THE FOUNDATION FOR SCIENCE AND TECHNOLOGY

DEBATE SUMMARY

Maximising the strengths of the research and innovation base in Scotland

Held at The Royal Society of Edinburgh on 29th October, 2014

The Foundation is grateful to the Royal Society of Edinburgh and the University of Strathclyde for supporting this debate.

Chair: **The Earl of Selborne GBE FRS**
Chairman, The Foundation for Science and Technology

Welcome: **Professor Dame Jocelyn Bell Burnell DBE FRS FRSE MRIA**
President, The Royal Society of Edinburgh

Speakers: **Professor Muffy Calder OBE FRSE FREng FIEE**
Chief Scientific Adviser for Scotland, Scottish Government
Professor Alice Brown CBE FRSE FRSA
Chair, Scottish Funding Council
Anne Richards CVO
Global Chief Investment Officer, Aberdeen Asset Management

PROFESSOR CALDER's role as Chief Scientific Adviser for Scotland concerned seeking evidence for policies which would maximize the strengths of Scottish research and innovation. This meant deciding what were the strengths of the base, how to measure them and determining the beneficiaries. Scotland's strengths lay in many areas, including: biosciences, imaging systems, stratified medicine, renewable energy, nano engineering, computing science and informatics, and fundamental physics. There were various ways of measuring the strengths – such as, the number of people employed, the contribution to the economy, the number of internationally recognized scientists or high impact academic papers. Other factors she also considered were gender and ethnic diversity, the pipeline of new entrants and the number of new companies formed.

Benefits could flow either to the economy, to the well-being of those using the output of the science, or to the well-being of those employed and whether they felt fulfilled. Much progress had been made, but there was still much to do.

She welcomed the establishment of the eight new major innovation centres. These are industry-led, and partly funded by the Scottish Funding Council (SFC). They bring together University researchers and industry. The Scottish Science Advisory Council recently reported on the huge opportunities for exploiting synthetic biology. The increasing number of degree students in STEM subjects was welcome although the numbers were still less than in law, economics and politics. Of concern was the large drop in students taking IT courses and the poor gender diversity in technology and IT.

There were two key questions:
- what are the key elements that makes Scotland do so well at research?
- what policies need to be put in place to maintain these strengths?

Professor Calder chairs an EU body of 26 science advisers concerned with future and emerging technologies, and commented on the need to learn from other countries, especially Finland, which stresses treating scientists as individuals and trying to ensure that they do work in areas in which they are passionately interested; and Israel which drives science hard in schools and uses national service to segregate and develop those who show promise, and then help them to set up companies.

We need, through the Research Councils, to ensure that we are forming a critical and appropriately distributed mass of research. We must support scientists throughout their

careers (mid-term, as well as at the start and end) with appropriate infrastructure. Finally she pleaded to let the new Innovation Centres and other institutions grow and become established – don't keep tearing them up before they have had a chance to grow roots.

PROFESSOR BROWN endorsed Professor Calder's view of the strength of research in Scottish Higher Education (HE) sector. Interdisciplinary work was particularly strong. The Scottish Government had made clear its vision for research, and would support it through its economic strategy. The Scottish Funding Council works within the larger framework of the Dual Support system. This aims to protect science and research, regards excellence as the key focus in any project, seeks to get the right balance between blue skies and targeted research, stimulates competitiveness, and ensures that the Haldane principle (merit must be the only determinant of selection for projects) is followed. The Scottish Government is committed to continuing the Dual Support system and to the engagement of Scottish researchers with the rest of UK's research base and with the European Research Area. The emphasis of the UK Research Councils on cross-cutting themes and the additional funding from charities and the EU was welcome.

Scotland has increased the funding for research and looks, not only to achieve the critical mass of scientists and researchers, but also to encourage competitiveness, and deliver appropriate facilities and training. Scotland is in the upper quartile of OECD countries in relation to HE sector R&D expenditure (as a percentage of GDP), but in the lower quartile of Business R&D. This meant the need to stimulate more companies to invest in R&D, and to ensure HE R&D supported innovation in business. SFC seeks to encourage a culture change in the Innovation landscape through initiatives such as: Research Pooling, Innovation Scotland, Easy Access IP and the Innovation Centres cited by Professor Calder. These Centres[2] are central to the strategy; they have been funded with £110m for five years.

MRS RICHARDS said, that, for business two things were crucial – the skills of the workforce and an appropriate public policy framework. She stressed the need for digital skills for all – both old and young, if they were either going to get jobs, retain them, find new work, or simply organize and enhance their own lives outside work. People must learn to use IT, and become comfortable with its special language. Digital technology is a global revolution, changing the way businesses and governments work and, if Scotland is to remain competitive, it must be in the forefront of understanding and using digital technology.

Scotland – indeed the UK - aspires to be a knowledge economy with strengths in areas such as low carbon technologies, creative industries, electronic manufacturing and business services. All of these rely crucially on IT and digital skills. Half the employment in 2020 will be in areas which demand a highly skilled workforce comfortable at various levels with IT. The digital workforce needs to grow significantly between 2013 and 2017. Will Scotland be able to find people with such skills?

Businesses are already complaining that they cannot get the skilled workforce they need, and there are substantial unfilled vacancies. Women, who could help fill the gap, are not coming forward. In society, digital skills are grossly undervalued. Many parents simply do not see the need for their children to acquire digital skills if they are to be employable; and those employed do not see the need to keep updating their skills. We need teachers in schools who are up to date in technology and can understand the need for their pupils to study IT.

Scotland needs more IT courses focussed on the IT skills that are needed for employment, employers must develop vocational and apprentice schemes (learn while you earn) and encourage more girls to do STEM subjects. Scotland has strengths in its legacy of scientific and medical research; as a small country it can expand flexibly and those in universities, the public sector and industry should find it easier to know each other and work together. Scotland does well on spin outs, but poorly on start-ups. Scotland is very weak on scaling businesses up to a national or an international level.

Her recommendations were, first, that Scotland should consider education holistically from primary school to university to ensure that STEM skills are recognized throughout as essential for all employment, even in an area that appears superficially not to need it; second, silos between disciplines

[2] http://news.scotland.gov.uk/News/-14-million-for-Innovation-Centres-1002.aspx Stratified Medicine, Digital Health, Industrial Biotechnology; Aquaculture, Sensors and Imaging, Construction, Data and Oil & Gas

should be broken down, so that someone who belatedly shows an interest in science or engineering can switch subjects; third, that the capital gap which hinders scaling up be bridged; and, fourth, keep the public policy framework stable. Do not keep tinkering with policy and institutional arrangements. The texting shorthand would be SOF – be strategic, opportunistic and flexible.

In the ensuing discussion, participants were sceptical about the possibility of universities and businesses acting together. Did participants accept that there was a major problem; academics naturally wanted the widest possible access to the results of their research; but, for businesses, it was crucial to keep their successful technologies under wraps – whether it had been generated by their own efforts or bought in from academia – in order to protect IP, maintain margins and keep competitive.

Intellectual Property Rights would always be a stumbling block to full collaboration and trust. But others said that this was an oversimplification. Academics were not a homogeneous group. Some, no doubt, only wanted to see the results of their research published in Nature, but others were anxious to collaborate with business and see their research commercialized into the market place and used for public benefit, or, at least, to increase choice; they would be willing to accept conditions which enabled them to spin off companies or set up new companies or simply sell the IP rights. Similarly businesses were aware that research cannot be compartmentalized, and that any new breakthrough is very likely to be followed closely by results from other researchers.

They would accept that, if they were to have the advantage of working with university researchers, because only those researchers could provide the intellectual change necessary, they would have to adapt, and be flexible. In some cases they would need to accept that collaboration was necessary not only between universities and their businesses, but also with other businesses, and, indeed, with the public sector and charities. If the research was truly innovative and ground breaking, this would be almost inevitable.

There would be difficult questions about regulation and about ensuring competitiveness. It is also possible that we are expecting too much of universities; it is true that, with the demise of large company research and development laboratories, there may be little choice for where companies go for expertise except to universities; but universities should also have changed their outlook; they will not see themselves solely as providers of expertise; they will want to operate, in some way, as corporate rent seeking institutions. But the tension between IPR and publication negating IP protection will always be there.

This is a global issue, and different countries have found ways of coping with it. A key factor is the need for investment in research. Universities will not always get what they want from government; investment from companies in their research is vital. Provided they get this investment, they will treat the licensing of any results as secondary to funding the research and sharing the results with the investor in any way he will be prepared to contract. Timing is a vital issue. Big Pharma need ten to fifteen years to develop and market a ground breaking drug; it needs IP protection for as long after the product is brought to market to recoup the cost. IT is very different; one year of sales may suffice.

It was not clear why the investment in R&D by Scottish companies was so low. A basic problem was the UK government's monetary and fiscal policy. Companies found it difficult in present circumstances to do anything other than pay dividends to stakeholders, justifying R&D expenditure with long-term and uncertain pay-offs was difficult. But the structure of Scottish companies may be relevant, and their international reach is important. The Innovation Centres may help to increase collaboration, but do not expect that companies will use them with a specific Scottish focus. Business is international, and manufacture and sales will follow the market. Competition is the key. If Scotland can provide not only the research but the follow up – such as highly skilled operators and manufacturing expertise – Scotland's economy will benefit; otherwise it may not.

Participant's queried whether policies were radical enough? Were they more than just a small change from what had already been tried? They saw no way that the cultural change speakers rightly wanted, could be achieved. Where was the policy that supported researchers throughout their careers? Where was the impetus that led to a "holistic" educational strategy? Where was the drive that would stimulate new entrants into the field, and provide new opportunities

for those who were unable to be innovative in their existing fields? Suitably amended (we were not going to introduce conscription) the Israeli experience in starting STEM and digital work from the nursery and segregating skilled people to develop their skills further, and providing capital had lessons for us.

What was the best way to get girl pupils to do STEM subjects? How did we stop "pinkification" from an early age which conditioned girls from aspiring to careers viewed as traditionally male?

Radical proposals often revolved around insufficient demand to provide skills businesses wanted. Businesses knew; but did educationalists, families and all those women who had been conditioned from birth to neglect or ignore them? Why did government, teachers and parents, not demand that STEM subjects be taught rigorously, and insist that digital skills were essential for employment? As for public policy, the Government's immigration policy had no regard to the need to attract highly skilled workers from abroad to come here, to contribute to our economy and teach businesses better ways of developing and marketing products to sell internationally.

Why should companies come to Scotland if they and their employees will find a better welcome elsewhere? One speaker thought that the £110m budget for eight Innovation Centres for five years was much too small; under £3m per year for each centre. What possibly could be done for that?

Participants did not underestimate the difficulties in developing radical solutions in a socially conservative population still unfamiliar with a rapidly changing world, and with an economy still under strain. They welcomed the speakers' endorsement of the UK Research objectives and their development by the Scottish Funding Council.

They fully supported the aim of closer collaboration between academia and businesses, and saw the Innovation Centres as a welcome move. But there were persistent doubts about likely outcomes.

Conclusions from the discussion were: first the policies were still too cautious to make a real difference (as with the small scale of the funding for Innovation Centres); second, government policies on immigration were counter-productive; third, unless Scotland realized that digital and STEM skills were essential for employment, deprivation and inequality would increase.; fourth that business already could not find the workers with the skills it needed and would go elsewhere if they were not provided; and, fifth, some, if not all of the answer, lay in the gender gap – getting girls digitally and STEM proficient was essential.

Sir Geoffrey Chipperfield KCB

Open the summary with Adobe Reader outside the browser and click on the URL to go to the sites below.

Aberdeen Asset Management
www.aberdeen-asset.co.uk

Research Councils UK
www.rcuk.ac.uk

Scotland Office
www.gov.uk/government/organisations/scotland-office

The Foundation for Science and Technology
www.foundation.org.uk

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