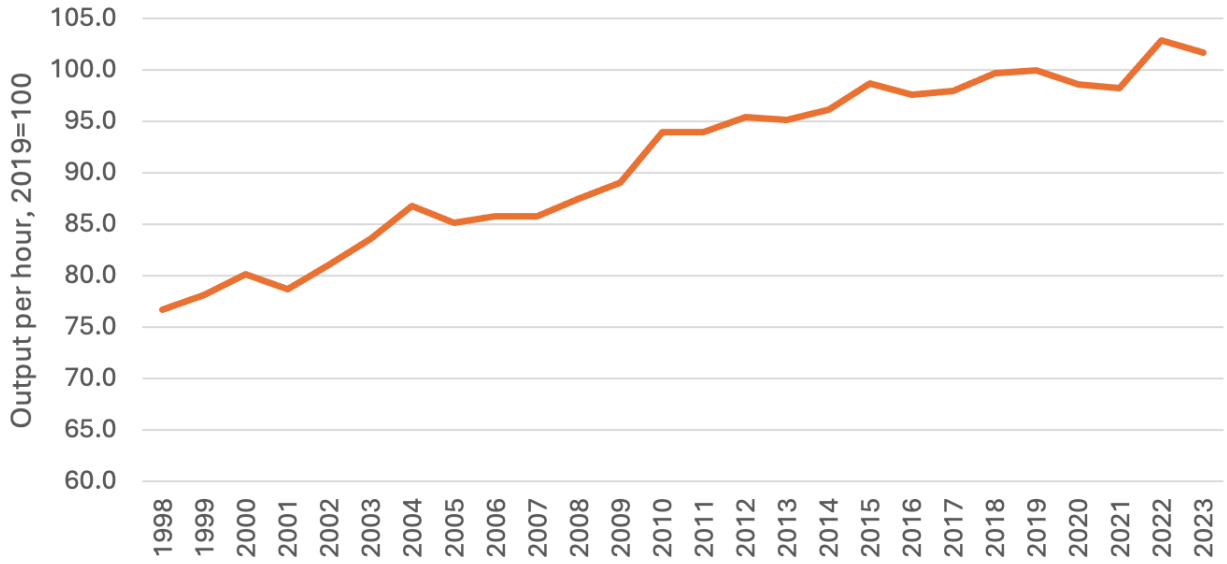


Source: https://www.ons.gov.uk/economy/grossdomesticproductgdp/datasets/regionalgrossdomesticproductallnutslevelregions. Unit: Gross domestic product (GDP) chained volume measures (CVM) in 2022 money value, per head, pounds

But Scotland has "kept pace" over the last decade at a moment when growth across the UK has stalled. The UK experienced a post-2007 productivity deceleration of around 2 percentage points – significantly worse than the slowdown seen in the US (1.6 pp), France (1.5 pp), or Germany (1.0 pp) prior to 2019.[2]

Looking at hourly productivity for those working in Scotland (figure 2), we can see a clear break in performance from 2010: with little more than 5% over the fourteen years to 2024 (or just 0.35% annual growth). That compares to growth from 1998 to 2010 of more than 25%, or an annual rate closer to 1.8%. And it is a story, as we shall see, of both low investment and sluggish growth in total factor productivity (typically the measure associated with innovation).[3]

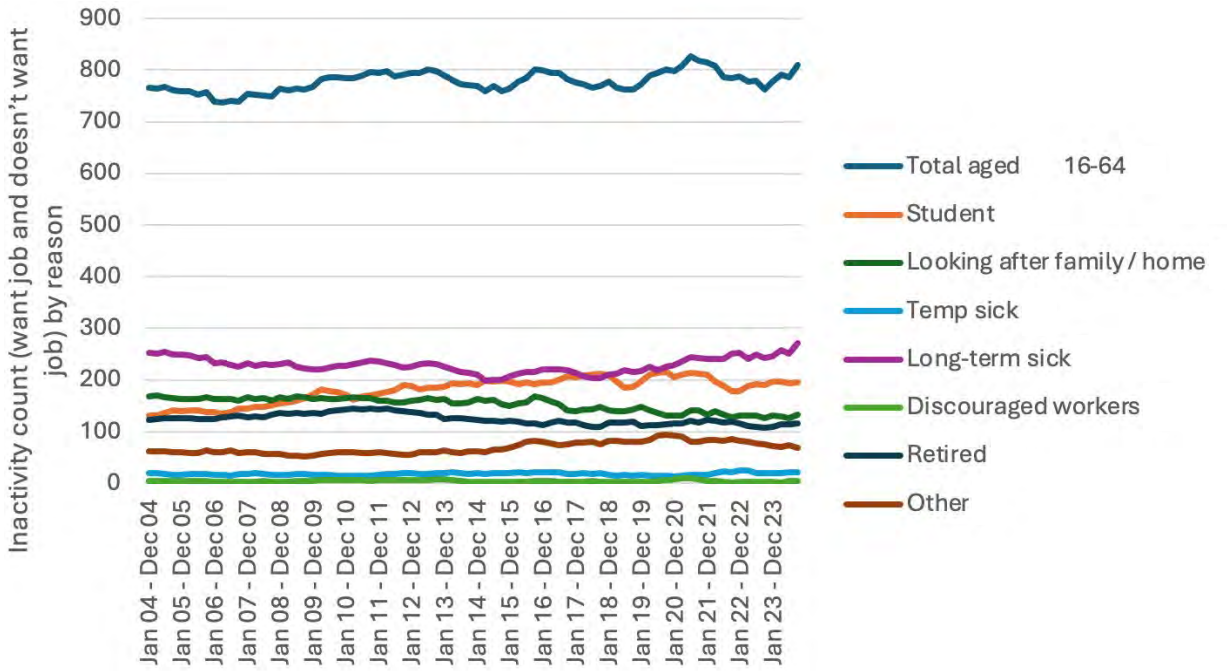
Figure 2: Scottish productivity has barely moved since the early 2010s



Source: Scottish Government

Alongside the stagnation of productivity for those in work, Scotland has seen economic inactivity among the working age population remain stubbornly high (and about 2 percentage points higher than the rest of the UK). As figure 3 shows, inactivity due to health conditions in particular have been continually rising since 2014.

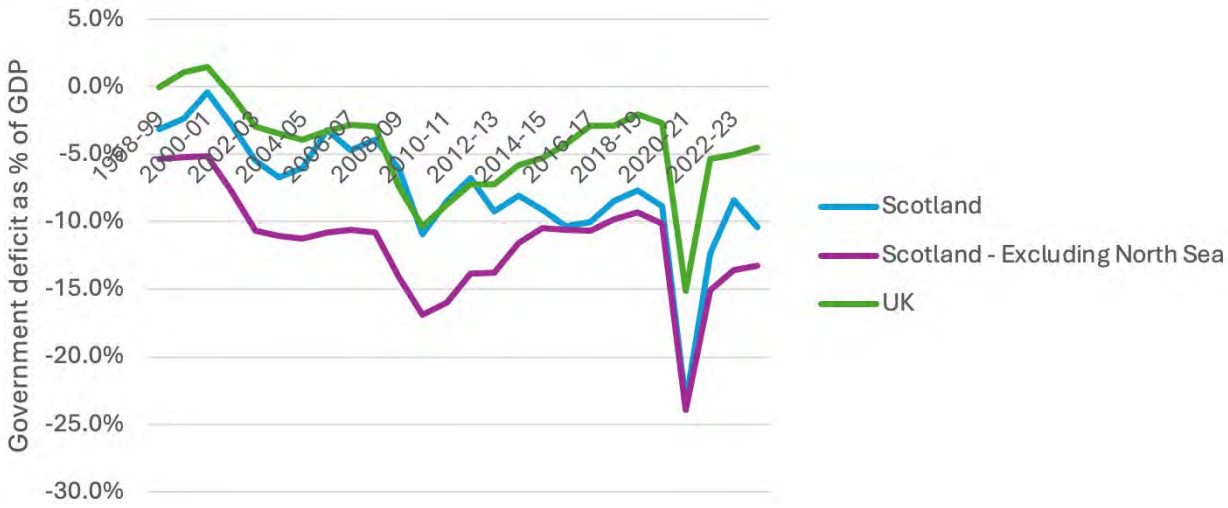
Figure 3: The number of working age, inactive Scots has been stable for two decades, though long-term sickness has risen nearly 50% since 2014



Source: ONS

As a result of this economic drift, the Scottish economy has become more dependent over time on public spending. The Scottish deficit somewhere between two to three times the size of the UK as a whole (depending on how we measure it), as set out in figure 4 below.

Figure 4: Scotland's has become more dependent over time on public sector spending and transfers from the rest of the UK



Source: Scottish Government

And, beyond the labour market, the social costs of this stagnation are visible in everyday life: over one in four children growing up in poverty; declining healthy life expectancy notably along the poorest; high levels of persistent poverty, especially after housing costs; and uneven prospects between and within Scotland's regions. As data from the Scottish Social Attitudes Survey set out in figure 5 shows, economic stagnation is leading to an erosion of confidence in government in Scotland.

Confidence in the Scottish Government has declined continuously since 2014, and the public now clearly want a focus on the economy.

Figure 5: Percentage of people who said they trust the Scottish Government to work in Scotland's best interests/ the UK Government to work in Scotland's best long-term interest, 1999 to 2023. N.B. Shading indicates a change in methodology from face-to-face to push-to-web between 2019 to 2023.

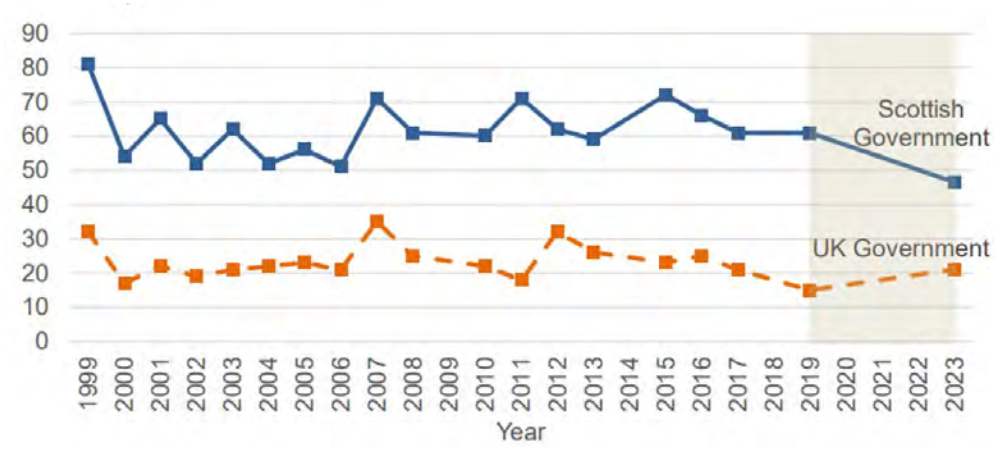
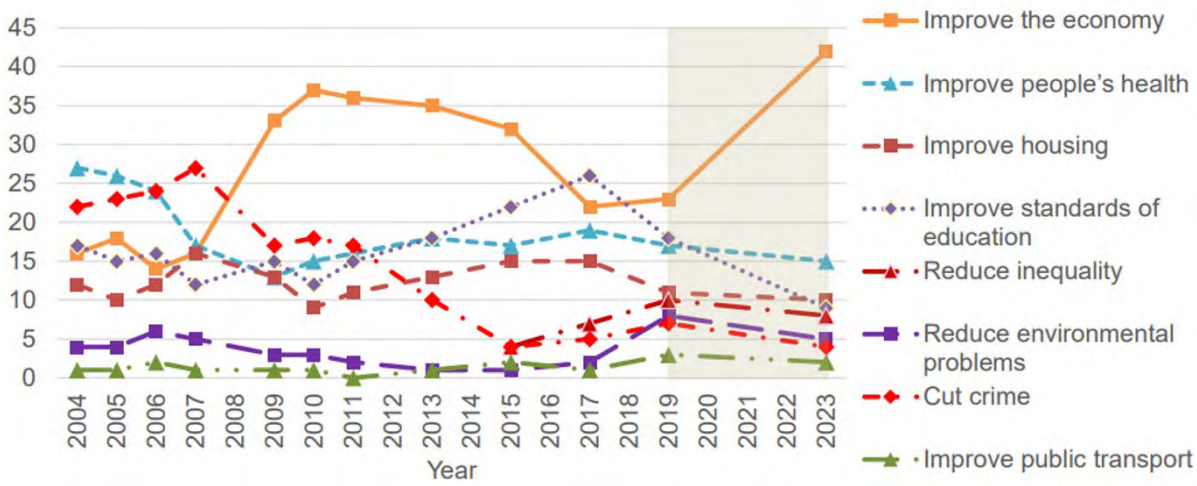


Figure 6: Percentage of people who said this should be Scottish Government's highest priority, 2004 to 2023. N.B. Shading indicates a change in methodology from face-to-face to push-to-web between 2019 to 2023.



Sources: Scottish Social Attitudes Survey

Scotland can choose a virtuous cycle of innovation-led growth

Scotland's drift is not inevitable. Nor is it due to a lack of public spending, or the Scottish peoples' ingenuity. Instead, it reflects a deeper problem: Scotland lacks a shared economic strategy to transform its strengths into sustained prosperity, and the effective leadership to seize opportunities.

This paper argues that a new national mission is needed: **to make Scotland the best place in Europe to start, grow or invest in an innovation-driven business**. And, following *From Growth to Good*, to use the proceeds of that growth to create good jobs, tackle poverty, and fund excellent public services. This must be a shared mission, co-owned by national and local government, business, education institutions, and civic society. It must go beyond rhetoric to deliver change at scale.

Why focus on innovation? Because the shape of global growth is changing. The 2020s and 2030s will be defined by breakthroughs in artificial intelligence, clean energy, and life sciences – a new industrial revolution that is already underway. Countries that embrace these technologies and build ecosystems around them will capture the lion's share of future economic gains. Those that don't risk falling behind, both economically and geopolitically.

Scotland is well-placed to lead in this transition. It has strong research capabilities in AI, data science, and biomedical sciences. It has deep renewable energy potential, particularly in offshore wind and hydrogen. Its cities are walkable, liveable, and increasingly connected to global networks. And it has a powerful sense of moral purpose – a public desire to see growth translated into social progress, not just corporate profit.

But to lead, Scotland must act. Too often, policy has been long on aspiration but short on delivery. There is a tendency to spread support thinly across too many sectors and regions, diluting impact. Government and industry strategies are too often misaligned. Planning and procurement systems slow down innovation rather than enabling it. Scotland has

had success stories – in fintech, in satellite manufacturing, in health tech – but they have sometimes emerged despite of the system, not because of it.

This report makes the case for a different approach. It builds on the foundation laid by *Growth to Good*, which showed that a growth strategy rooted in social democratic principles could unite Scots across the constitutional divide. It argues that innovation can be a powerful engine for that growth – if it is steered deliberately and designed to be inclusive.

Chapter 2 sets out some of the core rationale for backing an innovation-led growth model. Chapter 3 then assesses how the current state of innovation in Scotland stacks up: its assets, its gaps, and its trajectory. Chapter 4 take a deep dive into three of the sectors – life sciences, energy, and advanced manufacturing – where Scotland has some of the best prospects of leading again. Chapter 5 examines the Scottish and UK policy landscapes, identifying opportunities for alignment and reform. And finally Chapter 6 offers a five point plan to drive innovation-led growth and ensure its rewards are widely shared.

This is a moment of peril and possibility. The global economy is shifting fast, and so too are the expectations of the Scottish people. Polling, set out in *From Growth to Good*, shows that Scots want an economy that is fairer, greener, and more secure. They want their country to be ambitious, outward-looking, and able to shape its future. But they also want a government that delivers.

Scotland has the tools. It has the talent. It has the public support. What it needs now is a plan – and the architecture and leadership to see it through.

“SCOTLAND CAN CHOOSE A VIRTUOUS CYCLE OF INNOVATION-LED GROWTH”

2. Innovation underpins long-term growth, but without a well-used toolkit we will create too few ideas and application

Scotland's underlying economic challenge is one of low productivity. Compared to similar economies, Scotland has underperformed on both capital investment and innovation adoption. This isn't a new story – but the nature of the growth problem is becoming clearer, and more urgent, as incomes stagnate and underfunded public services struggle to deliver.

Innovation as a pathway to growth

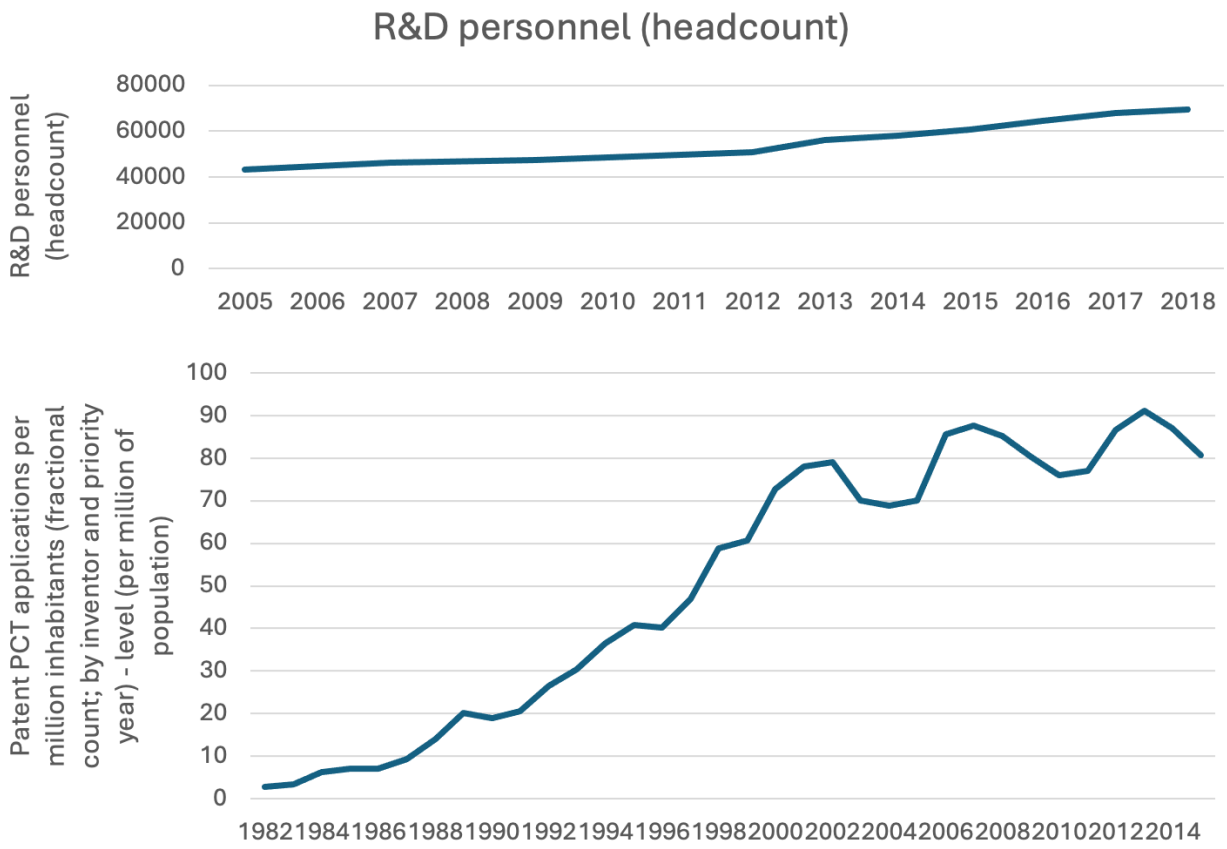
Innovation is the only sustainable driver of long-term growth. Following the line of work advanced most notably by Nobel laureate Paul Romer, economic consensus has held that rising living standards ultimately depend on our ability to generate and deploy new ideas. As Charles Jones observed in *The Facts of Economic Growth*, countries that invest more in innovation are reliably richer.[4]

But markets under-provide innovation. That's because most of the benefits of new ideas are spillovers – they flow to society, not just to the firm that invests. Lucking, Bloom and Van Reenen estimate that only 15% of the social value of innovation accrues to the firm that creates it.[5] Around 60% is captured by others – via imitation, knowledge diffusion, or downstream application. That justifies a strong public role in innovation policy.

And innovation is hard. There is growing concern that "ideas are getting harder to find." It takes more researchers today to produce the same level of technological advance as in the past.[6] Innovation-led growth now depends on mobilising more people, with more support, across a wider base.

Figures from Scotland confirm this general pattern: OECD regional data, set out in figure six below, show that researcher employment boomed through the 2000s and 2010s, without a commensurate rise in Scottish patent applications.

Figure 7: Scotland's innovation workforce has surged, but it hasn't translated into significantly more patent applications



Source: OECD

While only one measure – and while there is more recent work questioning whether researchers are simply spending more time doing non-research work, skewing their productivity statistics[7] - we should take seriously the risk that Scotland's innovation model is struggling.

Beyond the lab: innovation and occupational change

Over time, as ideas through the so-called Technological Readiness Levels from basic research to maturity and widespread adoption, innovation begins to reshape our wider society and economy. New firms and new jobs are created, as new communities flourish and different skill sets gain a premium they may not have had before; while others lose out, their livelihoods and their communities disappearing or fundamentally changing as old technologies give way to new ones.

We know that, over time, the effect of technological change on how we work goes well beyond incomes. Recent work has stressed the rise and fall of entirely new sectors or occupations. 60% of the jobs in the US in 2018 were in occupations that did not exist in 1940.[8] This "creative destruction" is how modern economies evolve: people shift into new industries, firms, and technologies.

While much of this change is welcome – not just because of higher incomes tied to higher productivity, but because work has also become safer, more creative, and healthier over time – many have come to fear technological change too. The concern is that not enough new "good" jobs have been created to keep up with the old middle-skill jobs that technology has left behind: the so-called "hollowing out" of the labour market, as good manufacturing jobs are replaced with insecure service work.

Between 1993 and 2022, high-skill jobs in the UK grew by 95%, compared to a 12% fall in mid-skill jobs and a 14% increase in low-skill jobs.[9] So while there is truth to the "hollowing out" story, it downplays a wider professionalisation of the labour force (driven by major growth in new occupations – especially those relating to IT – and an expansion of management in both the public and private sectors).

Indeed, one of the most pressing questions for policymakers at the moment is how we can use technology to augment rather than automate labour, improving the productivity and quality of work for those in low-pay, labour-intensive jobs. As the work of the most recent economic Nobel laureate Daron Acemoglu has argued, AI, data, and digital tools all have the potential to boost workers' capabilities, not replace them (if our politics will allow). And there is some suggestive evidence that a virtuous circle of technology-led upgrading may already be happening in the US, at least since the mid-2010s.[10]

We increasingly understand what the innovation toolkit looks like

There is no silver bullet for raising innovation, nor for making it automatically inclusive – but there is an increasingly clear toolkit. Key interventions available to policymakers include:

R&D tax credits: which are particularly effective when well-targeted, and which can be place-based to encourage the formation of clusters.[11]

Public research grants: Especially those targeted to firms rather than academics, and where they are linked to follow-on capital. Grants to researchers can catalyse spinouts and de-risk commercialisation.[12]

STEM and human capital investment: Attracting and retaining global talent is vital, as is a strong domestic skills pipeline; with migrants in the US disproportionately driving innovation and high-value entrepreneurship.[13]

IP frameworks: Rules around IP ownership – especially for publicly funded research – can accelerate or stall innovation, with higher equity shares for academics driving more entrepreneurial activity.[14]

Competition policy: Dynamic economies require competitive markets. Evidence shows that innovation thrives when markets are open, and not dominated by a single major firm.[15]

There is no "silver bullet" in innovation policy. The right blend of policy responses will depend on current gaps in a country's innovation system. For instance, writing for the US the economist John van Reenen proposes a roughly four-way split between research grants, tax credits, investment in the STEM workforce, and inclusion initiatives to access

“INNOVATION AS A PATHWAY TO GROWTH”

under-represented talent.[16] (If applied to the UK, this approach would tilt spending away from general R&D tax credits and towards inclusion and access initiatives).

The right tools also depend on the timeframe we care about, and may require off-setting investments to tackle side-effects like rising inequality. In a review of the literature, Bloom, Van Reenen and Williams[17] conclude with the summary set out in table 1.

Table 1: Innovation Policy Toolkit

Policy	Quality of evidence (1)	Conclusiveness of evidence (2)	Net benefit (3)	Time frame (4)	Effect on inequality (5)
Direct R&D grants	Medium	Medium	💡💡	Medium run	↑
R&D tax credits	High	High	💡💡💡	Short run	↑
Patent box	Medium	Medium	Negative	NA	↑
Skilled immigration	High	High	💡💡💡	Short to medium run	↓
Universities: incentives	Medium	Low	💡	Medium run	↑
Universities: STEM supply	Medium	Medium	💡💡	Long run	↓
Trade and competition	High	Medium	💡💡💡	Medium run	↑
Intellectual property reform	Medium	Low	Unknown	Medium run	Unknown
Mission-oriented policies	Low	Low	💡	Medium run	Unknown

Source: recreated from https://www.aeaweb.org/articles?id=10.1257/jep.33.3.163

Finally, the optimal response will depend on the firms and industries in question. Size matters. The economic literature shows that smaller firms often benefit most from innovation support.[18] That's where spillovers are greatest, and where competition pressures drive better outcomes. And, as David Sainsbury has argued in *Windows of Opportunity*, the scale economies or first-mover advantages of some new industries can

create a "winner-takes-all" dynamic. Where such non-linearities exist, there is a case for government picking winning technologies (without picking winning firms).[19]

Toolkits need tradespeople: the importance of leadership

Innovation policy also needs coherence, brought about by private or public leadership in a place. (Public leadership will always be necessary, as private leadership alone is likely to be underprovided; because key levers are held by the public sector; and to maintain democratic accountability and direction for growth).

Innovation policy in a vacuum won't realise its potential. Place-based leaders need to coordinate it with regional planning, business recruitment, small business promotion, workforce development, community redevelopment, and technology promotion.[20] Scotland has strengths in all six, but currently lacks integration between them – particularly at the scale of the city-region, where different policies ought to be blended to fit local conditions.

Scotland's challenge is not just to raise the rate of innovation – but to make it rooted, accessible to all, and mature in its scale. That means, first, building up clusters that retain firms and talent; and then making sure those clusters connect into their wider regional economy (raising productivity across the supply chain) and their community (providing access to innovation for all, helping make best use of Scotland's talent).

With these tools – and a sharper focus – Scotland can build an innovation model that drives not only prosperity, but inclusion and resilience for the long term.

3. Scotland is a world leader on research and spin-outs, but needs to do more to bring innovation to scale

Scotland is rich in the raw materials of innovation.

It has one of the highest-educated populations in Europe, with more than half of 25–64 year-olds holding post-secondary qualifications. It is home to three of the world's top 100 universities – more per capita than almost any country. It has deep research strengths across life sciences, artificial intelligence, energy systems, and aerospace. And it has distinctive city-regions – like Edinburgh, Glasgow, and Aberdeen – that combine talent, infrastructure, and institutions capable of supporting innovation.

Yet the translation of this potential into productivity, prosperity, and public benefit has fallen short. Scotland performs below the UK average on key innovation and entrepreneurship indicators, and well below comparable small advanced economies such as Denmark, Finland, or the Netherlands.

Scotland's innovation assets

Scotland has several recognised strengths:

- **World-class research base:** Scotland hosts three of the world's frequently-cited top 100 universities (Edinburgh, Glasgow and St Andrews). Scottish universities account for 12% of all UK research output, despite Scotland representing only 8% of the UK population.[21] Research excellence is concentrated in areas such as precision medicine, photonics, synthetic biology, AI and informatics, and marine energy. The University of Edinburgh is among Europe's top institutions for computer science and AI; the University of Glasgow in infectious disease research and responses; the University of Dundee is a global leader in drug discovery; and Heriot-Watt and Strathclyde have major capabilities in robotics and advanced manufacturing.

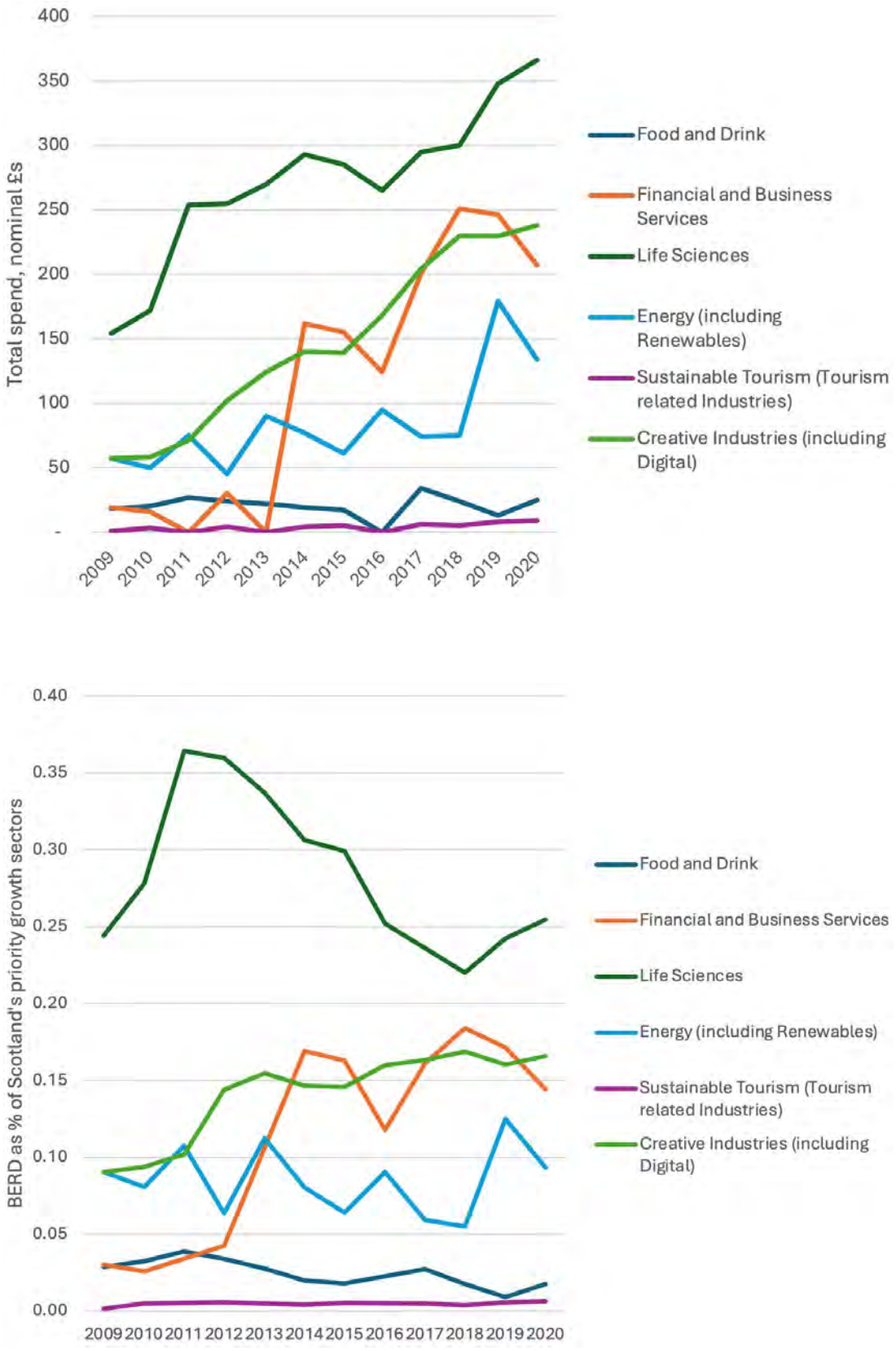
- **Strong innovation infrastructure:** Scotland hosts several centres within the UK's Catapult Network – bridging gaps between industry and research – including Glasgow's High Value Manufacturing Catapult, Edinburgh's Cell and Gene Therapy Catapult, and Leven's Offshore Renewable Energy Catapult. Scotland is also home to the National Manufacturing Institute Scotland (NMIS), and the National Robotarium.

- **Public-private partnerships:** The Scottish Funding Council, Scottish Enterprise and enterprise agencies have supported collaborative innovation, particularly in life sciences and advanced manufacturing. For instance, the Medicines Manufacturing Innovation Centre (MMIC) in Renfrewshire represents a £56m collaboration between Centre for Process Innovation (part of the UK's Catapult network), the University of Strathclyde, UKRI, Scottish Enterprise, and leading pharma firms like AstraZeneca and GSK.

- **Skills:** As *Our Scottish Future's* recent report 'A workforce fit for the future' sets out, Scotland is a success story in developing its human capital. 50.4% of 25-61 year olds in Scotland hold post-secondary school qualifications in 2019; considerably higher than the UK and EU average of 44.7% and 31.7% respectively (though the share of the population with a degree – 26.1% in the 2021 census – is more in line with peers).[22] Apprenticeship starts have risen over the last decade, with 90% of those completing apprenticeships being in work within six months.[23]

- **Sectoral strengths:** As figure 8 below sets out, Scotland's business R&D is led by life sciences industries; but that private innovation base has grown and diversified over the last decade, with a surge in fintech and digital firms. As a whole, Scotland's financial and business services firms and Scotland's food and drink firms are more likely to be innovation active than their equivalents in the rest of the UK.[24]

Figure 8: Life sciences continues to be the largest driven of Scottish business R&D, but financial and business services, creative industries, and energy have all closed the gap.



Source: https://www.gov.scot/publications/industry-statistics/

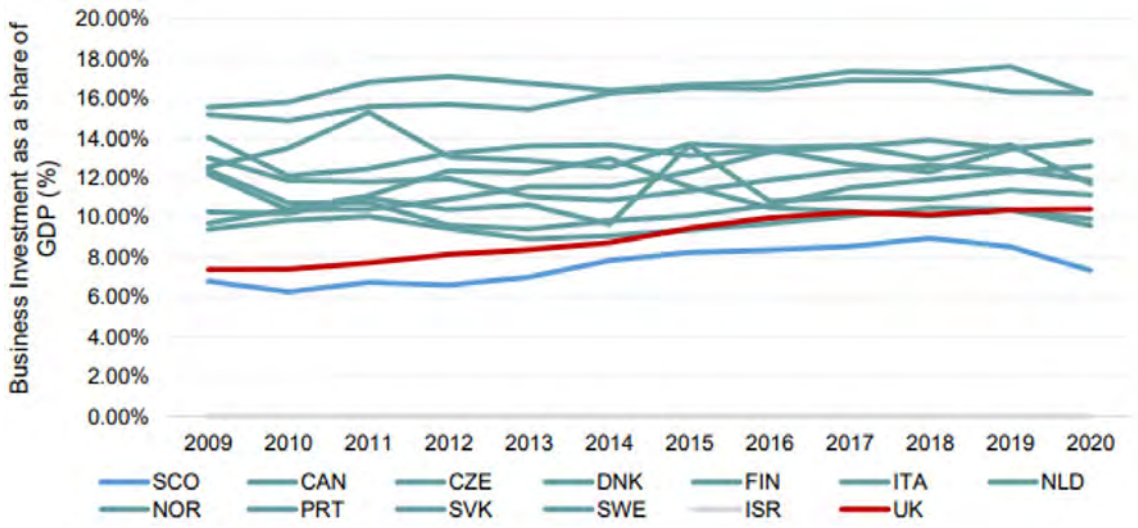
Scotland's challenge: converting university strength into broad-based innovation

R&D spend per head in Scotland sits just below the UK average, at £894 in 2022 (compared to £1046 for the UK). That places it fourth in the nations and regions of the UK, behind London, the South East and East of England.[25]

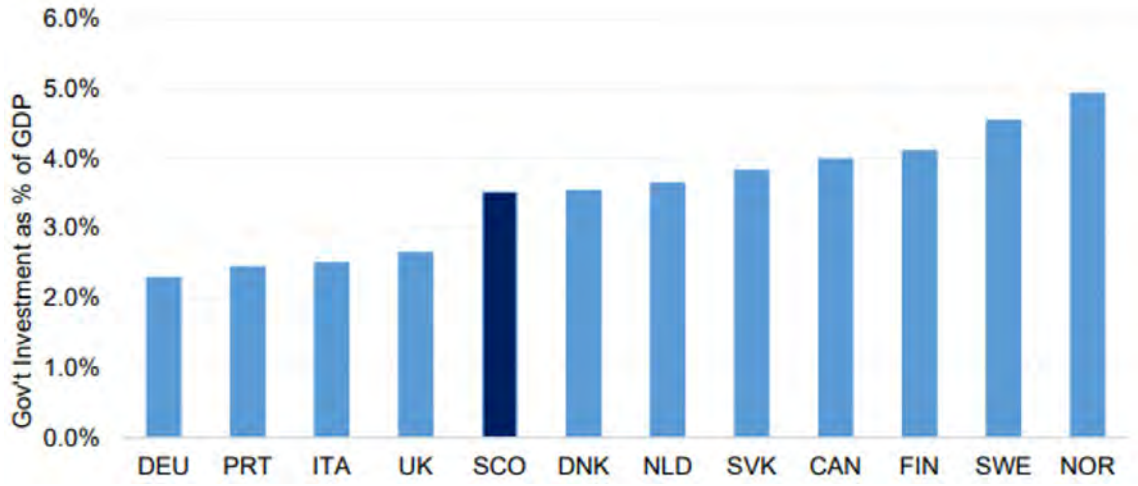
Scotland remains disproportionately dependent on higher education for its R&D (despite business R&D rising significantly over the last decade).[26] As a result, Scotland underperforms (in per capita terms) business R&D spending (BERD), providing 6.6% of all UK BERD.[27] In 2022, Scottish business enterprise R&D intensity was around **1.45% of GDP**, compared to **2% in the UK overall**, and more than **2.6% in Sweden**.[28]

These weaknesses mean that the university-led innovation system gets less 'bang for its buck' in Scotland than its peers: while Scotland sees the second-highest levels of spending on R&D in universities (as a percentage of GDP) in the OECD (after Denmark), it is the second-worst (after Costa Rica) in the OECD for crowding in private R&D as a result. **Every pound of higher education R&D spending in Scotland is associated with just £1.46 of business R&D, compared to £3.07, £3.01 and £4.73 for the UK, EU and OECD respectively.**[29] This pattern of low private investment and relatively high public investment is reflected across the Scottish economy more generally (as figure 8 makes clear).

Figure 9: The UK lags most OECD countries in business investment in general, with Scotland even further behind; while higher government investment pushes Scotland closer to the Nordic countries than the rest of the UK or Germany



Source: Quaterly National Accounts Scotland, ONS, OECD



Source: Scotland – Quaterly National Accounts Scotland, ONS, OECD

Scotland's research-to-business pipeline

Scotland punches above its weight, producing 12% of the UK's **university spin-outs between 2011 and 2025 (243 in total) – the most per capita of any UK nation or region**. Both Glasgow and Edinburgh are in the top ten local authorities across the UK for active spinouts (with 61 and 86, respectively).[30] However, if Scotland matched the spin-out rates of other UK universities *per pound of research spending*, Scotland would have seen a doubling of output to 72 additional spinouts between 2019 and 2024.[31] And UK spin-outs have a median investment size a third that of their US counterparts ($5.6m to $17m), a gap that has widened over the last decade (from $2.45m vs $5m in 2013).[32]

In this sense, Scotland mirrors the UK: relative to the US, we rely far more on state funding for innovation relative to venture capital. Public financial support such as R&D tax credits is four times as large in the UK (0.24% of GDP or $139/head) as in the US (0.07% or $56/head in the US); while US venture capital is worth $624 per person per year compared to $274 in the UK (and the divide is even starker for early stage firms).[33]

Scotland's headline rates of business start-ups are low – for instance, the total share of new business owner-management in the Scottish workforce stands at 9.1%, the lowest rate of the Home Nations.[34]

If we were to look at *quality over quantity*, Scotland's start-up environment looks much more positive. **Scale-ups (firms of at least 10 employees achieving 20%+ annual growth in turnover or staff, over a three-year horizon) account for just half a percent of Scotland's businesses, but generate a third of all SME turnover and around 5% of all Scottish output.**[35] They are broadly based across sectors and regions of Scotland's economy – 61% are in the Central Belt, but the highest rate of scale-ups per head is found in Aberdeen City and Shire. (And 42% of Scotland's scale-up firms are over twenty years old; this is not just a start-up story.)

These firms are particularly important, as, first, the rapid growth of scale-ups indicates unmet market potential and competitive advantages; and, second, over time economy-wide employment shifts from declining industries to rising industries, raising the overall level of productivity. Supporting and nourishing scale-ups is a way to speed up this shift, providing good jobs across Scotland rather than leaving those employed in shrinking industries to unemployment or downgrading. The lack of high growth firms is a crucial factor behind the economic gap between Europe and the US, as set out in the 2024 *Draghi Report*: the UK has only two $10bn firms founded within the last fifty years (ARM and Sage), of around thirty for Europe as a whole; while the US hosts 232 such companies (118 in tech), with a combined valuation of $20.5trn compared to $150bn in Europe.

Scotland is particularly well supported at the early stage of funding for high potential firms (for funding in the hundreds of thousands or low millions). **Of the top ten angel investor networks in the UK (according to Beauhurst, from 2011 to 2021 data),[36] four are based in Scotland**, with a fifth being London-based with an Edinburgh presence. Those networks are Glasgow-based Kelvin Capital, Borders-based TRI Capital, Equity Gap and Archangels in Edinburgh (the latter being the world's oldest continuously-operating business angel syndicate); alongside the Edinburgh office of London-based 24Haymarket. Alongside these private funders, Scottish Enterprise is the most frequent investor in Scotland's visible scale-ups.[37]

If we look at the Scale-Up Institute's list of 'visible' scale-ups (from Companies House), they identify 437 Scottish companies.[38] Looking at Glasgow-based firms, the author can identify forty four 'knowledge economy' scale-ups taking root in Glasgow's economy – from digital firms (Axis Studios, Amor Group, ICS Learn, Veracity, Systal) to advanced manufacturing (Clow Group, Lemac, M Squared), life sciences (Strathclyde Pharmaceuticals, Clintec, Collbio) and financial services (sipp, Caledonian Finance, Kinnell Group). The 2025 FT1000 of Europe's fastest growing companies includes three Scottish firms:[39] Glasgow-based MAC Recruit Group and CCL Components (a renewable energy equipment manufacturer and distributor); and Aberdeen-based renewable energy consultancy Exceed (XCD) Holdings.

That's not to say that it is "mission accomplished" when it comes to building up Scotland's spin-out, start-up and scale-up ecosystem – British Business Bank research finds that the average equity deal for small to medium enterprises was smaller than the UK average,[40] and the Scottish National Investment Bank has identified a funding gap of between £217 million and £1.5 billion for scaleups[41] – but these are areas where policymakers should continue supporting strength rather than reinventing the wheel.

Scotland is home to three Unicorns (start-ups valued at $1bn or more): Brewdog, Skyscanner, and Edinburgh-based wealth management company FNZ.[42]

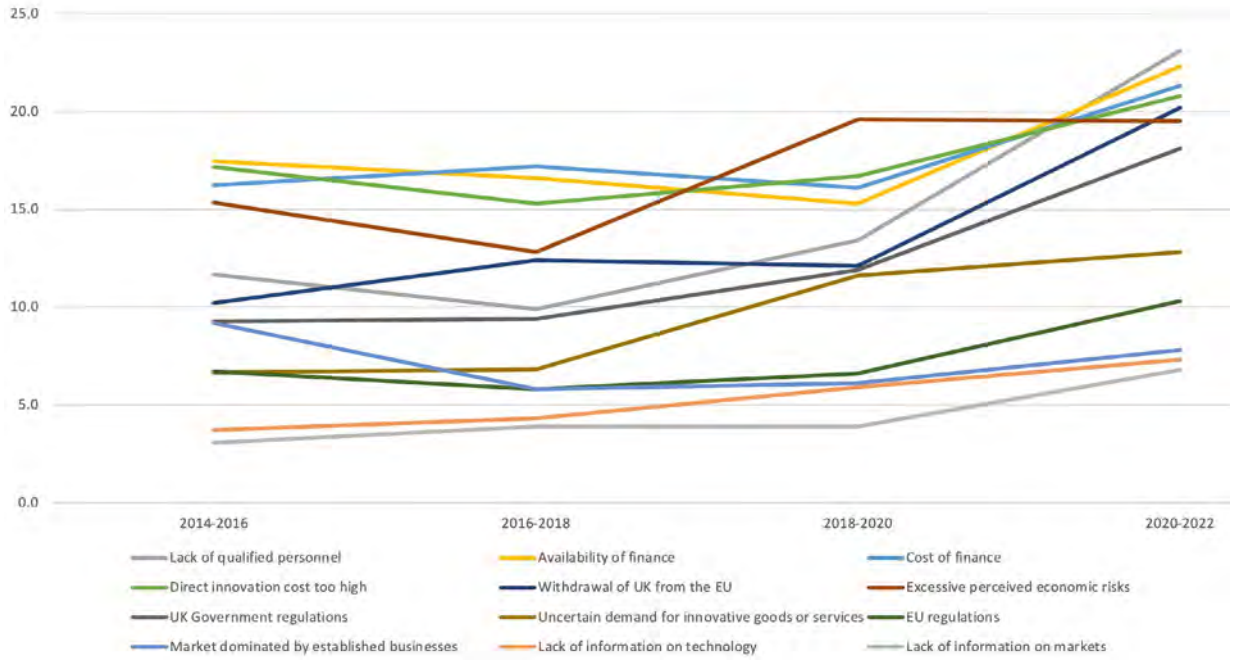
The online gaming unicorn FanDuel was a University of Edinburgh spin-out, but is now head quartered in New York; and other previous success stories include Exscientia (a Dundee-founded drug design and development company, which relocated to Oxford before being bought out by US rival Recursion); and Glasgow-based Smart Metering Systems, acquired last year by US private equity in a £1.3bn deal despite opposition from both its founder and former chief executive.[43] Other firms that had been identified as "futurecorns"[44] have invested outside of Scotland as they seek to scale – such as Motherwell-founded biotech firm Amphista Therapeutics, who are expanding around Cambridge.

Keeping home grown successes rooted in Scotland: what is holding Scotland back?

What these cases highlight is that Scotland has a challenge converting its burgeoning enterprises into a broader employment base – the foundation for a broad-based, inclusive, innovation-led growth model.

As the UK innovation survey shows (see figure 10 below), the barriers cited by Scottish firms to adopting innovative growth models, access to (or cost of) capital is cited by a quarter of firms as a barrier to innovation. A similar number cite skills gaps; and others still challenges around regulation.

Figure 10: Scottish businesses cite personnel, finance and regulatory barriers as holding back innovation



Source: UK innovation survey 2023

1. COST OF, AND ACCESS TO, CAPITAL

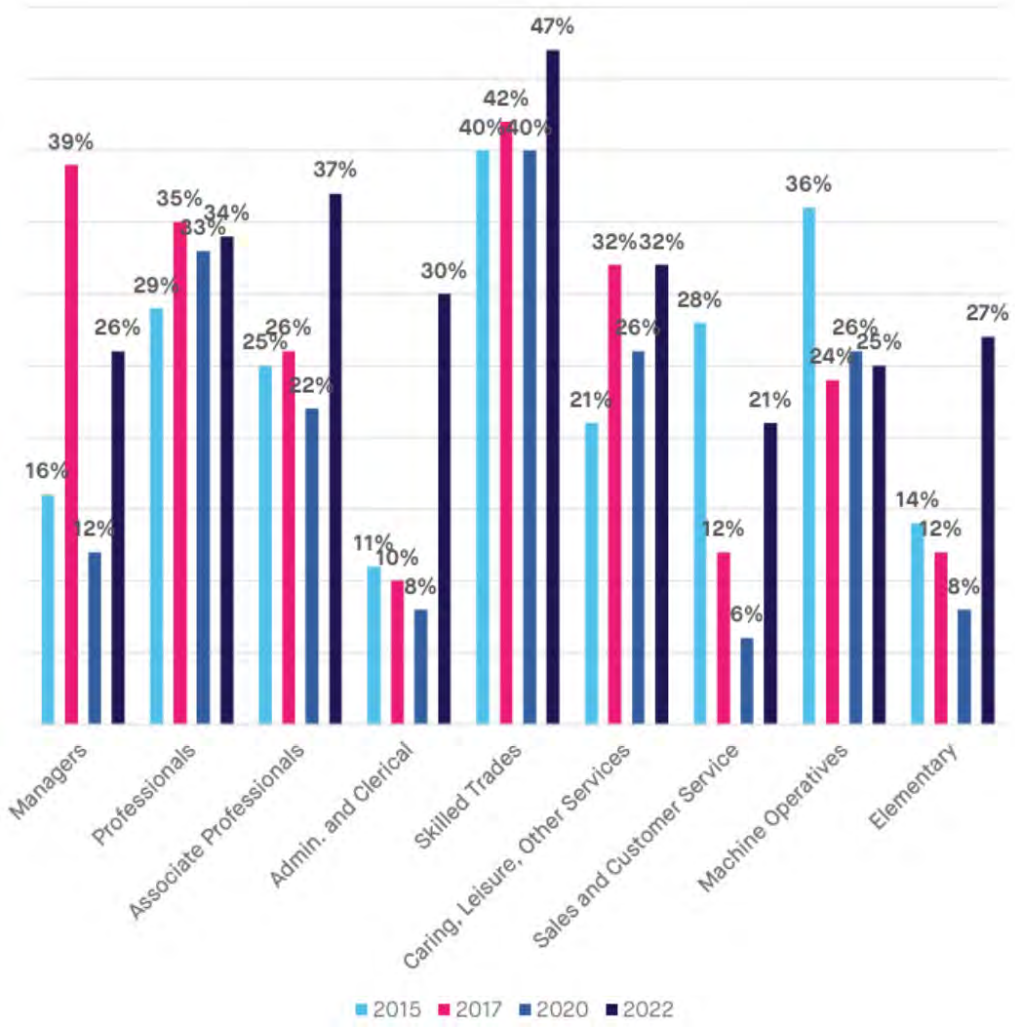
In recent years, investment in UK start-ups has begun to slump following a post-pandemic surge to £37bn, now at £16bn (by contrast, US start-ups saw their investment rise by 71% from 2023-24)[45]. And, despite Scotland's burgeoning success in building access to finance for start-up and scale-up firms, most companies rely on conventional forms of credit (credit cards, business overdrafts, and other debt financing from retail banks) to fund innovation and investment.[46] Recent research has identified the emergence of a risk premium for such forms of capital since the global financial crisis, with the Scottish risk premium rising some 200 basis points above that of London following the crisis;[47] while my own work has found that in the 2010s observably-identical Scottish SMEs receive around 80% the equity deal size of their peers in London.[48]

2. A SKILLS MISMATCH

As this paper's companion piece *A workforce fit for the future* and our previous paper *From Growth to Good* make clear, Scotland's success in boosting skills is not as tied to business demand as it could or should be. As 37%, Scotland has the second highest rate in the UK of graduates employed in non-graduate roles.[49]

Part of the reason for Scottish under-employment is a lack of high skill, high productivity firms demanding graduate-level skills (hence the declining university wage premium in Scotland).[50] But there is also indicative evidence of a skills mismatch: the wage premium commanded by scientific (STEM) skills has fallen by far less other types of skills at a degree level,[51] and – as figure 10, taken from *A workforce fit for the future*[52], makes clear – skills shortages are more pronounced in the skilled trades than elsewhere (e.g. at a managerial level), suggesting more needs to be done to provide intermediate skills.

Figure 11: Skill shortage vacancies are most common in Scotland's skilled trades



The ONS publishes data at an industry-by-industry level of occupational shortages,[53] with Scottish data indicating that ten greater occupational shortages in 2023 spanned a range of skills levels across trades, manufacturing, services and technology:

1. IT user support technicians
2. Solicitors and lawyers
3. Other registered nursing professionals
4. Metal working production and maintenance fitters
5. Cooks
6. Vehicle technicians, mechanics and electricians
7. Book-keepers, payroll managers and wages clerks

8. Programmers and software development professionals
9. Human resource managers and directors
10. Electricians and electrical fitters

Skills should be thought of as one specific case of agglomeration effects – the benefits, in terms of labour market density, innovation networks, and supply chains, that come from firms co-locating. The relocation of Scottish life science scale-ups to Oxford or Cambridge is due in part to skills, but also due to other productivity advantages of working in those cities (in spite of higher operating costs).

3. INEFFECTUAL OR ILL-DESIGNED REGULATION

Finally, firms cite regulation in holding back innovation. There is no single story of the effect of regulation, as it varies sector-by-sector. Financial services, for instance, face a trade-off between new approaches to financial management and other fiduciary responsibilities; tech firms have to navigate ambiguous and evolving legislation around data protection; and life sciences firms face administrative challenges in designing and securing sign-off for clinical trials.

Many of these trade-offs are unavoidable, and it is the legitimate domain of democratic politics to navigate those choices. But, as I return to in sector-specific case studies below, Scotland has an opportunity to use its devolved powers to improve the regulatory environment for innovative firms.

Attracting multinational investment to Scotland

While Scotland stands out for its reliance on public sector R&D spending, the rest of the world has become more reliant on business. Across the OECD as a whole, business R&D has risen to 74% of all R&D activity, up from 66% in 2010).[54]

That shift reflects the economies of innovation in sectors like life sciences, technology or advanced manufacturing, where high fixed costs or network and scale effects increasingly create a "winner takes all" market structure. In those markets – which, as we've seen, are particularly important to Scotland's innovation economy – other OECD research finds that multinational enterprises play a disproportionate role in finding innovation.[55]

As Canadian academic Dan Breznitz notes,[56] different places would do well to place themselves at different points along the innovation pipeline (with some prioritising innovation in production and assembly, or continuous improvement of existing products). But given Scotland's foundational strengths in basic research and discovery, the surest bet for Scotland's innovation economy is as a node in the global frontier innovation economy in tech, life sciences, or advanced materials.

A similar "crowding in" approach to multinationals has been the basis for Ireland's economic growth over the last decade, and has been pursued by other British cities such as Birmingham or Leeds in, first, attracting in back office functions; building a physical campus of multinationals; linking those campuses to the local skills system; and over time supporting local start-ups and encouraging incumbent multinationals to move up the value chain in their area.

For Scotland, that means thinking about its physical connectivity to nodes outside the UK (especially to the US - Dublin boasts twice the number of daily flights to the US as Scotland); and, as we return to in chapter six, brokering major inward investment from multinationals with the promise of speeding up planning and connections, and the offer of using Scottish Government powers to provide skills and regulatory support for inward investors.

Scotland's tasks: maintaining research strengths; keeping up progress on spin-outs and scale-ups; and making innovation "sticky".

Scotland has the building blocks of a world-class innovation economy: talent, research, institutions, and some standout firms. But it struggles with physical infrastructure[57], some financial incentives, and the coordination needed to create critical mass in a local economy.

Scotland's task is to protect its core innovation assets – at a time of global economic turmoil, and specific challenges in the higher education sector; to progress ongoing work to support spin-outs and scale-ups; to make sure Scottish success stories and multinationals are able to plant and take root in Scotland, rather than having to relocate to the US or elsewhere in the UK to expand.

To illustrate the argument, the next chapter looks at three emerging Scottish success stories – in life sciences, energy, and advanced manufacturing – to demonstrate what's working in Scotland's innovation economy and what more needs to be done.

Then, in chapters five and six, we return to the question of Scotland's policy landscape and the reforms it needs to make to capitalise on its assets. What Scotland now needs is the will – and the coordination – to deliver.

“SCOTLAND HAS THE BUILDING BLOCKS OF A WORLD-CLASS INNOVATION ECONOMY: TALENT, RESEARCH, INSTITUTIONS, AND SOME STANDOUT FIRMS”

4. Bright Spots: Scotland's emerging clusters

Life sciences: Scotland's quiet innovation strength

Life sciences is one of Scotland's strongest and fastest-growing sectors. It combines cutting-edge research, high-value manufacturing, and global exports – all while delivering health and societal benefits. This chapter examines the scale of the sector, its comparative strengths, leading firms, global positioning, and the policy framework supporting its growth.

SCOTLAND'S R&D LEADER

Scotland's life sciences cluster employs around 46,900 people, across 748 life sciences enterprises, with a GVA of around £10.5 billion as of 2021 (5% of Scottish GVA). It spans medical technologies, pharmaceuticals, biotech, digital health, and contract research and manufacturing. The sector contributes over £4.4 billion in exports annually, as well as leading Scottish R&D.[58]

A hallmark of the Scottish life sciences sector is its integration of research, clinical expertise, and manufacturing. Major hospitals and universities are co-located with incubators and commercial firms, creating strong knowledge spillovers. The Edinburgh BioQuarter, Glasgow's University of Glasgow and Glasgow Riverside Innovation District, and Aberdeen's Health Campus exemplify this integrated model.

RESEARCH STRENGTHS AND EMERGING OPPORTUNITIES AROUND MANUFACTURING

Scotland punches above its weight globally in areas like genomics, regenerative medicine, imaging, and neuroscience. Research institutions such as the Roslin Institute, Centre for Regenerative Medicine, and the CRUK Scotland Institute (formerly the Beatson Institute) have global reputations. The University of Dundee is consistently ranked among the top institutions for drug discovery, particularly in cancer research, closely partnering with multinationals including Pfizer, AstraZeneca, and Johnson and Johnson.

The country has also pioneered digital health and data-driven medical innovation, underpinned by the NHS Research Scotland framework and access to integrated population health data – often cited as a strategic advantage in clinical trials and AI health applications.

Scotland is home to globally important firms such as BioOutsource, RoslinCT, and major research and production facilities for Charles River Laboratories. It also hosts manufacturing plants for multinationals like GSK (Montrose, Irvine), Merck, Valneva, and Thermo Fisher Scientific.

CASE STUDY: PRECISION MEDICINE IN GLASGOW AND BEYOND

Precision medicine uses advances in genetics and data to target healthcare at individuals, rather than providing a one-size-fits-all approach (for more, see Our Scottish Future's *Precision Medicine and Scotland's Opportunity*, 2023). For example, people with liver disease can be screened and given the treatment and care suitable for their own unique circumstances.

One in five drugs approved in the US are in precision medicine, and Scotland is ideally placed to take advantage. Glasgow is home to the Precision Medicine Scotland Innovation Centre at the Queen Elizabeth hospital, while Dundee and Edinburgh are also seeing growth.

High productivity manufacturing, and associated technical professions, already employ around 60,000 people in metro-Glasgow, with perhaps 6,000 of those based in precision medicine-related roles. This autumn, the Health Innovation Hub will open as a centre for precision medicine in the Glasgow Riverside Innovation District, catalysed by UK Government funding through the Strength in Places Fund and with support from Kadans Science Partner, Scottish Enterprise, and the University of Glasgow – bring 400 jobs to Govan.

With the global market expected to head past the £100bn barrier in 2025, spin out companies like BioClavis, which provides data and diagnostic tests for individual patient care, are taking advantage of the research know-how in the city to expand their facilities.

Other companies like Glasgow-based Reprocell Europe support the world's big pharmaceutical firms as they develop new treatments. Meanwhile, in Dundee, spin-out firm Exscientia, which uses AI to reduce the time it takes to develop medicines, recently became one of Britain's largest university exits when it went public on the Nasdaq with a £2.2bn valuation.

POLICY GOALS: BUILDING ON RESEARCH AND DISCOVERY TO CREATE JOBS

The Scottish Life Sciences Strategy, developed by the industry in Scotland, targets £8 billion turnover by 2025 – a goal achieved five years ahead of schedule. The strategy prioritises:

- Scaling up manufacturing capacity
- Attracting inward investment
- Supporting university spinouts and SME growth
- Enhancing digital health and diagnostics

Public infrastructure has grown in recent years:

- The Medicines Manufacturing Innovation Centre (MMIC) near Glasgow provides scale-up facilities for advanced drug production.
- The Cancer Research UK Scotland Institute and the Centre for Virus Research at the University of Glasgow, providing anchors for Glasgow's life sciences economy that will expand with the opening of the Health Innovation Hub later this year.
- The Edinburgh BioQuarter expansion aims to create over 160,000 sqm of lab and office space.
- The National Robotarium (Heriot-Watt/Edinburgh partnership) supports medtech, rehab robotics, and AI-driven surgery tools.

The UK Government has supported sector growth through investments through Innovate UK and the Biomedical Catalyst, ongoing support for the UK Clinical Research Collaboration, and its direct engagement with industry through NHS procurement – most notably in the experience of the Vaccines Taskforce in 2020. Life sciences is one of the eight growth-driving sectors identified by the UK Government in the Industrial Strategy Green Paper of December 2024, with a refreshed Life Sciences Sector Deal expected imminently.

Yet challenges remain, in line with the challenges set out in the previous chapter. As the example of Exscientia (the University of Dundee near-unicorn, now relocated to Oxford Science Park) shows, local policy-makers face a "chicken-and-egg" problem when expanding physical spaces such as Edinburgh's BioQuarter, as success relies on reaching a tipping point of firms, talent and infrastructure. Before that tipping point is reached, the opportunity cost of scaling locally may be prohibitively high for businesses.

As industry groups report, this creates difficulty in accessing follow-on finance, especially for clinical-stage biotech firms; skills gaps in manufacturing and regulatory affairs; and a shortage of high-spec lab space for scale-ups. Properly addressing those challenges requires policy coordination and investment – which in turn requires clear prioritisation of sectors, places and bottlenecks to prevent duplication or competition across nascent clusters within Scotland.

Taken together, these barriers are estimated to have cost the UK £15bn over a decade in foregone foreign direct investment, with the UK's share of global pharmaceutical exports and clinical trials declining even as the life sciences industry grows domestically.[59]

SCOTLAND CAN DO MORE ON LIFE SCIENCES, BY BUILDING SKILLED CLUSTERS AND A FOCUS ON REGULATORY EFFICIENCY

Scotland has life sciences strengths to build across the country, notably in Dundee, Glasgow and Edinburgh. Quality matters as much as scale, allowing smaller places like Dundee to succeed in life sciences.

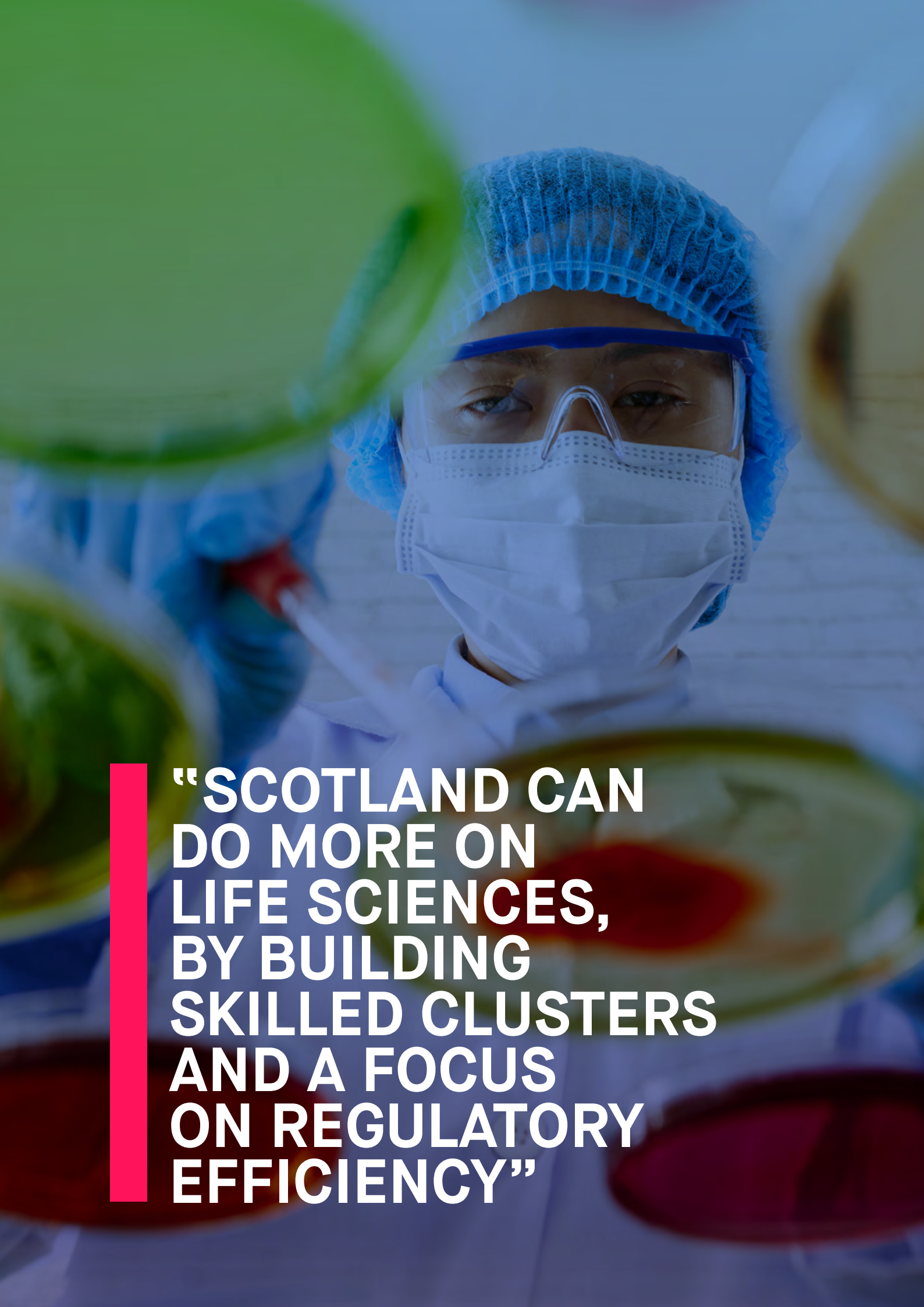
As in other sectors, human capital per se isn't a barrier: Scotland is home to thousands of highly experienced and talented workers in the sector, who have made a career with global firms like GSK or AstraZeneca, or in research roles. Rather, the challenge is building the critical mass of talent in a place to form a Cambridge-like cluster (rather than remaining a spoke to Cambridge's hub); which in turn means addressing infrastructural, regulatory and financial constraints to growth.

To meet ambitions for converting basic research strengths in life sciences into manufacturing and jobs investment, Scotland faces an issue with access to later stage capital. Clinical trials held in Scotland can deliver good efficacy data on new technologies, but translating them into manufactured products requires tens or hundreds of millions of pounds of investment – which often means turning to investors outside the UK, often in the US. This link between Scottish talent and US investors is an important reason behind why so many of Scotland's unicorns end up relocating to the US rather than scaling in Scotland.

The scale of reform required to create homegrown competitors to US investors needs to happen as a UK-wide scale. The Chancellor's proposed Mansion House reforms are an important step forward, reviewing ways to bring UK pension funds in line with their peers in terms of their appetite for investment in private assets: one Canadian investment into Octopus Energy in 2021 was larger than all UK pension fund investment in UK start-ups in 2022 combined; while Australian pension funds invest ten times the proportion of their funds in private assets than UK funds.[60]

Nor, despite strong growth over the last decade, should Scotland neglect opportunities in supporting discovery work (especially to support the financial resilience of the University of Dundee, and to realise the potential of Edinburgh's BioQuarter). There are opportunities in life sciences for Scotland to act as a "smart consumer" through NHS procurement, and to improve the regulatory environment on an area of comparative strength: clinical trials. RoslinCT, for instance, was support by the Scottish government buying its pioneering cystic fibrosis drugs before the NHS in England was prepared to.

Delivery, as well as money, matters for supporting life sciences. Scotland has an opportunity to build on the work of the Office of Life Sciences at a UK level, provided ministers and civil servants are empowered to focus on goals and alignment rather than "ticking boxes". For instance, Scotland could establish a centralised mechanism for clinical trials. As the O'Shaughnessy Review into commercial clinical trials set out,[61] life sciences companies negotiate hospital-by-hospital with ethics committees in a process that could be centralised and streamlined, with a target of turning around approvals within a month. This could be a win-win, investing in support for life sciences in return for low pharmaceutical costs, as in Spain.



"SCOTLAND CAN DO MORE ON LIFE SCIENCES, BY BUILDING SKILLED CLUSTERS AND A FOCUS ON REGULATORY EFFICIENCY"

Scotland's life sciences sector is a proven engine of good jobs and inclusive innovation. With strong public-private collaboration, growing clusters, and clear strategic direction, it can continue to thrive. The priority now is to take steps to speed up regulation around trials and medical discovery; support inward investment for mature firms seeking to expand manufacturing in Scotland; and broker industry-Scottish NHS deals to underwrite risk or expedite discovery in return for access to cheaper, more innovative medical technologies.

If Scotland can deepen its specialisation in high-value niches – biomanufacturing, cell & gene therapy, medtech – it could anchor not only national prosperity, but global leadership in health innovation.

Scotland's energy economy: powering a just transition

Scotland stands at the forefront of the global energy transition. With some of the best renewable resources in Europe – offshore wind, tidal power, and vast potential for green hydrogen – it has the opportunity to lead the world in building a clean, secure, and fair energy system. This chapter explores Scotland's current energy economy, its comparative advantages, the state of key technologies, the firms driving innovation, and the public policies shaping the sector's future, building on Our Scottish Future's 2024 *North Sea 2: The Future of Energy from the North Sea*.

SCOTLAND IS AN ESTABLISHED LEADER IN ENERGY INDUSTRIES, OLD AND NEW

Energy has long been central to Scotland's economy. North Sea oil and gas powered UK industry and government revenues for decades, peaking in the 1980s and continuing to provide jobs and exports today. This legacy means that Aberdeen is home to several major multinational energy companies, headquartering Harbour Energy, Shell, BP and Iberdrola.

But the world is shifting fast. Climate change imperatives, changing global demand, and geopolitical shocks (notably Russia's invasion of Ukraine) have accelerated the move toward clean energy.

Scotland is uniquely positioned to benefit from this shift, but it faces substantial hurdles – politically, technologically, and operationally – to get there:

Renewables growth: As of 2022, nearly 100% of Scotland's electricity demand is met from renewable sources in an average year.[62] Wind, especially onshore and increasingly offshore, dominates. In 2022, wind alone generated 27.6 TWh – more than Scotland's total demand. Solar, hydro, and bioenergy round out the mix.

Offshore wind potential: The ScotWind leasing round, concluded in 2022, awarded 25 GW of offshore wind development rights – more than double Scotland's current electricity capacity.[63] These projects, led by consortia including Shell, SSE, and TotalEnergies, could position Scotland as a global offshore wind leader. Floating wind in deep waters offers a particular edge, with Scottish sites among the best globally. But the expansion of offshore wind is being hindered by both supply constraints[64] and Scottish Government reallocation of half a billion pounds worth of renewable energy funding to plug budget shortfalls.[65]

Green hydrogen: With abundant wind power and industrial heritage, Scotland may have potential to become a green hydrogen exporter. The Scottish Government's Hydrogen Action Plan targets 5 GW of renewable hydrogen capacity by 2030. Projects like Acorn Hydrogen in Aberdeenshire aim to produce blue and eventually green hydrogen at scale. Hydrogen hubs in Orkney and the Western Isles are pioneering local use in transport and heating. However, hydrogen's role in the climate transition is becoming less central as time progresses, due to its relatively high cost (according to the Climate Change Committee's latest pathway to net zero).[66]

Grid and storage: A major challenge is infrastructure. Scotland's renewable generation is often located far from demand centres, and the grid needs major upgrades. Investment in interconnectors, battery storage, and smart grids is essential. The UK Government's Review of Electricity Market Arrangements (REMA) may open the door to locational pricing, which could affect Scottish generators' revenues.

Oil and gas transition: The North Sea remains significant, employing around 90,000 people directly and indirectly in Scotland.[67] But output is declining, and the UK Government's licensing of new fields is contentious.

CASE STUDY: SCOTTISH RENEWABLES AND ENERGY IN ABERDEEN AND THE EAST COAST.

For forty years one of the oil capitals of Europe, Aberdeen and the north-east is transitioning fast to become a world leader in renewable energy and technology.

One example is the plan to position Aberdeen as the UK leader in the new hydrogen economy, with a megawatt stationary fuel cell powering its Event Complex, and one of Europe's largest fleet of hydrogen buses.

The Aberdeen Hydrogen Hub now proposes to deliver renewable production of hydrogen and a transport refuelling facility, with longer term plans aimed at delivering green hydrogen for rail, freight and marine power. Potential economic benefits have been measured at upwards of £700m GVA to Scotland's economy by 2030.

Other communities on the west coast stand to benefit from the growth of the green energy sector. The Offshore Renewable Energy Catapult site in Levenmouth, Fife, is a world-leading test site for wind – with the most advanced, open-access offshore wind turbine for R&D purposes. The Catapult is partnering with local Communities and colleges to test domestic hydrogen technologies, bringing both manufacturing and retrofit construction opportunities for Scotland.

CAPITALISING ON NEW ENERGY MARKETS REQUIRES TAKING MORE TECHNOLOGICAL AND FINANCIAL RISK IN AN INDUSTRY ALREADY UNDER PRESSURE

The most obvious opportunity for Scotland, then, is in renewable energy. Scotland is a world leader in integrating renewables into the grid, particularly wind. Its pioneering work on floating wind (e.g., Hywind Scotland) and tidal energy (e.g., Orbital Marine Power) has attracted global interest. However, scaling up remains a challenge:

- **Global investment:** ScotWind's success has brought major international players to Scotland, but manufacturing and supply chain commitments have lagged. Much of the turbine fabrication is still overseas. To capture more value, Scotland needs ports, fabrication yards, and a pipeline of skilled workers.
- **Carbon Capture and Storage (CCS):** The Acorn CCS project at St Fergus (north of Aberdeen) is one of the UK's most advanced, subject to decisions on funding in the UK Spending Review this month. It aims to repurpose existing pipelines and reservoirs to store CO_2 from industry and hydrogen production.
- **Just transition and skills:** The Just Transition Commission has called for clear pathways for workers to move from declining sectors to emerging ones.[68] This includes targeted retraining, community benefit from projects, and regional planning. Aberdeen is repositioning as a global "energy transition capital," with investment in renewables R&D and university partnerships.

Scotland hosts a growing number of innovative firms and energy clusters who can play a key role in the transformation of its energy system:

- **SSE Renewables:** Based in Perth, SSE is a major developer of offshore wind, including the Seagreen and Dogger Bank projects. It is investing in grid and storage infrastructure across Scotland.
- **Orbital Marine Power:** Based in Orkney, Orbital operates the world's most powerful tidal turbine, the O2. The company has received innovation funding from the UK and EU and is seen as a global leader in tidal technology.
- **Hydrogen Clusters:** The Aberdeen Hydrogen Hub, involving BP and Aberdeen City Council, is producing and using green hydrogen for municipal buses. Orkney's hydrogen programme uses excess wind to generate hydrogen for ferries and heating – making it a globally recognised testbed for hydrogen innovation.
- **Ports and Fabrication:** Cromarty Firth and Forth ports are being upgraded to handle wind turbine components. These hubs could anchor a future green industrial base – if skills and investment align.

CHARTING A "BALANCED TRANSITION" FOR SCOTLAND: ADDRESSING INFRASTRUCTURE BOTTLENECKS AND MAXIMISING INVESTMENT INTO NEW INDUSTRIES

The Scottish Government's Energy Strategy and Just Transition Plan sets out a vision for a net-zero energy system by 2045. It includes targets to double electricity generation, deploy 20 GW of hydrogen capacity, and a "presumption against new exploration for oil and gas" – sparking concerns from business and unions alike that the Scottish

Government's ambition is not matched by a detailed plan of "the concrete and detailed path necessary"[69] at a time when evidence suggests the North Sea basin is becoming increasingly mature and seeing costs rise, independent of new exploration.[70] Others specifically reject the presumption against new exploration, on the grounds that given ongoing global demand for oil there should be an opportunity for cost efficient North Sea industries to service that demand, even as the Scottish energy system moves to net zero.[71]

The challenge for Scotland, as Nick Butler argued for Our Scottish Future,[72] is to find a "gradual balanced transition", with the profits and revenue from existing strengths in energy being used to fund the next generation of low carbon activity.

Important public initiatives to complement that private shift are already in motion, but still in early stages. For instance, the Home Energy Scotland was launched in late 2022 to lead on heat and energy efficiency, with £1.8 billion committed to help decarbonise over a million homes by 2030. Between 1990 and 2022, however emissions from buildings fell by only 32 per cent.[73] Real progress will depend on markedly scaling up retrofit programs in the coming years. Two "Green Freeports" – in Inverness/Cromarty Firth and the Forth – were designated in 2023 to spur low-carbon industrial hubs. And new programmes have been put in place to tackle skills gaps, such as the Energy Skills Partnership's Offshore Wind Skills Programme.[74]

Scotland's energy future is pivotal not only to its economy but to its international reputation. If it can capture more value from offshore wind and carbon capture, reskill its workforce, and build a secure, affordable and sustainable energy system (including through North Sea energy system integration and interconnectivity), it will be a model for the rest of the world.

But the opportunity is not guaranteed. Grid infrastructure bottlenecks, investment delays in ports and supply chains, and policy uncertainty could squander it. With the new UK Government launching Great British Energy and headquartering it in Aberdeen (with two other sites, in Edinburgh and Glasgow), there is an opportunity for change – provided the Scottish and UK Governments can partner to set out a detailed roadmap for transition.[75]

The next decade must be one of delivery. The prize is vast: tens of thousands of good jobs, cheaper energy, a secure export base, and a just transition that ensures no community is left behind.

Advanced manufacturing: reinventing Scotland's industrial base

Manufacturing has been a backbone of Scotland's economy for centuries – from shipbuilding and steel in the past to today's high-tech production of aerospace parts, electronics, and precision instruments. While the sector's relative share of economic output has declined over time (as in all advanced economies), it remains critically important for productivity, exports, and innovation diffusion. This chapter examines Scotland's advanced manufacturing sector: its scale and recent trends, how it stacks up internationally, profiles of key firms driving innovation, and the policy context shaping its future growth.

MANUFACTURING IS CENTRAL TO SCOTLAND'S "GOOD JOBS ECONOMY"

Scotland's manufacturing sector encompasses diverse industries: aerospace and defence, transport equipment (like buses and marine vessels), electronics and semiconductors, chemicals and pharmaceuticals (overlapping with life sciences), food and drink processing, textiles, and emerging areas like space technology and advanced materials. Some key points about the sector's profile:

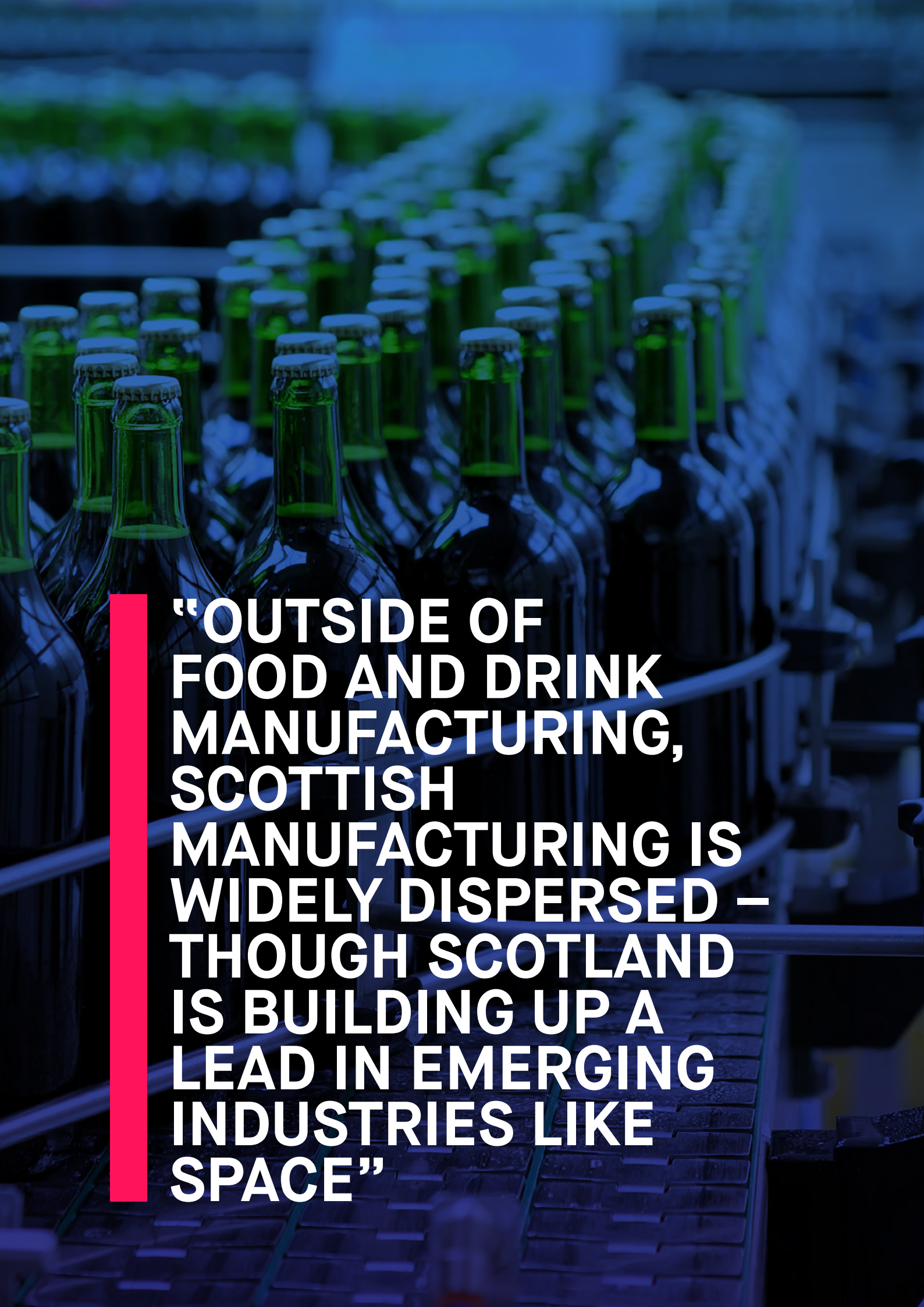
- **Output and employment:** Manufacturing in Scotland contributed approximately £18.3 billion in GVA in 2024 (around 10% of Scotland's total GVA).[76] It employs about 200,000 people (roughly 1 in 13 jobs, 8% of the workforce), meaning manufacturing employment is more productive on average. These jobs are spread across Central Belt industrial clusters (Glasgow area, West Lothian, Fife), the Northeast (Aberdeen's engineering firms), and pockets like Ayrshire (aerospace) and the Borders (textiles). While employment has fallen from past decades, those jobs that remain are often highly skilled, well-paid positions.

- **Productivity and R&D:** Manufacturing tends to have higher productivity than many service sectors. In Scotland, manufacturing output per worker is significantly above the economy-wide average (reflecting capital-intensive processes and specialised skills). Importantly, manufacturing companies are responsible for almost half of all business R&D spending in Scotland. This outsized share (47% of BERD)[77] indicates how crucial manufacturing firms are in driving innovation, whether it's developing new products or process improvements. For example, segments like electronics, aerospace, and pharmaceuticals invest heavily in research, design, and engineering.

- **Exports:** Manufactured goods account for the majority of Scotland's international exports – over 50% according to Scottish Government figures. This includes whisky and food products, refined petroleum, chemicals, electronics, and machinery. Iconic Scottish exports like whisky fall under manufacturing and alone contribute around £5 billion a year in export value (over a quarter of all Scottish exports, and more than half of our manufactured outputs). High-tech manufacturing exports (like medical instruments, aerospace components, and semiconductors) are smaller in absolute terms but strategically important and often high-value per unit – including £2.7bn of power generation machinery exports and £1bn of medical and pharmaceutical products.[78] The health of manufacturing thus directly affects Scotland's trade balance and exposure to global markets.

- **Historical transition:** The structure of Scottish manufacturing has shifted markedly over the last 30-40 years. In 1998, manufacturing was about 17% of Scotland's GVA; by 2016 it was around 10-11%. Heavy industries such as shipbuilding, heavy machinery, and electronics assembly shed many jobs due to competition and offshoring. However, new niches have risen: today Scotland is known for producing complex, high-value items rather than mass low-cost goods - including satellites and spacecraft, renewable energy equipment, advanced textiles, precision optics, and bespoke engineered systems.

"Advanced manufacturing" specifically refers to the use of innovative technology and processes to improve products or production – things like automation and robotics, 3D printing, advanced materials (carbon fibre, photonics), and integrating digital devices like sensors into processes. Scotland's adoption of these so-called 'Industry 4.0' techniques



"OUTSIDE OF FOOD AND DRINK MANUFACTURING, SCOTTISH MANUFACTURING IS WIDELY DISPERSED – THOUGH SCOTLAND IS BUILDING UP A LEAD IN EMERGING INDUSTRIES LIKE SPACE"

is uneven – some leading firms are cutting-edge, while many SMEs are still catching up. A policy priority (discussed below) is to diffuse advanced manufacturing capabilities to more of the manufacturing base, to boost productivity and resilience.

OUTSIDE OF FOOD AND DRINK MANUFACTURING, SCOTTISH MANUFACTURING IS WIDELY DISPERSED – THOUGH SCOTLAND IS BUILDING UP A LEAD IN EMERGING INDUSTRIES LIKE SPACE

Measured against international benchmarks, Scotland's manufacturing sector shows both strengths and weaknesses:

- **Product mix:** Scotland has world-class performance in certain manufacturing sub-sectors. For example, in aerospace, Scottish sites produce critical components for Airbus and Boeing jets. In pharmaceutical manufacturing, as noted in the life sciences chapter, productivity is extremely high and products from Scottish plants supply global markets. In food and drink manufacturing, Scottish whisky is a global premium product with decades of export growth. Meanwhile, in other areas like consumer electronics or automotive assembly, Scotland has little or no presence.

CASE STUDY: AGRI-FOODS AND WHISKY IN THE RURAL ECONOMY.

Between them, agri-food and scotch whisky are huge earners for Scotland's rural heartlands. The biggest food export, salmon, was the UK's biggest food export earner, hitting more than £500m in 2022. Scottish farmers supply a food and drink sector which generates over £15 bn to the Scottish economy.

The giant Scotch whisky sector, meanwhile, now amounts to nearly 80% of all Scottish food and drink exports, around £5bn GVA a year to the UK economy. There are currently 148 Scotch whisky distilleries across the country.

Supported by world leading researchers at the James Hutton Institute, agri-businesses are branding Scotland as a sustainable producer of food – such as the "Ethical Dairy" in south-west Scotland which, uniquely, keeps calves with their mothers. At the other end of the country, the Harris distillery in the Western Isles has sought to tackle depopulation on the islands by employing 50 staff producing gin and whisky.

- **Productivity and automation:** Compared to manufacturing powerhouses like Germany or South Korea, Scotland (and the UK generally) has lower manufacturing productivity and less automation. Robot density (robots per 10,000 manufacturing workers) in the UK is a fraction of levels in Germany or Japan – suggesting scope to increase automation. Some Scottish factories are exceptions – for instance, the semiconductor fabs in Glenrothes and Greenock operate highly automated processes at world-class yields. But many factories, especially SMEs in machining or food processing, have been slower to invest. This partly reflects the industrial structure (more SMEs, fewer large automotive plants than say the Midlands in England or Germany's Mittelstand which heavily invested in robotics). To remain globally competitive, many Scottish manufacturers need to adopt more advanced manufacturing tech, and this is an active area of policy support via initiatives like the Made Smarter Scotland digital adoption program.[79]

- **Space and emerging industries:** An area where Scotland punches above its weight internationally is the space sector. Remarkably, Glasgow now produces more small satellites than any city in Europe.[80] Companies in Glasgow have built dozens of cube satellites for commercial and research purposes, capturing a significant share of the fast-growing smallsat market. This is a new industrial strength, effectively creating a space-tech manufacturing cluster from scratch in the last 15 years. Additionally, Scotland is on track to host the UK's first orbital space launches – spaceports in Shetland (SaxaVord) and Sutherland have been licensed, with companies like Orbex building rockets to launch small satellites by 2024-25.[81] These developments position Scotland at the forefront of Europe's new space economy, a highly advanced manufacturing endeavour combining rocketry, avionics, and satellite design.

- **Alignment with research assets:** Especially at the technological frontier, Scotland sees strong links between industry and research. For instance, the Critical Technologies Supercluster initiative brings together industry, researchers and the public sector to support around £4bn of activity in photonics, quantum, semiconductors, connectivity and sensing in partners with the University of Glasgow and the University of Strathclyde.[82] The University of Glasgow, for example, hosts the UK Government-funded James Watt Nanofabrication Centre (JWNC), a leading open-access semiconductor facility.

- **Supply chain resilience:** The COVID-19 pandemic and Brexit have tested manufacturing supply chains. Internationally, there's a move to reshore or "friend-shore" critical manufacturing (like semiconductors, medical supplies). Scotland has a chance to attract some of this – e.g. the UK Government's semiconductor strategy identified Semefab (a fab in Glenrothes) as a key site to expand for domestic chip production,[83] and indeed Semefab secured funding to boost output of MEMS and power semiconductors that go into appliances and cars. Competing internationally for these investments requires Scotland to offer skills, infrastructure, and innovation – areas where it has strengths (a well-educated workforce, good universities, relatively low operating costs compared to SE England).

- **Exports and trade:** Scottish electronics manufacturing declined in the face of East Asian competition – today, only niche electronics manufacturing remains (like bespoke sensors, ATM machines by NCR in Dundee until recently, etc.) – and international competition in all advanced manufacturing remains fierce. To regain

"ADVANCED MANUFACTURING EMPLOYMENT IS SPREAD ACROSS THE COUNTRY, AND WILL BE CENTRAL TO A REGIONALLY-BALANCED SCOTLAND"

ground, Scottish manufacturers often focus on high complexity or custom products rather than volume. Internationally, that's a viable strategy: compete on quality and specialization, not cost. We see that in fields like photonics (laser and optical tech companies in Scotland are globally renowned) and precision instruments (e.g. Edinburgh's companies making scientific instruments). The key is continuous innovation to stay ahead of the curve.

In summary, Scotland's advanced manufacturing has strong points – high-end aerospace, emerging space industry, globally recognised engineering firms – but also areas where it lags leading nations in modernisation and scale. The sector's international success will depend on moving up the value chain (more innovation, design and IP originating in Scotland), adopting advanced processes to raise productivity, and leveraging unique Scottish strengths (like abundant renewable energy, which could attract energy-intensive manufacturing such as green steel or battery gigafactories in the future).

ADVANCED MANUFACTURING EMPLOYMENT IS SPREAD ACROSS THE COUNTRY, AND WILL BE CENTRAL TO A REGIONALLY-BALANCED SCOTLAND

Scotland's advanced manufacturing landscape features a mix of multinational corporations with significant Scottish operations, home-grown firms, and new start-ups. For instance:

- **Spirit AeroSystems (Prestwick):** One of the largest aerospace employers in Scotland, Spirit's Ayrshire facility (formerly part of Boeing/McDonnell Douglas) designs and manufactures wing components and other aerostructures for Airbus and Boeing aircraft. This includes advanced composite wing spoilers and leading-edge panels for the Airbus A320 family. Spirit in Prestwick employs over 1,000 people in highly skilled jobs, and has invested in robotics and composite material processes to remain at the cutting edge. Aerospace manufacturing in Scotland extends beyond Spirit: Rolls-Royce's site at Inchinnan (Renfrewshire) manufactures and repairs turbine blades for jet engines, and BAE Systems' naval shipyards on the Clyde build advanced warships for the Royal Navy using the latest digital design techniques (though shipbuilding is often treated separately from "advanced manufacturing," it is indeed a high-tech production enterprise today).

- **Alexander Dennis (Falkirk):** A storied Scottish manufacturer of buses, ADL is the UK's largest bus producer and known worldwide for double-decker buses. Now part of Canadian NFI Group, ADL has pivoted strongly to innovation in clean transport – it developed the world's first hybrid double-decker buses and more recently electric and hydrogen-fuel-cell buses. Its new Enviro series electric buses, some built in Falkirk and also in overseas plants, incorporate advanced battery systems and lightweight materials. ADL's ability to continually innovate (in partnership with tech providers) has kept it competitive internationally, supplying buses from London to Hong Kong. It's a prime example of an older manufacturer embracing technology to stay relevant in a net-zero age.

- **Diodes Inc. (Greenock) and Semefab (Glenrothes):** These are Scotland's two semiconductor fabrication plants. The Greenock facility, originally built by National Semiconductor in the 1970s, is now owned by Diodes Inc. (USA) and produces analogue and power semiconductors. Semefab in Glenrothes is smaller but notable for

producing MEMS sensors and silicon chips for healthcare and industrial uses. These fabs demonstrate advanced manufacturing at the micro/nanoscale – cleanrooms, precision process control, and continuous innovation in process technology. They also anchor an electronics supply chain that includes design firms and equipment suppliers in Scotland.

- **Photonics and Precision Engineering SMEs:** Scotland has a cluster of specialist firms like M Squared Lasers (Glasgow), which makes ultra-precise lasers used in quantum research and medical imaging, and Optos (Dunfermline, profiled earlier in life sciences, making retinal imaging devices). These companies, though medium-sized, are global leaders in their niches and rely on advanced manufacturing techniques (high precision assembly, optical engineering) to produce their cutting-edge products.
- **BAE Systems and Defence Manufacturing:** While civilian manufacturing is our focus, it's worth noting defence-related advanced manufacturing in Scotland. BAE's shipyards in Govan and Scotstoun have adopted digital design (virtual reality simulations, modular construction) to build advanced frigates. Likewise, Leonardo in Edinburgh manufactures cutting-edge radar and sensor systems for aircraft – a high-tech electronics manufacturing activity. These facilities keep Scotland at the forefront of certain advanced manufacturing capabilities (naval engineering, defence electronics), supported by steady UK defence contracts. The spillovers of know-how from defence to civilian tech (and vice versa) often bolster innovation.

CASE STUDY: SCOTLAND'S SPACE TECH CLUSTER – FROM SHIPBUILDING TO SPACECRAFT

Glasgow was once famed for building ships; today it is gaining fame for building satellites. Over the past decade, a vibrant space technology cluster has emerged in Scotland's largest city, making it arguably the most important UK hub of the "new space" industry. Two pioneering companies lead this cluster: **AAC Clyde Space** and **Spire Global**.

AAC Clyde Space began as Clyde Space, a University of Strathclyde spin-off in 2005, and built Scotland's first nanosatellite (*UKube-1* launched in 2014). Now part of Sweden's AAC Clyde, the Glasgow facility designs and manufactures cube satellites – small satellites often the size of a shoebox or microwave. These cubesats pack sophisticated instrumentation for missions ranging from Earth observation to communications. To date, Clyde Space has delivered over 100 satellites or subsystems, many for international clients like NASA and the European Space Agency. Their assembly cleanrooms in Glasgow's West of Scotland Science Park are a far cry from the heavy engineering of old – technicians in white suits meticulously integrate microelectronics, solar panels, and miniature thrusters.

Spire Global, originally from the US but with its primary R&D office in Glasgow, has taken a similar path. Spire produces small satellites for tracking ships (AIS data), aircraft, and weather. It has built and launched over 150 satellites – a significant portion fabricated in its Glasgow facility – making it one of the world's most prolific private satellite makers. Spire's Glasgow team handles end-to-end production: circuit boards are populated with sensors, satellites are tested in thermal vacuum chambers simulating space, and the finished 5kg cubesats are shipped for launch.

This cluster has been supported by local talent (graduates in engineering and computer science), by Glasgow's history of precision manufacturing, and by support from the Scottish and UK Governments. For example, the UK Space Agency has provided funding for innovation in satellite tech and is developing launch capabilities in Scotland.

The result: **Glasgow now manufactures more satellites than any other city in Europe**. The growth continues – companies like Alba Orbital (building tiny "PocketQube" satellites) have joined the fray, and supply-chain firms for testing and software have sprouted.

The space cluster exemplifies advanced manufacturing in the purest sense: high-skilled, R&D-heavy, export-oriented, and inspiring to the next generation of engineers. It shows Scotland leveraging its engineering heritage into a new, globally competitive sector. The presence of satellite manufacturing also complements other industries – for instance, data from these satellites feed into fintech and renewable energy management, enhancing innovation across the economy. With upcoming **Scottish spaceports** planning launches, Scotland is unique in Europe in hosting both the building and launching of satellites within one country, positioning it as a true space nation on the rise.

THE POLICY OPPORTUNITY: CAPTURING "UP FOR GRABS" MANUFACTURING SUPPLY CHAINS TO DRIVE JOB GROWTH ACROSS SCOTLAND

Existing initiatives to support manufacturing in Scotland include:

- **Making Scotland's Future – Manufacturing Strategy:** This initiative, co-developed with industry, focuses on stimulating innovation, adopting new technologies, and upskilling the manufacturing workforce. A tangible outcome is the creation of the National Manufacturing Institute Scotland (NMIS). NMIS is a £75 million state-of-the-art centre operated by the University of Strathclyde, opened in 2023 near Glasgow Airport as part of the High Value Manufacturing Catapult network. It houses a Digital Factory and a Manufacturing Skills Academy, and includes specialist centres like the Lightweight Manufacturing Centre and the well-established Advanced Forming Research Centre.[84] NMIS aims to be an innovation hub where SMEs can access expertise in automation, AI, and advanced materials, and where workers and students train on modern equipment. NMIS represents Scotland's attempt to replicate the success of Germany's Fraunhofer institutes or the US manufacturing innovation institutes, providing a public infrastructure to de-risk and diffuse advanced manufacturing tech. Early projects at NMIS include collaborating with distilleries to manufacture biomedical-grade alcohol sanitiser during COVID, and helping an SME adopt robotic welding to increase productivity.

- **Adoption Programs:** The Made Smarter Scotland pilot, launched in 2020, provided advice and small grants to manufacturing SMEs to adopt digital technologies (e.g. sensors on production lines, data analytics software). Companies reported improvements in efficiency and order books as a result. There's also the Scottish Manufacturing Advisory Service (SMAS), which has for years provided on-site consultancy to manufacturers to improve processes (lean techniques) and now increasingly advising on automation and energy efficiency.

- **Cluster and Sector Development:** Recognising the space sector's promise, the Scottish Government created *Space Scotland* (an industry leadership group) and set a goal to grow Scotland's share of the UK space sector to 20% by 2030. Similarly, for the aerospace sector, there's support for transitioning to sustainable aviation tech (e.g. hydrogen or electric aircraft demonstrators in Orkney). And Scotland is developing other niche and emerging sectors, such as advanced textiles in the Borders – as old industrial strengths are repurposed to move into technical textiles and fashion-tech with support from innovation funds.

- **Space and Aerospace:** The UK Space Agency and UK Research & Innovation (UKRI) have provided funding for the Scottish space sector – e.g., matching funds for the Sutherland spaceport, grants to AAC Clyde Space for advanced satellite components, and to Orbex for rocket engine development using 3D-printed parts.[85] In aerospace, the ATI (Aerospace Technology Institute) has backed R&D at Spirit AeroSystems on lightweight composite materials for wings. These funds keep Scotland in the loop of UK's aerospace decarbonisation drive (like the FlyZero project for zero-carbon small aircraft by 2030s).

- **Levelling Up and City Deals:** The Glasgow City Region City Deal (jointly funded by the UK and Scottish Governments) funds a host of innovation programmes, including providing £8.9 million towards setting up NMIS's specialist centres.[86] The Edinburgh City Deal funded the *Bayes Centre* for data-driven innovation, which includes applications in robotics and manufacturing analytics. Investment Zones – proposed by the last UK Government, but under review by the new administration – could also include an advanced manufacturing focus in Glasgow, bringing additional tax incentives for investments in factories or R&D facilities.

One persistent issue raised by industry is energy costs for manufacturers. The energy chapter noted Scotland's renewables abundance; harnessing that to provide competitive green power to industries (possibly via direct supply contracts or future reforms) could attract energy-intensive advanced manufacturing (like battery gigafactories or green steel plants). Nonetheless, projects like the planned hydrogen bus manufacturing hub in Aberdeen (tying together ADL's hydrogen buses, a local supply of green hydrogen, and bus fleet conversions) show how aligning energy and manufacturing policy could create new opportunities.

The advanced manufacturing sector in Scotland is at a crossroads – facing the need to modernise existing industries and to foster new ones, at a moment of global uncertainty about the future of manufacturing supply chains. Policy support has created institutions (NMIS, Innovation Centres) and funding streams to assist, but ultimately success will depend on the ability of firms to innovate and scale. The foundations – a strong research base, examples of world-class firms, and public commitment – are in place. With further collaboration between government, academia, and industry, Scotland can aim to grow its advanced manufacturing output in areas that capitalise on its strengths (renewables hardware, space, medical devices, specialty vehicles, digital manufacturing services) and in doing so, create high-quality jobs across the country.

5. Scotland's policy landscape: too complex, too diffuse

Scotland has strong foundations — including a mature institutional landscape and globally competitive research base — but its innovation policy remains fragmented across multiple agencies and levels of government. The result is a system that can be difficult to navigate, particularly for SMEs. Mixed responsibilities between governments, competing mandates, and strategy overload have hindered clarity and action.

Industry voices and parliamentary committees alike have called for fewer plans and more delivery, with the fleet-of-foot coordination and personal leadership to land deals with Scottish or international R&D investors – providing the alignment on skills, infrastructure, permissions and regulatory processes businesses need to have the confidence for investments in the hundreds of millions of pounds.

Scotland has a narrow window in which to act: just as trade wars mean scale-ups and multinationals everywhere are rethinking their business models, and the UK is lowering friction to innovation investment - re-entering the Horizon programme and resetting trade relations with Europe and the US; and within the UK, devolution offers Scotland the chance to go further in making it as fast and cost effective as possible to invest in innovation.

SCOTLAND HAS A BROADER RANGE OF (OFTEN MUCH MORE ESTABLISHED) DELIVERY AGENCIES THAN THE REST OF THE UK...

Scotland's innovation policy is delivered through a complex ecosystem of agencies, strategies, and partnerships – some devolved, some UK-wide, and many overlapping.

Devolved powers and institutions – including higher education and university funding, via the Scottish Funding Council; economic development, through Scottish Enterprise, Highlands and Islands Enterprise, South of Scotland Enterprise, the Scottish Funding Council, and the newly established Scottish National Investment Bank (SNIB); and skills, through Skills Development Scotland – are integral in supporting research, commercialisation, and business growth.

Scotland's advantage is that these institutions have a scale and maturity not seen elsewhere in the UK. Unlike their counterparts in England, for instance, the enterprise agencies were not abolished in the 1980s, and formed the inspiration for Regional Development Agencies in England and Wales under the New Labour Governments.

More recent innovations – such as the SNIB, launched in 2020 – complement and in some cases go further than their counterparts in other parts of the UK. SNIB was an attempt to provide patient capital to support innovation, and early investments have included life sciences manufacturing, renewables, and technology infrastructure. But concerns have been raised about SNIB's pace of delivery and coordination,[87] and its alignment with Scotland's economic priorities.

Scottish Enterprise plays a major role in supporting business innovation, including through R&D grants, innovation centres, and export support. Yet business surveys suggest the

system is complex and difficult to navigate, particularly for SMEs. Calls for a "one-stop shop" for business support have grown in recent years. And at a Scottish level, funding for economic development has fallen in recent years. Scottish Enterprise's grant-in-aid funding (its core budget for economic development activities) has fallen by over 20% in real terms since 2009/10.[88]

The UK Government's retained powers include research funding and other key levers such as (most) fiscal and tax policy, trade and international science collaboration, large-scale infrastructure finance, and international property law; as well as UK-level institutions such as UK Research and Innovation (including Innovate UK) and the National Wealth Fund (formerly the British Business Bank). Scottish institutions receive significant UKRI grants – especially in life sciences and data – but coordination with devolved priorities is often limited.

Nonetheless, there are examples of successful cooperation across UK and Scottish government. The Medicines Manufacturing Innovation Centre (MMIC) in Renfrewshire is a joint UK-Scottish investment supporting life sciences commercialisation. Two new Green Freeports – in the Forth and Cromarty Firth – aim to attract innovation and investment in clean technologies, with support from both governments. And Glasgow hosts one of three UK Innovation Accelerators, providing targeted financial and other support to fast-growing spin-outs such as Chemify.

...BUT SUCCESS IS HAMPERED BY COMPETING MANDATES AND LACK OF COORDINATION

The net result is that Scotland lacks a single institutional home for innovation strategy or delivery. Responsibility is fragmented across economic development, education, planning, and finance. Complexity is not a problem *per se*, and some institutional competition can be constructive; but the absence of a "system integrator" makes it hard to adopt a whole-economy view or respond to fast-moving opportunities, leading to what Jamie Gollings has described as a implementation gap in Scotland.[89] The lack of a "system integrator" is further complicated by shared responsibilities at a UK- and Scottish-level, with mixed devolution of powers and historically low levels of cooperation between the Scottish and UK governments; nor has the more-recent turn towards Regional Economic Partnerships in Scotland created a strong local power integrator comparable to England's Combined Authorities.

Industry bodies and experts have called for a more focused and aligned approach. In evidence to the Scottish Parliament's Economy and Fair Work Committee, businesses reported strategy overload, weak follow-through, and insufficient co-design. The Committee has echoed these concerns – calling for fewer documents, more delivery, and sharper targeting of Scotland's unique economic advantages.

In summary, Scotland has active institutions and public commitment but needs strategic clarity and leadership. Alignment, simplification, and delivery discipline are required to turn ambition into impact. The next phase must focus on mission clarity, institutional streamlining, and stronger local empowerment.

6. Recommendations: realising Scotland's potential as an innovation nation

In *From Growth to Good*, Our Scottish Future set out the case for an ambitious, coordinated industrial strategy to unlock Scotland's economic potential. This chapter builds on that foundation, refining and focusing our recommendations around five priorities. To move from potential to progress, Scotland needs a bold, unified strategy for innovation-led growth. This is how we can begin.

1. Set out a single Scottish Industrial Strategy, jointly owned by the UK government, Scottish government, and regional partnerships

Scotland needs a single, clearly defined industrial strategy, jointly owned by the UK and Scottish Governments – in place of competing strategies designed in isolation from one another, and nestle within the UK's forthcoming Industrial Strategy.

This strategy should establish a small number of priorities for long-term economic transformation—with shared commitments on skills, infrastructure, R&D, innovation, and investment. This would replace the fragmented landscape of overlapping initiatives and institutions with coordinated action.

We propose a series of big bets on a handful of strategic clusters as the structuring logic of the Strategy, meeting the imperative of building a critical mass of skilled workers, research facilities, and anchor multinationals. That requires sector-specific action on infrastructure and regulatory bottlenecks; and place-specific action on skills and local amenities.

Indicatively, in line with the logic of this paper, those bets could include:

- **Renewable energy and green manufacturing** (Aberdeen)
- **Life sciences and technology** (Dundee)
- **Next generation business services** (Edinburgh)
- **Advanced manufacturing (such as satellites and precision medicine)** (Glasgow)
- **Premium agrifoods and alcohol** (Inverness)

Each suggestion reflects local strengths and can support national economic transformation; learning from recent success stories (such as the Tech Scalar model following Mark Logan's review for the Scottish Government).

The strategy should include a high profile chair from industry, with a joint Scottish-UK delivery board and statutory reporting to both Parliaments. The development of the strategy itself will be a tested of refreshed intergovernmental relations, given the lack of coordination between the Scottish and UK Government's innovation strategies in recent years despite overlapping responsibilities.

Scotland should aim to go further and faster on industrial policy than the UK where it can, such as in implementing a centralised system in the NHS in Scotland for clinical trials in life sciences or in using public procurement to spur innovation. For example, the NHS could aim to pilot a number of Scottish-developed health technologies each year (with a path to scale if successful), providing local firms a test bed and first customer.

Industrial innovation will not and cannot be limited to a small set of clusters; it must also set out a vision for all of Scotland's communities. We propose innovation-related, Scottish-led missions. For instance, a "Net Zero Islands" programme could ensure that public funding to decarbonise Scottish islands (Uist, Orkney etc.) using innovative technology from Scottish companies, turning remote communities into showcases for home-grown solutions (from tidal energy devices to smart grid software).

Scotland could also consider innovative financing mechanisms like outcome-based funding or challenge prizes to stimulate solutions to Scotland's big problems, beyond the challenges facing any particular cluster. For example, the Strategy could launch a £10 million "Scotland Carbon Challenge" prize for any Scottish company that can deliver a certain breakthrough in climate technology (like a step-change improvement in energy storage or a low-cost carbon capture technique). This can galvanise entrepreneurial effort and draw global attention.

2. Build five Growth Zones, around economic clusters, backed by a consolidated Scottish Development Fund

Each cluster should be anchored by a designated Growth Zone – physical sites with governance shared by the UK and Scottish Governments and local authorities. These Zones (in Dundee, Aberdeen, Edinburgh, and two in Glasgow) would offer tailored infrastructure (lab space, industrial units), linked to each sector. They would expand the UK's Investment Zone model with deeper policy alignment, funding, and export-oriented ambition.

Growth Zones should offer a physical campus for innovation investment in Scotland's main urban areas. These Zones should be small – we know that the benefits of co-location can drop off within a few minutes' walk[90] – and anchored around public and private investment, including a sector-specific Catapult Centre and, crucially, brokering flagship R&D intensive multinational investment to provide an anchor for these Growth Zones.

For instance, a Bio-Scaler programme for life sciences entrepreneurs (leveraging BioCity, Glasgow's Health Innovation Hub, or Edinburgh BioQuarter facilities) or an Energy Launchpad for clean energy start-ups (perhaps in Aberdeen) could provide sector-specific mentorship, network access, and incubation space, similar to Tech Scaler's offering for software start-ups. Government can underpin their costs so that participation for promising start-ups is either free or highly subsidised.

To turn Growth Zones into multinational campuses, the Scottish Government should commit to proactively recruiting anchor employers from global industry, offering to reinvest local business rates for 25 years, and offer tax incentives conditional on job creation and exports. This could replicate successful models like Deloitte in Belfast or HSBC in Birmingham.

The UK Government should commit to funding a sector-specific Catapult Centre in each Growth Zone, and to ringfence funding from a consolidated £4bn Scottish Development Fund (aligning funding from the UK's National Wealth Fund, the SNIB, and Scotland's UK Shared Prosperity Fund capital allocations); as well as maintaining progress through the Mansion House reforms to create consolidated pension funds with more generous conditions on funding.

These Growth Zones would foster industrial clustering, agglomeration benefits, and job creation – supported by simplified planning, targeted tax incentives, and strategic procurement.

3. Put "Scottish Combined Authorities" in the driving seat, tasking them with delivering these Growth Zones

In *Rewiring Scotland*,[91] Our Scottish Future set out the case for a new Local Governance Act to create Scottish Combined Authorities, clarify the roles and responsibilities of different levels of government, and provide a mechanism for devolution within Scotland. These Authorities would cut through the thicket of Scottish and UK agencies to provide clarity for innovators and investors.

While there would be a negotiation over the exact geographies and powers between the Scottish Government and local authorities, the Scottish Government should follow the lead of last year's English Devolution White Paper in making clear that it wants to see reformed governance in, at least, Greater Glasgow, Edinburgh, Dundee, and Aberdeen, potentially with elected mayors or provosts.

As a quid-pro-quo for reform, these city-regions could take on powers over transport, housing, education, and economic development - including light rail and bus franchising expansion; overseeing Growth Zones in their region; and managing devolved Jobcentre+ services and training budgets, as proposed in *A Workforce Fit for the Future*. Scotland-wide quangos such as Scottish Enterprise and the SNIB should (at least partially) federalise around those new city-regional boundaries, with a view to potential full devolution of their functions over time.

High-quality infrastructure underpins cluster development. We recommend accelerating Scotland's digital infrastructure plans – full fibre broadband and 5G to all innovation sites (so even rural innovation campuses are ultra-connected). On transport, focus on improving connectivity that links skilled workers to cluster sites: e.g., better rail links between university cities (Glasgow-Edinburgh improvements, Aberdeen-Inverness upgrades) to enable easy collaboration; and within cities, ensure new cluster developments (like Edinburgh BioQuarter or Glasgow's AMIDS for manufacturing) have strong public transport links for accessibility. And we need affordable housing near cluster hubs. Policies to earmark and invest in housing around innovation districts will support cluster growth and inclusion (so workers of all wage levels can live near emerging job centres).

4. Back what works in Scotland's innovation ecosystem: world-class universities, a strong spin-out performance, and thriving early stage financial system

Scotland's universities are research powerhouses and will sit at the heart of each Growth Zone. But it's not "job done" on incentivising spin-outs, especially at a moment of acute financial pressure for the sector. Now is the time to go further in diversifying income, rather than cutting back.

Policy should double down by scaling up support for university spinouts through a Scottish Universities Fund (modelled on Northern Gritstone), with first round funding from a coalition of universities, the Scottish Government, local authorities and patient investors such as pension funds. And, for larger scale programmes, using blended finance to crowd in private capital – leveraging domestic institutional investment through Mansion House Compact-style vehicles at a Scottish level (brokered by our proposed Scottish Development Fund).

The Muscatelli report's recommendations[92] should be revisited and firmly implemented: set ambitious targets for spin-outs and licensing income, and back that with expanded proof-of-concept grant funding (the successful Scottish Funding Council PoC program, which was scaled back, should be restored to provide more early grants to researchers to commercialise ideas).

And we should reinforce progress that's already underway: resolve IP policy issues that inhibit spin-outs – consistent, fair rules across universities for academic equity stakes in spin-outs - to simplify negotiations for entrepreneurs; establish or strengthen "innovation labs" open to external entrepreneurs, so the broader community can tap into university equipment and expertise (for instance, a biofoundry in a university could be open to biotech start-ups off campus for a fee); and support student entrepreneurship via seed funds and incubators in every university – the next Skyscanner or FanDuel might come from a student project, and should be nurtured.

Given feedback from business, reform should include simplifying how companies access support. This could mean creating a single front-door portal for all innovation support (merging disparate grant schemes and advisory services into one coherent brand), and ensuring agencies like Scottish Enterprise, South of Scotland Enterprise, Highlands & Islands Enterprise, and our proposed Scottish Development Fund are aligned on the proposed Scottish Industrial Strategy. For example, if SNIB invests equity in a tech scale-up, Scottish Enterprise can concurrently provide an R&D grant, forming a seamless package.

Innovation support should be needs-driven, not organisation-driven – companies shouldn't have to navigate a maze to find assistance. A single Innovation Scotland online platform with account managers assigned to promising firms, ideally regionalised alongside Scottish Combined Authorities, could improve outcomes.

5. Putting inclusion at the start of innovation, rather than treating it as an optional extra – by bringing the community into innovation, and bringing innovation to "the everyday economy"

Innovation is not equally distributed – and this inequality matters. Research by Chetty, Hendren, Kline and Saez found that in the US, children from low-income families were dramatically less likely to become inventors – even when their academic performance matched that of wealthier peers.[93] If marginalised groups innovated at the same rate as the most privileged, the US innovation rate would quadruple.

In other words, talent is everywhere, but opportunity is not. The same is likely true in Scotland. Between 2000 and 2015, just 7% of UK patent applications were filed by women – a statistic confirmed by the IPO's Gender Profiles in UK Patenting report.[94] Other groups – ethnic minorities, disabled people, those from lower-income backgrounds – face similar barriers.

A successful innovation strategy for Scotland must close these gaps. Not only is this the right thing to do – it's also economically essential. If Scotland can unlock its "lost Einsteins," it will raise its innovation rate and its growth trajectory. John van Reenen, Chair of the Chancellor's Council of Economic Advisers, has used this evidence to advocate for spending on inclusion initiatives comparable in scale to spending on research grants or tax credits[95] - a budget in the mid-hundreds of millions for Scotland.

Scotland has the ingredients for an innovation-driven economic transformation – a skilled population, excellent research, a strong sense of community, and emerging industry strengths. But realizing the vision of "innovation-led growth" and ensuring it creates *good jobs for the future* will require concerted action and a willingness to do things differently. We recommend:

- **Inclusion in Innovation:** Make inclusion a metric of innovation success. Following the spirit of the "Lost Einsteins" research, Scotland should implement programs to expose under-represented groups to innovation from a young age. This could involve funding for every secondary school in disadvantaged areas to partner with a local tech company or university on innovation projects (robotics clubs, coding workshops, biotech experiments – such as the existing 'Stemovators' programme). We also recommend setting up a "Scotland Invents" mentorship scheme where women and minority inventors and entrepreneurs mentor the next generation of diverse talent.

- **Link Growth Zones into their surrounding communities:** Each major innovation cluster should have a strategy for community engagement and benefit. For example, if a new manufacturing R&D hub is set up in Renfrewshire, ensure there are apprenticeship slots reserved for local young people, and that local suppliers (catering, facilities, maintenance) get contracts to support the hub. If a biotech company expands in Dundee, could it partner with local colleges to offer entry-level lab tech training to people from deprived areas, creating pathways into good jobs for those who might not get a PhD? We recommend the government formalise Community Benefit Agreements for large innovation projects (similar to those used in infrastructure/construction) – these agreements would outline how the project will provide opportunities for local residents, from jobs to education outreach.

Finally, innovation has its part to play in raising the quality and productivity of work across the economy, including in non-traded local services such as retail, hospitality, or care. As Harvard's Dani Rodrik has argued, "good jobs" are underprovided by the market because their wider benefits aren't internalised by employers or workers.[96] Innovation policy is one way to 'raise the floor' of employment standards and pay. Therefore, we recommend:

- **Incentivising innovation in the everyday economy:** the Scottish Government could examine opportunities for new tax credits, targeted at SMEs (or all firms) in the non-traded sector – beginning with retail and hospitality – to incentivise technology-related training investments, and investment in new labour-augmenting capital (such as bespoke apps to support care workers).

- **Empowering workers to call out bad practices:** Scottish labour markets are very concentrated outside the big cities,[97] which can suppress wages and leave workers at the whim of a single strong employer. To promote good jobs and to raise the balances against 'race to the bottom' management, policy should strengthen worker voice and labour market competition. Union engagement in emerging sectors could be offered from the outset – unions can work constructively to shape training and job quality (for example, union input in setting standards for new jobs in offshore wind or electric bus manufacturing can help make them attractive careers).

These recommendations, taken together, form a comprehensive plan for innovation-led growth in Scotland. They span education, finance, institutions, and inclusion because a complex challenge like transforming an economy requires a multi-faceted response. The prize is substantial: a Scotland that not only creates more wealth but does so in a way that spreads opportunity, regenerates communities, and positions the country as a global leader in solving the challenges of the future.

If implemented with vigour and sustained over the coming decade, the payoff could be an economy growing faster than the UK average (closing the productivity gap), thousands of new high-quality jobs (from lab technicians to wind turbine engineers to AI specialists), and public revenues large enough to invest in first-class public services and poverty reduction. In the spirit of *From Growth to Good*, faster growth fuelled by innovation can indeed drive social good – but only if we shape that growth deliberately. Scotland has done this before in its history, from the Scottish Enlightenment to the Industrial Revolution. Now it can do so again in the 21st century, becoming the inclusive, innovation nation that it aspires to be – a nation of good jobs, thriving communities, and shared prosperity built on the frontier of human knowledge.

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