HOUSE OF COMMONS

Science and Technology Committee

Oral evidence: The role of technology, research and innovation in the COVID-19 recovery, HC 95

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Watch the meeting

Members present: Greg Clark (Chair); Aaron Bell; Katherine Fletcher; Carol Monaghan.

Questions 231 - 281

Witnesses

I: Professor Frank Coton, Senior Vice Principal and Deputy Vice Chancellor (Academic), University of Glasgow, and Karen Watt, Chief Executive, Scottish Funding Council.

II: Dr Gillian Lang, Deputy Director of Science, Glasgow Science Centre, Elaine Gemmell, Head of Regulatory Affairs, Scottish Health Innovations Ltd, and Dr Lynne O'Hare, Chief Commercial Officer, National Manufacturing Institute Scotland.

III: Simon Andrews, Executive Director, Fraunhofer UK, and Dr Stuart Hannah, Founder, MicroPlate Dx.

Examination of witnesses

Witnesses: Professor Frank Coton and Karen Watt.

Q231 **Chair:** I am delighted that we are going to talk about research funding, a constant theme of interest for the Committee and our colleagues in science and research. To help us answer some questions on that, we have Professor Frank Coton, who is the Senior Vice Principal and Deputy Vice Chancellor (Academic) at the University of Glasgow, and Karen Watt, who is the Chief Executive of the Scottish Funding Council. Thank you both very much for coming to give evidence today and perhaps through you, Professor Coton, we can thank your colleagues at the University of Glasgow with whom we enjoyed a very stimulating and informative discussion over dinner last night when we arrived.

I will start with a question to Karen Watt. Can you outline for the Committee and for the record how research is funded in Scotland and how it differs from funding for England, given that the principal funding body, UK Research and Innovation, by definition, covers the whole of the UK? What does the Scottish Funding Council do?

Karen Watt: Thanks very much for the opportunity to talk to you today. It is probably useful to outline a little bit about the difference in the mix of research funding and then some particular features in the system that we fund that might be different from elsewhere.

On the funding mix, we have the dual funding system, as you know. As part of that, the Scottish Funding Council provides annual infrastructure research funding. We provide about 26% of Scottish university funding and that is, as you know, specifically quality-related core grant. Then we have UK research councils within UKRI, where universities bid for specific projects and programmes. UKRI funds about 25% of Scottish university research funding. Whereas English universities are within the envelope of UKRI, both Research England and the research councils, we are straddling this dual support system where we have fundamental research funded from SFC and the bidding process for projects elsewhere.

The second difference in the mix in Scotland is that we have a funding council. I would say this, wouldn't I, but there is a benefit in having a Scottish Funding Council that both has tertiary education funding for colleges and universities and holds the research and knowledge exchange portfolio. That is quite unique at the minute across equivalent UK bodies.

On other features, just very briefly, there are some distinctive features that we have funded. For example, we have encouraged a very collaborative ethos across the Scottish research base. Over the last decade we have put about £155 million into research pooling—specific disciplines that we have funded across universities. That has evolved and has been a very important part of the ecosystem. On the innovation front, the SFC top-sliced money, so that we could fund things like innovation centres, taking the research strand and making it useful into

that connection with industry, business, colleges and the skills pipelines for connecting the innovation piece with the skills agenda. I think those are some innovation features from our funding.

Q232 **Chair:** Thank you very much. That is very helpful and a very good grounding. Can you go a bit further and say, in your view, what are the advantages of having a funding body that funds both higher and tertiary education?

Karen Watt: For us, there is an opportunity to look at how a learner journeys right through the system. In Scotland quite a lot of people might start in a college and then transfer into a university, so we can fund those routes and that progression if that is what students want. We also have the opportunity to be interesting with colleges and how they connect with universities on the innovation and the knowledge exchange front. For example, we have a college innovation fund that looks at how you help local businesses be more productive.

We have a predominantly SME base, so the college innovation system matters in a lot of regional areas as well as the university system. It allows us to look across the piece at what skills might be needed at every qualification level in Scotland. It allows us to plan more coherently at a national level and to encourage colleges and universities to work together in regions to manage better the eternal triangle between what a learner needs, what a business and an employer needs and what public policy is looking for, while at the same time helping colleges and universities to stay financially sustainable.

Those are the kinds of conundrums that a funding council is constantly trying to balance, and that is where there is a benefit in having further and higher education in there.

Q233 **Chair:** Thank you very much indeed. A question to Professor Coton. This may be an invidious question, given that we are talking about agencies that fund you. Unlike the majority of UK universities, you have UKRI and the UK-wide funding sources and you also have a Scottish Funding Council. A lot of the reviews that are taking place at UK level are to try to reduce some of the bureaucracy—I don't intend that in a pejorative sense—the layers of approvals, and to make the system more agile. What is your experience of dealing with multiple and specifically two different organisations?

Professor Coton: Many thanks for giving me the opportunity to address you today. On the particular topic that you have raised, we do have a mixed portfolio. To put that in broad context, at the University of Glasgow our research income annually is approximately £200 million not including the SFC core grant based on quality, which is about another £50 million. Just over half of the £200 million is public funding through the likes of UKRI, for example. So we are quite used to dealing with a mixed portfolio. We find that the various components are complementary. The funding council is sensitive to the position of the research-intensive

universities in Scotland which have this kind of mix. Glasgow and Edinburgh are broadly similar and a university like Strathclyde has significant research income. The funding council is sensitive to that and the degree of dialogue with the Scottish Funding Council is very strong, which means that the integrity of that mixed portfolio is maintained for us. So we don't really see major difficulties in negotiating that landscape.

Q234 **Chair:** During the early parts of the pandemic, the Committee took evidence from vice chancellors across the UK who were very alarmed at the consequences for their finances—teaching and, by consequence, research because there is some cross-subsidy between the two—of the pandemic, that it would hit student numbers and, in particular, overseas student numbers, and that this would amount to a significant new blow to university research. Now we hope we are coming out the other side of that emergency, how has it been in practice and how did it measure up against the fears of the sector?

Professor Coton: I think that there are two dimensions to this. One is how things actually transpired. The other aspect is how universities had to prepare for the possible scenarios.

I will start with the preparation for the possible scenarios. If you take a university like the University of Glasgow—and this would apply to most of the Russell Group in the UK—we have a high level of dependency on international student fees and that contributes to our research base. There was a real risk at the beginning of the pandemic that there might be a total collapse of international student fee income, so we had to plan for that. We had to take steps to reduce the cost base of the university, to ensure that we did not get into a position where we would jeopardise the livelihoods of our staff but also the experience of our students that we knew would be with us.

As the pandemic played out, that degree of uncertainty remained for quite a long time. In fact, as it transpired, many international students—although they studied with us—did not arrive in the UK for quite some time and some have not arrived yet. What it also meant was that, as we went into the pandemic itself, we had to shut research labs. We basically had to stop core research. It was not only the case of research labs shutting down; there was an impact on PhD students who were in the middle of their PhDs, and so on.

I have to say in this respect that the additional funding that we received, from both the UK Government and the Scottish Government, through the funding council, was extremely welcome because it allowed us to mitigate some of the worst effects on research groups and on research students themselves. Nevertheless, the reality is that a lot of research basically stopped for a significant period. The consequence of that has been that we are in catch-up mode. In some cases, where the research stopped, it has been relatively straightforward to restart it, simply with a gap in time; but in other scenarios it is much more problematic.

One that I would highlight is around the areas of medical research and chronic diseases that are heavily funded by charities. Of course, charities have gone through a very difficult time during the pandemic in terms of funding, and areas such as cancer research and the like are struggling to get going again. Therefore, I believe that the impact of the pandemic on our research base is not over. I think it will take some time yet before that fully washes out of the system.

Q235 **Chair:** What about the impact on student experience? Are you more optimistic that that is nearly over? It is clearly not over yet—the Committee was talking informally over lunch to some students and it is very clear that two years in the life of a student coming to university is all about interacting with each other. With due respect to faculty members, you learn as much from your fellow students as you do, sometimes, from your teachers—as I am sure you experienced in your time, Professor Coton—and they have missed out on a lot of that. How optimistic are you that that is in the rear-view mirror now, rather than ahead of us?

Professor Coton: It is probably not fair to say that it is completely in the rear-view mirror at this stage. I think we are in a much better position now. In answering the question, I should really pay tribute to my colleagues—and by "my colleagues" I mean academic colleagues right across the UK in higher education institutions—who had to deal with this situation, but also to the students for their forbearance in what has been a very difficult period.

We basically had to completely shift the teaching model in a very short timescale to allow education to continue, and that is not a trivial thing to do. What has happened progressively over time is that we have begun to move back towards what, I guess, would be viewed as a pre-pandemic educational experience. We are still not back there because at the moment we still have some limitations on what we can do.

As we look forward beyond this point, we are looking to move more and more back towards what we saw in pre-pandemic times, but I would highlight that we are also taking learning from the pandemic period. Prior to the pandemic, there was a sense that higher education was not quite where it needed to be in terms of the experience for students. A lot of emphasis is still placed on the lecture as the prime mode of communication.

To put that in context, if you have someone who is an extremely highly qualified professor, who is a leading mind in their field, it is a terrible shame if they walk into a room full of students and simply read some bullet point from a PowerPoint slide. It is much more effective if they come into the room with students, and the students can access the experience and the ability of that individual to go deeper into a subject. Therefore, the model was shifting towards one where information was transmitted outside the classroom but we spent more time inside the classroom in active learning. That has certainly been the direction of travel at the University of Glasgow.

One of the benefits of the pandemic has been that there has been a significant upskilling of staff in the use of digital technologies for communication. We need to think carefully about how we capitalise on that and, when we bring back more face-to-face teaching, how that face-to-face teaching can be high-value and not just more of a transmissive interaction.

Q236 **Chair:** Finally from me before I turn to my colleagues, as you are aware as a senior leader, there have been calls in universities for refunds of student fees that have been paid. The Committee has heard evidence that there have been costs. Indeed, a lot of work has been undertaken by your academic colleagues to respond to the pandemic. However, the innovations that you describe may be attractive for the next cohort of students but people who have suffered the privations of the last couple of years will not be able to access that—or will they?

Is there anything you can do for students who have passed through the University of Glasgow, and indeed other universities, to make it up to them in part? That is not to say that it is your fault, but they have suffered an impaired experience, as I think everyone agrees. Is there anything for this cohort of students that could be done by the universities and colleges that they have attended over the time in the future, in the early years of the future, to provide some kind of restitution, if not the direct experience, or some additional value?

Professor Coton: I should probably begin by saying that, of course, in Scotland there are no student fees so the notion of a fee refund is different here. However, there were tremendous efforts from the university sector to provide a high-quality educational experience to students but, as you say, that experience is different.

I would perhaps rephrase your question slightly and ask: what can we do for all students in the longer term? Education and upskilling should not be a one-off. We should have—and universities do have—a long-term commitment to society in terms of developing the capabilities within society, even when students leave.

I would give one relatively simple example and that is through the funding council. There has been an upskilling programme in Scotland, which is basically aimed at providing a range of additional skills that students in Scotland can access free—they register with programmes—and that is in addition to the plethora of massive, open, online courses that we already support. There is a continuing commitment to society, to student groups, regardless of when they graduated but including the student groups that have gone through this difficult period.

If that is looked at over the long term, I would hope that what we will see is a consistent landscape of support. I would just layer in one point that Karen Watt made earlier. That is that this needs to be looked at across the tertiary system, because the colleges have a very important role to

play in this space as well and they are playing an important role in this space.

Chair: Thank you very much indeed, Professor Coton.

Q237 **Aaron Bell:** I want to talk about the targets for spending on research and development. I will start with Ms Watt and come to Professor Coton for some comments later. As you know, the UK Government set a target of 2.4% to be spent on research and development. How close is Scotland to achieving that target?

Karen Watt: If you were looking comparatively, we are below levels of spend from a business research and development angle. From a university research and development perspective, we are probably higher than most areas in the UK. If you are looking at it in the global round, though, we are probably slightly under the average. Therefore, there is a challenge for us about our business base. We have a predominantly SME business base and we have an immensely vibrant university sector.

Rather than view these as two separate things that are either funded or not, or are underfunded in some kind of way, possibly the question for us is: how do we get the entire ecosystem to work better? How do we get that translation out from universities into the business space? How do we help grow the business space to a point where it is investing in these kinds of areas, has the strength and involves the larger companies that do much more of that kind of investing? I suppose that is the challenge for the Scottish economic business space more than anything.

Q238 **Aaron Bell:** To speak to the point you made, I was going to quote some statistics. The Royal Society's factsheet from May 2021 says that, UK-wide, the business sector makes up 68% of R&D and that in Scotland it is only 50%. I appreciate that you are not here to speak directly for the Scottish Government, but the Scottish Government's R&D expenditure has been falling quite significantly over the longer term as well. It has fallen in the UK by 9.6% between 2007 and 2019 but it has fallen by 25.8% in Scotland. How confident are you that the need for further Government investment is being heard in Holyrood?

Karen Watt: As a funding council, our job is to advise Government about the quantum and the consequences of not having the quantum that Scotland might need. However, our job essentially is to distribute the envelope that we have in the wisest way that we possibly can.

You will imagine that, as a funding council, we always make a very strong case for not just maintaining the envelope but keeping it at pace with inflation and with the challenges.

Over the last couple of years, though, while we may be looking at that long-term view about whether we are keeping pace, we have seen a much more significant input for one-off—particularly large—packages of capital support for research and the research base. For example, over the last pandemic period, we invested an additional £70 million to £79

million. That came through a range of things, like Covid consequentials and other aspects. We would like to make sure that we make the most of that but we also make the case for this.

I think there is a real commitment to this around Scottish Government circles. The issue for us is constantly making the benefits more broadly understood, so that it is not simply a case of thinking about fundamental research in a particular way but thinking through how it leverages-in other investment and the social and wider economic environmental impacts. I feel that at times we do not always make the best evaluative case for those impacts and that has to be understood if we are going to both secure and grow that fundamental research envelope.

Q239 **Aaron Bell:** Going back to the business point, you say that it was because the Scottish economy had perhaps a higher proportion of SMEs. How can they be encouraged to play their part in getting to 2.4%?

Karen Watt: We have made a certain number of significant national asset investments, for example, in our innovation centres; we have seven or eight of those. They are trying to make that connection between academia, business and the sparks around productivity or pushing into innovations and encouraging businesses, where they can match-fund, to have that element of the innovation centre reaching into their businesses but getting the businesses to come further into that investment space. They have been successful.

Not all of the innovation centres have been as successful as some but they are one element in this ecosystem that needs to develop. You probably need to have a conversation with some of our other sister enterprise agency funders, because this is about how we all come together to grow that and to encourage the business space to do more.

Q240 **Aaron Bell:** Going back to the overall 2.4% target, as chief executive of the SFC, as things stand currently, approximately what year do you think Scotland will get to 2.4%?

Karen Watt: That is a very, very difficult—if not impossible—target to talk about. The funding council is just one element of this and in many ways I think our ability to pump-prime, to make sure that there is still an infrastructure and a place for fundamental and discovery research, is the biggest part that we can play in this ecosystem. However, a lot will depend on UK Government policy as much as the Scottish policy environment. I think it is impossible to put a number of years on that. We are seeing a real commitment from the UK Government's spending reviews around how this will kick in; to be fair, not in the immediate years but into the longer term in the spending reviews. I guess we are looking at multiple years.

One of the biggest issues for us is getting a commitment to multi-year spending. We are largely a one-year budgeting funding council. One of our key recommendations is getting, if not absolute budget commitments, at least planning assumptions that enable institutions, our

universities and colleges, to plan effectively for how they leverage-in other funds.

Q241 **Aaron Bell:** Yes. The need for multi-year settlements is a message this Committee has heard several times over several different topics.

Finally to you, Ms Watt: some of our international competitors are going past 2.4% to 3%, Do you think 2.4% is an ambitious enough target in the medium term?

Karen Watt: Given that I could not answer you about when we might get to 2.4%, I am going to stick with that as a pretty ambitious target. I completely understand the international comparison point and I think this is beyond research; this is into any number of fronts where we are going to be challenged on any number of consequences from our place in the world and where we will need to keep competitive.

Q242 **Aaron Bell:** If I could go briefly to Professor Coton: first, your thoughts on the 2.4% target and whether that is enough and, secondly, what can the academic sector, the university sector, do to try to encourage more business investment? Because it is business investment that is letting the side down a little bit in Scotland. What roles can universities like yours play in encouraging more business R&D?

Professor Coton: In terms of the international comparison that you mentioned a moment ago, it is fair to say that when you look at some other countries there is a stark difference between them and the UK. But we do need to progressively get to a position because otherwise you will not have a sustainable base from which to grow. Is 2.4% ambitious enough? The straight answer is: I don't know if it is but probably the answer I would give is that it is taking us in the right direction.

The role that universities can play is multifaceted but probably at the centre of it is the extent to which universities facilitate the engagement with business. Obviously, the Government can play a role in this, both the Scottish Government—through the funding council and other means—and also the Westminster Government. We had the recent announcement in the Levelling Up White Paper that there would be an innovation accelerator in the Glasgow region. That is very welcome news indeed and of course the universities will be heavily engaged with that.

If I can give a specific example from my own university, we have just opened a facility—an advanced research centre. The purpose of that advanced centre is to bring together different research disciplines that are tackling the grand challenges globally into the same space, so that you get the real value of the interaction between the disciplines. For example, in relation to the response to Covid, we saw that, yes, an enormous component of that came from medical science but there was also a very significant component that came from social sciences, understanding people behaviours and the like. At the interface of different research areas, you can get real added value and you can open new ideas.

That advanced research centre is sitting right beside a zone that we are now developing for innovation. The intention is to open that zone up so that we invite small companies, large companies—and we recognise the challenge in Scotland around SMEs—making it easy for them to come in the door, making it easy for them to access the expertise in the university, and also making it easy to bounce ideas off, to develop their future alongside the university's future is key.

If we are going to make real progress in areas where we have significant strength—and one area where there is significant strength that was mentioned earlier is quantum technologies in the west of Scotland—we need to allow companies to integrate quantum technologies into their future product lines. They are going to need the help of the fundamental scientists, so we need to make that connection and that will apply to large and small companies.

Aaron Bell: I could talk about this all day but I think I had better leave some time for my colleagues.

Q243 **Katherine Fletcher:** That was a bit of a trot round the question of what we do differently. Let me take you back to the pandemic. It has been described previously as almost pressing fast forward on the old cassette deck for five or 10 years of innovation.

While it has been difficult and challenging to get through this—and I would echo what the Chair said about our conversation with the students earlier, "You will be telling your grandkids about it"—what are the keepers from your approach? Perhaps Professor Coton first. What are the innovations that are like, "Oh, good"?

Professor Coton: One of the key keepers is the understanding that focus matters. In some respects, there is a tendency to dilute focus in some research areas where we do not funnel towards outcomes in the way that we might. That is not to say that anything in the research landscape, or any particular part of the research landscape, is ineffective but sometimes, in terms of the frameworks and the interaction with Government, that funnelling is not thought through.

I will give you a very specific example. If we think about the vaccine development, we have a plethora of activity there from the fundamental science through to the jab going into somebody's arm, and if you think about what has happened there, that fundamental science did not stop the moment the jab went into somebody's arm. If anything, there was a recognition from, for example, the work that was being done on looking at the virus, looking at the evolution of the virus, that told us that we needed to keep innovating at the fundamental end if we were to keep jabbing people in an arm with a vaccine.

Sometimes in areas of research and development, as we go along the TRL line towards delivery of the technology, we begin to cut off the fundamentals too early. We think, "The fundamentals are done. Let's

move to the next phase." What we find at the next phase is that there are still a lot of fundamental questions that need to be resolved to deliver that technology and for it to add value to society.

To take one other example, to come back to the one I used earlier of quantum technologies, at the moment there are four quantum hubs in the UK looking at the fundamentals of quantum, and let's be clear: quantum presents the opportunity to transform huge aspects of what we do, whether it is quantum computing, whether it is sensing and the way that sensing interacts with life, visualisation. There are a range of different areas that quantum can touch on.

Going from that fundamental science to practical devices that really make a difference takes a lot of work and requires you to overcome a lot of challenges. My fear is that we will look at the four quantum hubs and think, "Yes, they have done a fantastic job. Great research has come out of there. Let's just turn the tap off there and go to the next phase." That kind of approach is the wrong approach. We need to think about extending the range of coverage in focused areas, to make sure that we are feeding the fundamentals and allowing those fundamentals to overcome the challenges for application as we integrate into society.

Q244 **Katherine Fletcher:** Ms Watt, what do you reckon? What are your keepers from the pandemic?

Karen Watt: I think that, first, it showed extreme adaptability in a sector that may not always have had a perception of speedy change, shall we say. That is just a perception but that kind of sense of quickly pivoting into getting campuses safe, keeping students attached to productive learning, and a bit of acceleration around some aspects of future learning and ways of behaving through digital platforms and other things that will be there for a long time and will be developed.

I really agree with the point that this should have shown that the ability to accelerate, to spark innovation and do things differently and at speed, is because we had rooted our investment in bedrock investments that were incredibly important to spring that innovation from. For example, the precision medicine area, where we have spent a lot of quite specialist attention in Scotland—we have an innovation centre on it, we are looking at that—that enabled us to pull through very quick and speedy thinking around medical devices, around health data, around looking at how we track. We used health tech in a different way through the pandemic but I think that was because we had a bedrock of investment going in from the start that we could spark from. That point about, "Let's make sure that we know what we are investing in," with focus, even at that bedrock level.

The other thing for me is that some institutions became much more visible in their communities. We had footfall, not in the way you might have wanted but we had universities and college campuses opening up for vaccines and other things. People who might not ordinarily have gone

into these kinds of places were engaging with them in a different way; they were seen in a different, civic space and I think that is very important. There were elements of these broader consequences as well as the specifics around the science and tech that accelerated in certain ways.

Q245 **Katherine Fletcher:** I am going to use a term and then I am going to duck when Carol Monaghan swings her right arm towards me: levelling up gets talked about a lot and—as you can hear from my accent—I am not from London and the south-east so let's take a very generic view of that, which is that historically lots of R&D investment, lots of academic overviews, lots of people who were happy just getting on a train for an hour out of Liverpool Street or Euston, have congregated.

We are setting targets, saying that we want at least 40% of what gets spent by the public sector to be spent outside the south-east. I have had some people—probably, a group I would include myself in—say, "Yes, easily done. Thank God for that. Let's get on with it!" and other people have said, "It's just not possible, my dear. You know that it's not there. We're not ready." Perhaps I could start with you, Professor Coton. Is Scotland ready to be part of that revolution?

Professor Coton: This is one where I will give a very straight answer: yes, it is. This has been an issue for us. We have been very aware of the levels of investment, particularly in the golden triangle, and the original research pooling initiative that took place in Scotland was a response to that. It was pooling the capabilities of universities like Glasgow, Edinburgh and Strathclyde to create the research mass to compete, and to compete on what was really not a level playing field. But are we ready from the university perspective to engage with that? Absolutely.

Karen Watt: I agree very strongly. Increasingly, we are seeing regional approaches to science, technology and research developing very strongly. It is fantastic that we have Glasgow as one of these accelerator districts. That is superb, and Glasgow is absolutely ready for it.

We have been quite successful in some broader aspects, for example, of the funding that has come out of UKRI for particular places. I am thinking about the south-east of Scotland and the south-west, where we have been looking at our natural economy and looking at how we can decarbonise some of our farming in our rural areas. Funding has been very important for that. I suspect that we have got the underpinnings right to play that part and I think regional approaches to investment are going to be increasingly important.

Therefore, yes, I am absolutely with Frank Coton; I think we can play our part. The city deals, if nothing else, have shown that there can be a coming together of investment portfolios where it is going to benefit particular areas.

Katherine Fletcher: To run the two together, the way to hit the 2.4% is

to demonstrate to business that this cluster has got a critical mass to it. Brilliant. Thanks very much.

Q246 **Carol Monaghan:** That leads nicely to what I want to talk about, and it is how collaboration helps. Glasgow has the Riverside district. Strathclyde has the city science site and of course here, in the technology and innovation centre, we have the Fraunhofer as well. They are all set up to encourage collaboration. Ms Watt, can you tell us how these initiatives do encourage collaboration and how research pooling feeds into this?

Karen Watt: To start with, research pooling was quite fundamental in growing a critical mass of expertise around particular disciplines—physics, computer science, things like that—and that would be taking particular disciplines right across the Scottish university system: a fantastic way of growing postgraduates and graduate schools. They were very successful and they have come together to bid for moneys internationally at European and UK levels.

What I think they have demonstrated, over the last 10, 15 years or so, is that it needs some initial pump-priming—which the funding council did—and then it becomes much more self-financing and self-sustaining. We are not at a point where I think we need a slightly different approach to that collaboration. We would like to seed back the research pools, which are very successful, into the university sector and think about the next generation, which might be slightly more interdisciplinary, where we are bringing different disciplines together from universities and encouraging that kind of pooling around either specific themes or missions.

You were talking earlier to the panel about a missions-based approach to how we think about concentrating our energies. The next generation of pump-priming, that collaboration around research pooling, may come into more mission focus, more cross-interdisciplinary episodes, encouraging that way of looking at things, and connecting those research pools into the infrastructure we have in Scotland: like the innovation centres, like these districts, these brilliant districts and clusters that are joining up, so there is a next generation evolution of the research pools and better connectivity with the broader assets that we have developed.

Q247 **Carol Monaghan:** You have mentioned the initial injection of funding and you have talked about these collaborations then leading to sustainable businesses. Beyond sustainable, are these collaborations helping to encourage economic growth rather than just managing to stay even?

Karen Watt: This is where, for our bit of the spectrum, if we were looking at where we come in on fundamental research and then making that more useful and bringing it right through into innovation and productivity gains and all the rest, I would say that the fundamental part was to grow these to a critical mass where they could sustain themselves and, beyond that, universities now taking those into the next stage.

The biggest point of the connections into things like the innovation centres is where you will get the spurt in growth and industry and business developing further, either with more commercial products from these innovation centres. That is what they are set up to do, to help that translation. We are seeing that happening. We are seeing a greater number of spin-outs. Scotland has a lot of spin-outs. However, the big issue is how we scale some of this up and whether the funding packages—the Scottish National Investment Bank and the like—are able to come in with that kind of ability to scale up quite radically, which I think is a significant challenge for us still.

Q248 **Carol Monaghan:** Would the Scottish Funding Council have a role in scaling up or is its role more the initial injection?

Karen Watt: I think we take it so far along the evolutionary spectrum, if you like. I think we are at the fundamental research end and making that happen: brilliant things, like quantum computing, space, natural capital, precision medicine and all of these things, where Scotland has a competitive advantage, and seeing that they are being properly funded.

Then we can take it a bit further into where we connect fundamental research, project-based research, into business and make those connections happen. We can do that either through innovation-centre funding or through, for example, Interface, which is another body we fund where we try to connect up. But I think that commercialisation and into the next phase needs to be where others need to come in. We are part of that ecosystem but it is not at our own hand.

Q249 **Carol Monaghan:** Professor Coton, do you have any comments to add to what Ms Watt has said?

Professor Coton: Just to agree with what has been said, and to highlight that Scotland learned a lot from pooling. It was the first time that there was a financial incentive of that type to collaborate. We found different ways of collaboration and new modes of collaboration. We tended to learn what worked and what didn't.

Therefore, I would suggest that there is a level of maturity in the approach to collaboration in Scotland now that maybe was not there before. Many aspects of pooling worked very well; some aspects didn't, as we understand, and that helps us to think about the next phase. It has also helped us to collaborate on a range of other things.

Academics from the University of Glasgow are in this building quite regularly for a whole range of purposes, some of which are through formal collaboration structures. Others are not; they are just academics working together on common research topics and securing external funding or working with business on different topics. A good example is Glasgow and Strathclyde co-hosting the Scotland 5G Centre, looking at the potential for 5G to impact the way that society does its work.

There is a level of maturity here that I think is going to allow us to really leverage the power of the universities collectively in the coming years.

Q250 **Carol Monaghan:** Are there examples of similar collaborations in other parts of the UK?

Professor Coton: It is a good question because the Scottish Research Pooling Initiative was the first of the national collaborative research mechanisms. Since then, a number of different mechanisms have come together. For example, there is the N8 in the north of England and we see more and more evidence of regional collaborations between universities across the UK.

But let me just be clear: we collaborate extensively with universities all over the UK. I gave the example of the four quantum hubs. That is a great example of universities all over the UK collaborating on a key research topic that is important to the future of the country, and medical research is that way as well. We led on some of the clinical trials around immuno-compromised people and understanding what the effects of vaccines would be on them, but we were not the developers of the vaccine; we were working with Oxford and other institutions. We do that as part of our day-to-day business.

Chair: Thank you very much indeed, Carol, and thank you to Professor Coton and Ms Watt for your evidence today. We take a standing interest in issues of funding and questions that have been posed by the pandemic, but also some of the directions of UK Government policy on levelling up are very current, so it is very helpful and important to have your perspectives today. Thank you for that.

Examination of witnesses

Witnesses: Dr Gillian Lang, Elaine Gemmell and Dr Lynne O'Hare.

Q251 **Chair:** I am going to ask our next panel of three witnesses to join us at the table. While they are taking their seats I will introduce Dr Gillian Lang, who is the deputy director of science at the Glasgow Science Centre; Elaine Gemmell, who is the head of regulatory affairs at Scottish Health Innovations Ltd, and Dr Lynne O'Hare, who is the commercial director at the National Manufacturing Institute Scotland. Thank you very much indeed, all three of you, for appearing today.

Perhaps I can start with a question to Dr Lang and invite you to set out what the Glasgow Science Centre does and how it seeks to inspire the next generation of scientists and innovators.

Dr Lang: Thank you for the opportunity to come here today to talk to you. As a representative of the science centre network, I feel very privileged to be here to present in front of you.

Glasgow Science Centre is the largest interactive science centre by square metreage and visitor number in the UK. We aim to inspire the next generation of scientists and engineers, and to do so in an accessible and impactful way that is relevant to all members of society, so that they can contribute to the future of society and the economy.

The Glasgow Science Centre itself has spent a number of years trying to build those impactful relationships with our visitors and audiences. Over the past number of years it has spent a bit more time trying to develop more focused activity and with deeper, longer engaging experiences. It used to be that people came to places like ours, to public engagement activities, as a one-off type of experience. But we know from research from King's College London and UCL that one-off experiences are not always as impactful as we would hope, so we are now moving towards a much longer, deeper experience.

To give you an example of that, we have now developed our learning lab, which is a schools platform that explores hands-on activities for classes, for teachers. It also brings in the element of meeting inspirational professionals, allows students to discuss research in science with the people who are doing it and then meld that with learning from within the classroom. The programme lasts for eight to 10 weeks and it came out of Covid, out of the pandemic. We had to move quickly to a blended approach, which allowed us the opportunity to bring in the other professionals. Going from a point of zero standing last summer, we are now reaching 25,000 pupils and over 1,000 teachers, with a programme for expansion next year. That has attracted sponsorship and funding from other organisations—industry, charities, Scottish Power—and from local education authorities.

Another thing that we are very keen on doing is building a supportive ecosystem around people and around the potential to fill the pipeline of people towards STEM careers. It is not something that we can do on our own. It is very important that we bring in education, academia, industry and Government, so that there is a pathway for people to go through, whether that is all the way through school or returning from work or maternity, and so on, or whether it is just someone coming off the street to our planetarium events to watch Pink Floyd and getting an interest in space research. We provide a supportive ecosystem in one place for people.

I will give you a couple of examples of how that has manifested itself in Scotland. We have been very fortunate in that most of the people here presenting to you are contributors and sponsors of some of our work. We have created a number of interactive exhibitions around the subjects of the life sciences and energy and, most recently, about innovation itself.

We have representation from the Fraunhofer, from the innovation centres, from the National Manufacturing Institute Scotland and from a number of companies that are local to us, which can highlight how innovation is helping to solve some of the global challenges we face and how that can relate to the skills that people have within themselves so they can be developed.

That is moving on now to our next endeavour, the Newton Flight Academy. This is the first Newton Flight Academy in the UK. It is a collaboration between Boeing, FIRST Scandinavia, ourselves and NMIS. It is an exceptional learning, immersive experience. It has three film motion flight simulators in it and you can learn to fly a jumbo jet. It is quite an exceptional immersive experience for visitors and will be free at the point of use for schools. People can come to the centre and be inspired by the leading-edge technology that we are bringing in from Boeing.

The important thing for us is that we are a conduit between science, technology, innovation and the public, which should be recognised as an important part of the education ecosystem.

Q252 **Chair:** May I turn to Dr O'Hare? Perhaps you might briefly summarise your national manufacturing institute and say a little about the role of catapults in helping, in particular, small and medium-sized businesses.

Dr O'Hare: The National Manufacturing Institute Scotland is a group that delivers research, technology and workforce development solutions for manufacturers. We help them to de-risk innovation. We make it easier for them to develop and adopt new technologies and to train and develop their workforces to exploit those technologies effectively.

NMIS is operated by the University of Strathclyde and is supported by the Scottish Government's enterprise, funding and skills agencies, and it is part of the UK's high-value manufacturing network.

Our role as a catapult centre is to bridge the gap between business and academia. We want to be able to turn great ideas coming from a world-class research base into commercial reality and we do that by helping businesses access a combination of expertise and equipment that would be beyond the reach of many of those businesses as individual companies.

In terms of our interactions, in particular with small and medium-sized enterprises, small companies, we offer them access to talent, to academic research that is at the cutting edge of their respective fields of development. For example, in our industrial doctorate programme, we have more than 30 students working directly with industrial organisations in areas as diverse as sustainable electrochemical machining and complex data analytics in augmented environments. We work with academics across Scotland, through the Scottish Research Partnership in Engineering, to deliver their programmes that are supported by

universities that have the right expertise in the right areas but as part of an NMIS manufacturing community.

For small businesses, that sees us help them get their designs from the digital drawing board out into production reality. For example, in a recent case study with a local luxury fashion brand, ROCIO, we used 3D scanning and additive manufacturing to help create prototype tooling for the newest iteration of their signature handbag product. That work was supported under the Advancing Manufacturing Challenge Fund and will save significant time, cost and material as they develop their next generation of products which will debut at Paris Fashion Week.

We also help smaller businesses to access the talented workforce that they need to survive and grow. Under the £20 million National Transition Training Fund in Scotland, our graduate training programme is bridging the skills gap in advanced manufacturing for those affected by the pandemic.

Chair: Thank you very much indeed. Again, a very good introduction.

Q253 **Carol Monaghan:** First, I want to make a comment. It is unusual that we have all-female panels at the Science and Technology Select Committee and it is great to see.

Ms Gemmell, if I could turn to you first, could you tell us how easy it is for SMEs to access Government grants and private investments and other ways in which this could be improved for start-ups?

Elaine Gemmell: First, I will set the scene as to where I sit. The organisation I work for, Scottish Health Innovations Ltd, helps to develop innovations arising within the NHS and take them from initial concept through to commercialisation. We cannot do that alone so we do it across all sectors and engage with the NHS, clinicians, academia, SMEs and funding bodies.

Our engagement with SMEs is mainly when they have an innovation that they would look to roll out in a healthcare setting; they would have an idea that they would like to take into the clinical area.

With respect to the funding that is available for that, there are a number of options open to them. We would work with SMEs to help them access grants across lots of different sectors. It could very well be that funding is coming from enterprise agencies or by way of research going through the departments of the NHS. Scottish Health Innovations does have a small fund to help with the development of initial prototypes but the main role that we can play is to help to supplement any grant applications.

More and more, the area that I work in is regulatory approval for devices, making sure that when a grant application is put together, there is more and more focus and that every aspect is in place to ensure success. We help to supplement with information from a regulatory point of view and to put business in contact with our network of clinicians to add clinical

input, so helping SMEs hoping to play in this area to put in applications that are much more robust.

Q254 **Carol Monaghan:** Is there anything additional that the Government should be doing to support local innovation?

Elaine Gemmell: A lot has been done to make sure that there is a core group of functionality that is required for innovation. The landscape is diverse and a lot of different areas play a part, from the intellectual property aspect of innovation through to legal aspects, regulatory requirements and what technology is available. What can be done to support innovation is to make sure that there is a core function and at the very basic level, that core function should be able to open up doors to industry and to people who want to play in that area. It may well be that there is a signposting exercise; people may not know what is required but they can be signposted and put in touch through our network of experts to help them to bring their development to fruition.

Q255 **Carol Monaghan:** Dr O'Hare, I had the pleasure of visiting your site a couple of weeks ago and it was hugely impressive and may be something that the Committee could look at, at a later date. A lot of it is still in development but it was already hugely impressive. How important is UK and Scottish Government funding to encourage collaboration between universities and businesses in the commercialisation of research, for which you are sitting in a very particular position?

Dr O'Hare: I was delighted to welcome you to the National Manufacturing Institute Scotland recently and extend the same invitation, of course, to the full Committee in due course.

In supporting innovation and commercialisation research, it is critical that Government support is available. It is recognised that to bring new products and services to market, individual businesses must take risk. That is understood but where the level of risk is too great for an individual business to bear, it is important that Government support is there to help drive the innovation forward.

I can give an example. Our capability and expertise in the management of residual stresses in NMIS is recognised as leading the way for the UK in a global market. Residual stresses are the leftover effects of materials being heated, cooled, shaped, twisted and turned as they are processed and they can, if unmanaged, cause parts to distort in unhelpful ways, or even to fail in service. Our equipment and expertise has been accessed by many companies, whether they are manufacturing aircraft landing gear, gas turbine power systems or marine propulsion units or working in the oil and gas sector. Without Government support for our research and capability in that area, none of those individual businesses could have brought to their products or services the benefits of that technology, which would not then have been realised in the UK.

In our view, it is also critical for Government to support innovation and commercialisation to drive supply chain development, ensuring that the economic impact is maximised. We work, for example, in partnership with Boeing and as part of the Boeing Scotland Alliance, which has been supported by Scottish Enterprise, Boeing has committed to doubling their supply chain in Scotland through their research and development efforts and to creating 200 jobs in the next five years. Government support is definitely a critical factor in creating the right expertise and making it accessible to companies of all shapes and sizes.

Q256 **Carol Monaghan:** Finally, turning to Dr Lang. You will know that, because we have had interactions over a number of years, I would bring schoolchildren to the science centre but it has changed hugely over the last five to 10 years, and certainly even in the last probably three years. It is unrecognisable, the work that has been done at the science centre. I just want to back up everything you are saying, first of all. The big change is that rather than youngsters going in and playing about and having a lovely time, they are going in and having an experience that is going to enhance their science capability.

Just a quick question to you, Dr Lang. Are there other examples of this type of work in the UK, and could this be replicated by other science centres across the UK?

Dr Lang: Yes, absolutely, there are many examples. There is a great network of science centres across the UK. There are just over 60 science and discovery centres in most areas. However, they are of varying size. There are only probably about four or five of a similar size to Glasgow Science Centre. I do believe that most centres are now looking at developing the public's science capital, so their hold-all of all the science knowledge that they have developed across the years, whether that be from talking to a neighbour or watching television or what they have learned at school. We are all now looking at ways that we can develop science capital and really bringing that level of science literacy up.

Emily Dawson at UCL has talked about the lack of opportunity to access science, and learning about science, critiquing science and otherwise enjoying science, can be seen in the form of marginalisation. The science centres are very much looking towards increasing that science capital. If you look to your local science centres, you will see opportunities where they are trying to do that.

I believe Glasgow Science Centre may be a bit ahead of the game in terms of developing a real, strong process of that longer-term engagement. Indeed, we have had requests from other science centres to purchase that. I think there is real potential for us to develop things that can be rolled out on a much wider basis.

Q257 **Katherine Fletcher:** Hello, ladies. Brilliant—it is not often you get to say that.

I want just quickfire, if we can. We have been hearing from businesses—

we have also heard from the different panels—about the role of procurement and some of necessarily the less desirable behaviours that existing procurement processes can play into. We have brilliant science and innovation, inspired by people, such as Dr Lang, who have had a great idea and it is commercial. What can Government procurement do to help smooth that path and to make that stand on its own two feet?

Dr O'Hare: A fantastic question to focus on. Our experience in the pandemic highlighted the need for responsiveness and innovation in procurement, balanced with appropriate value for money and quality concerns. In Scotland, we saw in 2020 the development of the Scottish Government's Supply Chains Development Programme, which seeks to bring together the economic development and procurement aspects of Government with enterprise and innovation support from the public sector. That is something that we very much welcomed, and NMIS has integrated in that effort. What we want to do through that effort is to build resilient and strategic supply chains for the country.

We have seen some excellent examples, particularly in the health sector, where the Health Innovation Assessment Portal allows companies to bring really new and exciting ideas to public procurement for assessment in ways that maybe are not conventional responses to tender. We have seen Government foster manufacturing innovation by driving local manufactured content, focusing on inclusion, equality and diversity in the supply of goods and services. We would welcome much more of that.

Q258 **Katherine Fletcher:** So, it is perfect? There is nothing you would change about it from the UK Government?

Dr O'Hare: I think I would sit in the privileged position of not having to frequently respond to UK Government tenders. Our customers are the companies who have to engage in those processes, and I am sure that they would always tell you that faster, more accessible and long-term commitment would be what they would want. Our role is to be able to support them in that endeavour, so when there are requests for services, those services and goods can be developed rapidly, manufactured locally and deployed as quickly as possible.

Elaine Gemmell: A lot of the companies we are working with are looking to initially procure their devices within Scotland, so there is a procurement part of the process that we engage with very early on. They would be part of the whole development cycle. We would initially make sure that we could have the organisations in contact with the procurement individuals, so that we could find out what their criteria are for getting their products to market.

In past years, procurement has been a black box, but I have to say, in the last two years I have seen a huge change in the way that they engage with companies, particularly when they try to get product to market quickly. A lot of the steering groups that I sit on have a procurement person sitting on that, so that they are right in at the early

stages. While there are a lot of criteria that have to be met, understanding those criteria before you start to go into a whole development cycle is really important. There is absolutely no point in getting to the end of the development, having spent a lot of time and resource, to find out that you cannot get it through the procurement process for some way. Organisations are getting information about that at a much earlier stage, and they are also getting a much more engaged conversation with procurement at the start of the process.

From a UK Government point of view, I cannot really speak to that, but certainly within Scotland we are seeing that changing, and changing quite quickly in the last two years.

Q259 **Katherine Fletcher:** I am going to take a slight change of pace, if that is all right. In the last panel we touched on this thing called levelling up, where some people have discovered that there is actually a world north of Birmingham. I know it is news to everybody in this room. One of the things there is about making sure that we are shouting loudly and we are describing our attractiveness and our skills and our unique capabilities. This is not a mercy-dash levelling up. It is about giving people their voice.

May I in turn give you an opportunity to give your voice to one? How attractive is Glasgow for the R&D investment, if you are a foreign direct investor? What is your pitch?

Elaine Gemmell: We have had a number of spin-out companies that have been funded by private investment. The key factor that we have in Glasgow is the people and the skills and the collaborative way that people are able to get together and work together. They are very generous in sharing their knowledge and experience and making sure that the best way forward is identified and followed, regardless of silos within organisations. It is a very inclusive and very skilled workforce.

Dr O'Hare: Glasgow, I think, is very attractive for inward R&D investment. I would echo everything that has been said there. We have a vibrant workforce. It is well-connected to transport links, putting most of the central belt and the population within easy reach. We have an amazing education system supporting. Our universities are obviously world-class—of course I would say that—but we also have a fantastic college network and supportive organisations, like Glasgow Science Centre, to make sure that everyone from early years through to lifelong learning is able to access a journey.

We have three innovation districts in the Glasgow city region: the Glasgow City Innovation District, the Glasgow Riverside Innovation District and the Advanced Manufacturing Innovation District Scotland. We hosted COP26. Glasgow is on the world stage for its effort in sustainability, including, from my perspective, sustainability in manufacturing. We have other successful industries here that can support and grow that. We have a strong finance presence from the likes of

Barclays and JP Morgan. We have an amazing life sciences sector, and we have a really strong creative industry, which you see on many cinema screens across the world, with Glasgow as the backdrop now. I would say it is very attractive for R&D investment.

Dr Lang: It is probably something that my colleagues are better served to answer, but I would just echo what Elaine and Lynne have said in terms of the people that are here and their enthusiasm and interest in science. We are always blown away with the amount of questions that we get asked from people that you would not expect. People come in for all sorts of different reasons, and they are asking very pointed questions. They want to know more. They are very interested. They know they have a heritage in innovation and technology, and they want to do more for it.

Q260 **Aaron Bell:** I echo my colleagues' comments. Having an all-female panel is very refreshing because it does not happen very often on this Committee.

Just following on from what Katherine said and the questions she asked in the last panel, the Levelling Up White Paper says the Government have an aim of increasing public investment in R&D by at least 40% by 2030 outside the south-east. You have made a good pitch as to why Glasgow is attractive, but what would Glasgow do with 40% extra money? What could that achieve?

Dr O'Hare: Any increase in R&D spend is obviously very welcome. In particular, I commend the levelling-up agenda's focus on the role that Glasgow can play in accelerating innovation. As many businesses increase their focus on sustainability in all contexts—financial viability, cleaner, greener technologies, resilience, the shifting supply chain challenge—what we see is an increased focus on collaborative solutions to those shared challenges. Things like green infrastructure, for example.

In the Glasgow City Innovation District, the University of Strathclyde is leading an ambitious project to create shared heating, power, transport and climate adaptation solutions that are really attractive to not one but many manufacturing businesses and innovative businesses to come into the city. We would definitely welcome anything in the R&D spend that fostered collaborative solutions to shared challenges, that created better green infrastructure and that saw effective public-private partnerships.

For example, one of the areas that we have seen recently is the exploration of drone services for NHS Scotland. That has been led by a project, Caelus, as part of the Industrial Strategy Challenge Fund, the future flight challenge. They are very much looking forward to hopefully a second phase of that activity kicking off. We see those collaborations as effective ways of taking forward the big picture challenges that people are worried about.

We also would welcome the opportunity that the ability to address those shared challenges brings to attract talent. We recognise that we need to

grow the number of people in engineering and science disciplines, and that equality, diversity, inclusion in all forms are really central to being able to maintain that flow of talent. In terms of supporting that increased investment, those are the background and the environmental factors that we think will be really critical.

Elaine Gemmell: If I come at it from the point of view that I spoke about earlier, having a core set of skills within Scotland that could be accessed by academia, by industry, by the NHS in order to innovate and develop, clearly there would a significant amount of resource and finance required to set something like that up. I think that would be able to be accessed and would be for the good of any number of organisations, so it would certainly be money well spent. I would say investing in the core resource that is required for the innovation pathway would be a good use of additional funding.

Q261 **Aaron Bell:** You both work in the innovation sphere supporting companies. As you probably heard from my questions to Karen Watt in the previous panel, Scotland does seem to be a bit of a laggard in terms of business investment in R&D. I do not know the precise circumstances locally, but my experience elsewhere is it tends to be the mid-size firms that do not really think about it that much. How can we improve the amount of business R&D investment going on in Scotland, particularly in the Glasgow area?

Dr O'Hare: At Strathclyde we are quite proud to be known for our innovation ecosystem. We were featured as a case study in the UK on the roadmap, for example. In the environment here we host a wide range of industrial research centres. We have engagement with four different catapults. We have four innovation centres based on our campuses. We also engage with Fraunhofer UK. We have the National Physical Laboratory. The lab of the Government Chemist is here, as well as a range of businesses, large and small. What we do in the innovation districts that we are part of: we are trying to help those companies de-risk growth. We are trying to help them de-risk innovation and increase their productivity, as well as giving them access to a talent pipeline at all levels. Those are things that we think encourage that growth and productivity and investment.

Our efforts here recently won the Queen's Anniversary Prize for Higher and Further Education in the field of advanced manufacturing. We were recognised in that for having a very broad and quite distinctive programme that focused on transforming international competitiveness by bringing companies together to do shared challenges, as I have said, and for contributing to the communities that we serve through those innovation districts.

Q262 **Aaron Bell:** On this Committee we go on lots of visits. We see the very best of companies. We have just seen it this morning with the space sector. We are about to hear from two local companies who have obviously been selected because they are very innovative. There must be

an issue with reaching some of the companies that are—you could use the word "coasting", and that is absolutely fine for them, but it is not ideal for productivity and growth in the long run. What are your catapult and Scottish Health Innovations Ltd doing to reach out to companies that are not currently investing in R&D?

Dr O'Hare: Two big things. One is making companies aware of the opportunity that R&D can offer. Whether a company is happy with its size and shape, whether it warrants the change, that does determine how much management effort, leadership effort and thought goes into that. Bringing the opportunities into the light, introducing people, networking, and showing them the potential in new technology are important.

The other thing is creating what we would refer to as the absorptive capacity for research and innovation in businesses. You might have a 200-person small or medium-sized company that has very limited capacity for innovation among the staff that are there, in comparison to a three-person spin-out from a cutting-edge university research group. Our role—and we deliver this through our manufacturing skills academy—is to build and grow the absorptive capacity for innovation in those businesses to help them not just see the opportunities that we can share with them, but realise those.

Elaine Gemmell: I think there are a lot of companies in Scotland that have very good and very cutting-edge technologies, and they are focused on a particular task. In some instances, those technologies would lend themselves to a divergent technology into another field. When we are looking for companies that we can engage with, when we are looking for particular healthcare solutions, we could look at traditional companies with technologies in completely different areas, and we can help them to see that there is a transition that could be made, and their technology could very readily be transferred into a healthcare environment.

What we do is, first of all, identify that that is a potential for them, and then we can put them in touch with the clinicians and with the grant opportunities that would help them move from their traditional field of focus into different areas.

Chair: Thank you very much indeed. May I thank all three of our witnesses? You are part of organisations that help drive the possibilities in the region to make use of the assets that are here, and you have put them on the mark this morning. We will be able to draw on them in our reports and our recommendations to Government. May I say to Ms Gemmell, to Dr O'Hare and to Dr Lang, thank you very much indeed for helping us with our inquiry?

Examination of witnesses

Witnesses: Simon Andrews and Dr Stuart Hannah.

Q263 **Chair:** We are now going to ask our final panel of witnesses to join us at the table, and I will introduce them as they take their seats. Simon Andrews is Executive Director of Fraunhofer UK, which has been referred to several times in this afternoon's session. Dr Stuart Hannah is the founder of Microplate Dx. Thank you for joining us today. You have not had far to come, but we have come to see you, so we want to hear what you have been doing.

Perhaps I can start with Dr Hannah. Would you give us a little pen portrait of what Microplate Dx does?

Dr Hannah: Yes, absolutely. Thank you very much for the opportunity today. Microplate Dx is a University of Strathclyde spin-out company. We specialise in developing rapid in-vitro diagnostic sensor tests, which basically enable clinicians at the point of care to very quickly, in under one hour, ascertain the base choice of antibiotic to treat a particular patient's infection with.

If you compare that to the current gold-standard technology, which takes two days, it is a significant reduction in time. Ultimately, that means you can get the right antibiotic to the patient as quickly as possible. We are starting off looking at urinary tract infections, but this sort of technology has broad appeal into lots of different infectious disease areas: sepsis, fungal infections, and these sorts of areas. We are really trying to tackle the global health threat that is antimicrobial resistance or AMR.

Q264 **Chair:** Thank you. The progress that you have made to date to develop these exciting applications: what support have you drawn on, and from what sources has that come?

Dr Hannah: We have been very fortunate in terms of the support that we have received today. This started off as an academic project, back since 2018, and it has been slowly commercialised through the whole ecosystem. Starting off with a lot of support from the University of Strathclyde, that has been invaluable from a purely research perspective, but actually Strathclyde has a very well-established ecosystem in place for developing spin-out opportunities, helping review business plans, and really gearing us up for that commercial journey, essentially. That has been absolutely invaluable for us.

Over the last 18 months in particular we have been part of Scottish Enterprise's High-Growth Spin-out Programme, HGSP. We have gone through two rounds of funding with them. They identify essentially academic research projects that have that potential to add high value to the UK economy and beyond. They have been excellent in terms of giving that funding. That has essentially been a grant to the university, but it is very much taking us on that journey from getting it out of the lab into that commercial space, so looking at the opportunities available, developing our business plan and that side of things.

I have also at a personal level been fortunate. I have received funding from the Royal Society of Edinburgh as part of their Enterprise Fellowship Programme. Again, that on a personal level for me has been fantastic, taking me from an academic researcher to essentially the CEO of a new spin-out company. That has been great.

In terms of smaller pots of funding as well, we have been supported by people like IBioIC, the Industrial Biotechnology Innovation Centre here in Scotland, and Innovate UK as well. We have had some funding from them on a couple of different efforts, one to do a large piece of customer discovery work as part of their ICURe programme, and some smaller funding as well to be able to start developing our relationship with one of the UK catapult networks, so the Centre for Process Innovation, starting to look towards some of the manufacturing and some of the challenges to start scaling up that side of development.

Q265 **Chair:** Clearly you are succeeding. You are growing. You pointed out some of the successes in terms of support and funding that you have been able to access.

One of the things we want to do is to cover the back of those that do not make it, that fall at the various hurdles, and identify what those hurdles might be. Did you encounter any frustrations, anything that from your experience could make it easier for others to pass through?

Dr Hannah: Yes, absolutely. As a caveat, we are still at a relatively early stage in this process. We have been fortunate to date. We have had a number of opportunities.

Development of the ecosystem, to take research projects that essentially are coming out of academic institutions, and scaling it up to a point where it is then ready to be commercialised, and to form spin-out companies, to make that transition, and knowing the point to do that is not always easy. For us, we have been on a relatively well mapped out journey, but I think one of the challenges in the process is perhaps around the availability of funding at different stages.

From what we have found, there are a lot of funding opportunities locally and at national level for the academic research to take place, especially when it is the life sciences and diagnostic sphere that we are operating in, but a lot of that initially is focused on developing proof-of-concept work, which works really well in an academic environment.

In terms of finding the funding opportunities for us to go and perhaps develop partnerships and more collaborative arrangements, again, we have been fortunate in going out and asking people who have been interested in what we are doing, and we have been able to form relationships more organically that way.

In terms of actual funding streams to perhaps promote some of that work with manufacturers or even looking towards the NHS, where we are trying to get these innovations in place, some of that stuff could be

perhaps better signposted just to give other companies an opportunity to know at what point they can essentially access that and know at which stage in their journey they can start to tap into some of these resources. There is no doubt and we have heard today that these resources are available. It is just the signposting to know at which point you can take advantage of some of these opportunities, and then knowing the blend, ultimately, between some of the local opportunities and when private investment then starts to play a role in terms of starting to scale up the commercial side.

Q266 **Chair:** Finally from me on this, we are meeting in the aftermath of Covid. What effect has that had on your growth and the ability to propel yourself forward?

Dr Hannah: It is a very good question. It has certainly been a blessing and a curse in some respects. In terms of the negative impact of it, keeping the momentum going and keeping the team together has been challenging. Just accessing lab facilities with all the restrictions has been immensely challenging in some respects.

I would say, on the other hand, for us in the diagnostic space in the UK, it has had a lot of positives in one respect. We have certainly raised a lot of awareness at a UK level or a global level of the need for diagnostics, of the need for rapid testing, tying into us: not quite viral detection, but looking at bacterial detection, the idea of antimicrobial resistance. There is now a far wider public understanding of the area we are trying to operate in, which is excellent. You have primary school kids doing lateral flow tests on a daily basis. A couple of years back, there would have been no understanding of the idea of diagnostics at all. That has been hugely beneficial for us, trying to explain the message, talking to investors and a number of different stakeholders about what we are trying to achieve. In that respect, it has been a huge bonus.

Underpinning all of that, keeping that momentum going is important, and not losing sight of the need for diagnostics and the fact that things like AMR, from our point of view, is a pandemic that is essentially around the corner, and diverting attention back to some of these key areas is absolutely critical.

Q267 **Carol Monaghan:** Simon Andrews, could you tell us a little about Fraunhofer, the type of work it does and how it was impacted by the pandemic?

Simon Andrews: If I may, I also extend my welcome to the home of Fraunhofer upstairs, the Technology and Innovation Centre, Glasgow City Innovation District and the campus of Strathclyde University. I really appreciate the opportunity to contribute.

If I could give you a very potted background to Fraunhofer, it is a very unusual organisation. This Committee may be very well aware of Fraunhofer-Gesellschaft, often referred to as the gold standard of

technology transfer and innovation worldwide. It is a huge organisation in Germany, but it has also been doing things internationally for 25 to 30 years. There are something like 28,000 employees across 73 institutes in Germany, being that well-defined body between universities and industry in their context.

In 2009, the UK Government, the then Science Minister, Lord Drayson, invited Fraunhofer-Gesellschaft to do something in the UK, and that is why I am sitting here today. In around about 2012, after many universities being interested and developing business plans and looking at things, the ambition of this area was a very significant factor in developing and founding Fraunhofer UK Research Limited. That is the notional headquarters for Fraunhofer centres in the UK, of which we currently have one, the Fraunhofer Centre for Applied Photonics, which is upstairs.

In 2012, Scottish Enterprise, Scottish Government, Scottish Funding Council, the University of Strathclyde and Fraunhofer-Gesellschaft contributed co-funding for five years to get things going. It is good to try bold experiments. A few years on, I am delighted to say it works a treat. We were allowed to adapt the model to UK circumstances, UK funding sources, UK companies. We try to follow the model as closely as possible.

We are a UK company. We reinvest any surplus because we are not for profit. Any surplus is reinvested in the UK. Any IP stays in the UK. This is a philanthropic effort, a network of really good scientists and engineers. The ultimate goal is proving how good the Fraunhofer model is. We are here to benefit the UK economy and hopefully help connect up UK and German supply chains and make good use and good friendships with the things that are going on in Germany too, but we are mainly serving the local cluster and the UK broadly. About 45% of our business is in central Scotland, 45% across England, and maybe around 10% in Europe and the wider world dealing with the European Space Agency, Five Eyes Nations, NATO partners and that sort of thing.

It is a great success, it works. It is simple, it is consistent and it knows exactly what it does. We do R&D projects for industry, they give us a contract and we deliver a prototype, that sort of work as well as other complicated variants, and lots of collaborative work as well.

In the context of today's conversation, our ability to draw different parts of the supply chain together, to work with academia and a range of universities, and different parts of the supply chain is really powerful and really effective. I would happily argue it is the most effective, efficient and successful innovation initiative the UK and Scotland have ever tried. Our GVA has been measured to be 14.6 for £1 of taxpayer money going in. Other people don't quote cold, hard cash. We don't count in kind; we don't count ripple effects and multipliers. I need to do my 2021 numbers. At the end of 2020, for every £1 of Scottish taxpayer money we had consumed we had stimulated another £12.39 of R&D activity, audited

cash in companies in the UK—it is fantastic. Sometimes interventions and stimulations really do work if they are focused and know exactly what they are doing and they stick to the mission.

What we offer is extremely deep enabling technologies, although we don't say enabling and emerging any more; we say transformative and disruptive. It is all about photonics, lasers, optics and of course quantum technologies. Our impact, I believe, has been completely disproportionate to the scale of the operations. There are about 65 people—you will meet some of them upstairs, I hope—but just to calibrate, the population of Scotland is 8.2% of the UK, typically winning 3% or 4% of any of Innovate UK moneys. In quantum technologies Fraunhofer upstairs is winning 7%; central Scotland is winning 30%. There is great evidence that clusters work, and this sort of stimulation can work.

So that is who we are and what we do. It has been a terrific journey and we are very focused on just delivering stuff for industry.

I was asked about the impact of Covid for us. The laboratories were shut for 90 days in 2020, in accordance with Scottish Government rules. Our income was down 20%, which means we were doing some good work at home. Our expenditure was down 20%. So in terms of balancing the books, 2020 beat 2019. 2021 was our best year ever—we saw significant growth there, about 30% growth—and this year we are already ahead of where we were last year.

We have learned a lot from speaking with our industrial customers in terms of resilience and what they are doing. One of the most interesting things is local laser companies—instead of sending someone out to install a laser they have adapted the product so they can be installed remotely. In terms of resilience, industry has taken a long, hard look at its supply chains and discovered that it may have a dual source of some subsystems and components but deep down within them the chips are identical. Some companies are looking at the additional expense of ensuring that there is a dual supply all the way down the supply chain, and considering where those things come from, if Asia shuts for three months, is the dual supply genuinely geographically spread? It has been a real learning thing for all of us.

Q268 **Carol Monaghan:** Simon, because I am having microphone problems I am going to ask you two questions at once. First, you have talked about how successful this model is; why is there still only one Fraunhofer in the UK? The second question is, what specific products or devices did you develop over the course of the pandemic that were used for pandemic recovery?

Simon Andrews: In the history of where we came from, the Hauser Report and Dyson Report gave the confidence and encouragement for the UK to do something like Fraunhofer; that was clearly written in. In that time period there was a transition from a coalition Government to a Conservative Government and simultaneously the catapult centres were

being born and a huge amount of resource was put into those. They share some of our goals and there are some interesting similarities, and some interesting differences between the two systems. So much resource was put into that, there was not the commitment to put resource into other experimental models at the time.

We would be delighted to see other Fraunhofer centres around the UK in non-photonic areas and non-quantum areas. In Germany, every aspect of physics, chemistry, biology, engineering disciplines, computer science that industry would be interested in are all served by deep transformative and disruptive technology centres.

Concerning our direct response to the pandemic, we had some interesting conversations with young companies with some extremely ambitious ideas at early stage of how to do diagnostics non-invasively. None of those came to fruition in a particular project. It was too early stage and too early risk for their investors to pursue. Perhaps if they had known how long the pandemic would be they might have taken a longer-term view. Our impact in the economic recovery is probably all the more important and managing to keep up the momentum, growing in line with the ambitions of the UK Photonic Centre and the UK quantum community, we are ahead of what is going on there.

Carol Monaghan: Although we can all hear each other in this room it is for the broadcasting that we need the microphones, so apologies for this. I have forgotten what I was going to ask you. I might reserve the right to have another nod to the Chair and apologise again.

Chair: We will go to Katherine and then we will come back to you, Carol.

Q269 **Katherine Fletcher:** Gentlemen, hello. I am trying to explore the edges of this idea of genius level academic innovation that has a clear commercial purpose but falls by the wayside due to some of the practicalities, be that a lack of a masthead client, or a sum of money at a key point in the cycle.

Mr Andrews, if I come to you first, but then I want to ask you both quite a philosophical question, but you only need a quick response. There are lots of different pots of money to help smaller SMEs take that financial leap with capital. There is the British Business Bank, the Scottish National Investment Bank. Have you used them? Is it too complex? What is good and what can we do better?

Simon Andrews: Rather than talk about Fraunhofer UK, which has some core funding from Government and wins some other project moneys, I will give a perspective I have learned from all of our industrial customers.

We understand that Scotland has an excellent angel investor community but there is a venture capital gap missing. Stuart has talked about some of the things that happened well in the early stage. There are a wide range of aspects to bear in mind. A lot of our companies in Scotland are foreign-headquartered and it is really important that when we are looking

at the investment in companies, we make sure that foreign-headquartered companies coming here do not just come for manufacturing, but that they make very good use of that bountiful system that we have: here in Scotland we have Europe's most highly educated workforce and the university system is marvellous. If a company only moves manufacturing it is extremely easy to move on; the medical device industry in Ireland saw that. The ones who didn't move were the ones who engaged heavily with the local R&D infrastructure.

I am going to promote Fraunhofer, of course. A lot of companies don't have their own internal corporate labs, or the absorbent capacity. Having flexible external sources, they can turn it on and off to do something maybe a bit higher risk, or project No. 3 that is not top of the agenda—it is really powerful when companies use that, and once they begin to start flexing those muscles it is a wonderful thing to have.

With foreign direct investment we should encourage people over here because of the incredible workforce and the rich environment we have, but also make sure they are fully engaged and give the attractive incentives to make sure they do engage with that. That is what will keep them here and keep the higher-value jobs here.

Q270 **Katherine Fletcher:** Fair enough. I agree with the points you have just made but I was expecting you to say, "Well, you have to fill out a 278-page form to get £5 million out of the British Business Bank." You are not as exposed to that because of the Fraunhofer model—is that right?

Simon Andrews: One frequently asked question is about the bureaucracy and the hurdles. I am a huge fan of Innovate UK. It does an outstanding job of bringing together different companies and when you need it, RTOs and university expertise in business-led projects. It can only fund about half of the high-quality proposals it gets—the ones that are well above the quality threshold. I am delighted to see its budget is going up, but it is going to take another five years to get remotely to where it needs to be. That sort of stimulus is really helpful.

I am often asked, is it incredibly complicated and difficult to win an Innovate UK project, and anyone who has completed the process once I then ask them, "Now that you have been through that learning curve, would you do it again?", "Yes, it is really easy". It is the people who have not done it and not won who found it challenging, or daunting, looking at 10 questions. To hand out millions of pounds, I think deserves 10 questions. It is orders of magnitude less complicated than winning money from Horizon Europe or the European Space Agency, for instance, but there is that initial fear of the unknown. There is a reason why people do not claim their R&D tax credits; they probably think it is complicated but when they have done it once the second time is easier. Organisations like us have a role in helping people and guiding them through that process.

Q271 **Katherine Fletcher:** That is incredibly helpful, and extremely interesting. Dr Hannah, could I just get your brief perspective on that? Is

it a complex and daunting landscape when you are starting out as an innovator as you are now?

Dr Hannah: That is a really good question. It is certainly a complex environment. I am not sure I would go so far as to say it is daunting. From my point of view, it is all about having that balance between private investment and the public purse to a degree. As Simon mentioned earlier, there is a little bit of a gap at the stage that we are at, where we have spun out, we have those proof of concept, those early pots of money into the business, and largely that has been public funding through places like Scottish Enterprise. It is taking it to that next stage where you are wanting to show that you have been able to essentially de-risk the technology to a degree where it is attractive to private investors to come in.

Looking at it at a higher level, if you can get that private investment in from, for instance, the Scottish National Investment Bank or through Scottish Enterprise as part of a co-investment fund are fantastic to be able to leverage essentially match funding for a lot of those schemes. There are a number of different schemes we have been working through from Scottish Enterprise—grant schemes. There was a SMART Scotland scheme, which is unfortunately closed at the moment. Hopefully, that will be open in the summer because that is an extremely useful scheme to get some funding with a small amount of match funding required from the company.

We have had some small pots of funding from Innovate. The Innovate SMART scheme is highly competitive but, as Simon alluded to, if you can get through that process—the length of the applications and the actual requirements to get there are probably fair enough in terms of the support and the amount of funding you are getting back.

Regarding the challenges that we have faced, we have applied for two of the larger Innovate grants to date and we have been unsuccessful. I am not saying our innovation should have been picked over anything else, but when you look at some of the feedback, it does not always align with the national priorities. Antimicrobial resistance, a big Government national priority, the O'Neill report—all of that stuff that came out a few years back—does not always translate through into what is actually then getting funded through the pipeline. That is something that does need to be looked at.

Q272 **Katherine Fletcher:** Thank you. Just so I understand you, you think Innovate UK has become very successful in looking for the commercial opportunity and is perhaps not as good at talking about the geostrategic opportunities that may have a commercial future, such as antimicrobial resistance—is that correct?

Dr Hannah: There is certainly an element to that. Looking at it, there should be a better tie-in between what Innovate is essentially funding and national strategic priorities. I am only talking from a one-sided life

sciences diagnostics AMR point of view, but I think for us that was an area of significant priority and interest prior to the pandemic. Hopefully that will continue on a Government and policy level and translates on the ground in terms of the funding available. One of the challenges with that, and I can see the other perspective, is effectively the timescales involved in the diagnostic space. Covid clearly accelerated getting some of these tests out.

There are regulatory approval processes, clinical trial processes to go through; there is a lot of development work. It is having that match between expectations ultimately and putting the money in now versus perhaps seeing the benefits two to three years down the line.

Q273 **Katherine Fletcher:** That is very interesting. If I make sure I understand you, there is a role potentially for the Science Technology Committee to recommend to Government to be getting out of the way of some of the longer-standing regulatory burdens and maybe taking, where safe, the advantages of some of the developments that have happened during Covid, and ensuring those speedier approaches are embedded to help you deliver your innovations more quickly to market and potentially achieve a commercial return. Is that fair?

Dr Hannah: I think that is fair. There is definitely merit in pursuing something like that, absolutely. For me, some of these schemes are high risk but potentially very rewarding impacts can be determined from them. It is taking that balanced approach to eventually make a dent in it. I keep going on about AMR but that is the space we are operating in; going forward that is an area that will require some real innovation and potentially what might be perceived at this stage as relatively risky investment, and time to get to market.

Some of these things could be really valuable if there is that sort of focus on what can we do with this and how do we perhaps get there a little bit quicker.

Q274 **Aaron Bell:** Thank you both for your time. Going back to levelling up, the White Paper came out last week and I am not sure you will have had time to read the whole thing yet because it is pretty chunky. One of the things it is offering specifically to Glasgow is the concept of what they call a new Silicon Valley-style innovation accelerator which would see local consortiums developing a plan, identifying transformational projects to grow their innovation ecosystem. Would that be welcome, and is there a need for that, in Glasgow?

Simon Andrews: Yes, it would be very welcome. What we see in cluster activity is that active clusters thrive and grow, and it is more than just a couple of companies being similar.

It is interesting that it is referred to as Silicon Valley-type inspired. There is a huge myth that there is a different attitude to risk in Silicon Valley; I think that is absolute nonsense.

When an investor has invested in the similar sorts of technologies more than once they feel comfortable, they think they know something about it, they think they can spot some pitfalls and they are willing to invest again. From an employee's point of view joining a start-up company in Silicon Valley—we are all human beings—people can be risk-averse to simple things like having to move house or having their children move to a different school. Someone in a Silicon Valley start-up typically does not mind if it fails because they will not be moving house or sending their children to a different school. They will probably be parking their car in the same space when they join the next company.

There is no magic in the air; it is about that critical mass and it is about that cluster, and the confidence of having the key people there and also having investment there. I think I mentioned earlier there is a lack of a VC community in Scotland, or a lack of a VC forum where people are regularly coming up and visiting and seeing the rich vein of stuff that can be done here.

I would say yes, it is very welcome. We have discussed layers of strategy today; absolutely I think it should be done in a close and friendly collaboration and consultation with the Scottish Government, Scottish Enterprise, the Glasgow Economic Leadership Group—places like this in Strathclyde, on the innovation campus.

People like Allister Ferguson from Strathclyde, who went to Stanford 30 to 40 years ago on a scholarship, has built bridges between some of the Scottish universities and Stanford University and has been saying for many years that we need these sorts of things. He founded the Institute of Photonics that led to Fraunhofer UK. These things do not happen by accident; this innovation district is here because of a university plan, a university that already wants to embrace technology. Not trying to do it all itself, but by realising that by embracing the Offshore Renewable Energy Catapult next door, the Innovation Centres, Fraunhofer, and putting it all together, that is much greater than the sum of the parts and lots of things interweave. In terms of strategy there really need to be deep early conversations to do it.

A couple of things in the document terrified me. Overseen by UKRI and BEIS—pick one! Delivered day-to-day by UKRI and Innovate UK. You might want to pick one; but also the rest of the document is about decentralising. Day-to-day operations should not be from Swindon, with the greatest respect, much as I love Innovate UK; I think it should be decentralised. There is an aim to measure its success within three years; I think that is completely unrealistic. By the time a centre starts up, gets a chief executive, starts getting some management together, works out the local strategies and what to do, you are 18 months in and you have not really got going. Knowing whether or not it is successful within three years is not realistic—and I notice that the rollout was looking at funding things about half that level already.

I have got some concerns, but I welcome it. We will join in; we will chuck in our tuppence-worth and will hopefully make it a success. But I would recommend that there is really strong consultation with the local people who are driving things at a phenomenal pace here, and I would suggest you use an existing back office that is already set up. It will be easier to get up and running much more quickly, instead of inventing a new legal entity.

I would recommend Strathclyde in this, and Fraunhofer of course. I would love to see it happening and learn more about exactly what it is going to do.

Q275 **Aaron Bell:** Thank you for that very comprehensive answer, and thank you for taking the time to read the White Paper and prepare that. Dr Hannah, did you want to come in on the White Paper?

Dr Hannah: I have just a couple of things to add to what Simon has said there. Essentially that idea is key, and it would be very welcome indeed for Glasgow. If it helps attract more global talent in that space it is absolutely going to be welcome and potentially huge for the city. As Simon alluded to, the key is actually trying to embed this into the existing ecosystem—the framework—without starting from the absolute grassroots. There are a lot of lessons that can be learned from the way some of these clusters have worked before—looking at that in terms of how we continue some of that momentum and what has been done previously in promoting some of the collaborations between academia and industry and keeping some of that going. If that translates in then it will definitely be a huge success, I reckon.

Q276 **Aaron Bell:** Turning to your specific company, are you at the point of making sales yet?

Dr Hannah: No, not yet. We are still a couple of years from that.

Q277 **Aaron Bell:** I ask because it refers to the question Katherine was asking earlier about Government procurement. Are you anticipating having the Government, essentially NHS Scotland or the NHS in general, as one of your anchor clients, and is that something that more innovative SMEs need? What role does an anchor client—I will come to Mr Andrews on this in a minute—play in helping support the growth of start-ups and innovative companies?

Dr Hannah: On the procurement piece it is absolutely vital. For us it is the NHS in Scotland, but we are also looking at the NHS in England and trying to understand these different procurement routes to get to that point. We heard from Scottish Health Innovations Ltd, and it is doing some excellent work in identifying companies that are at that stage in the journey, that pipeline of technologies that are coming through.

Again, it is about maintain that communication, that momentum piece, about identifying it now. I am not saying it is a risk but not being afraid

to identify things at a relatively early stage will help propel them through that journey.

You are up against large lengthy tendering processes, entering into service contracts, what exists currently involving the gold standard solutions in the field we are trying to operate in. Sometimes you can be tied in for five to 10 years. That is challenging as a new organisation, where you are perhaps fighting a battle regarding the channels to be procured in the first instance, and then you are up against some of these lengthier processes.

It is about that wider picture—trying to identify what is coming through and look towards the future at where some of these things could come in. Exactly to your point, when we are that stage of making sales in two to three years' time there is that more seamless transition into being able to be procured at that point without then almost having to reinvent the wheel to an extent.

There is a lot of help there through organisations like Shell and some of the other ones. We have been working very closely with the NHS in Scotland and in England to try and understand these various routes to adoption. They have been invaluable in helping us shape the business plan, the technology and identify the need because, at the end of the day, they are going to be a major customer for us, so that is absolutely key.

Q278 **Aaron Bell:** Mr Andrews, on a wider point, how could the UK Government's procurement be used more strategically to support innovative SMEs?

Simon Andrews: That is a very good question. We have heard the word risk a lot of times this afternoon. It is about the shared risk between the company, the investors and the Government. Companies are willing to take a certain amount of risk and investors know how to measure the risk. I would like to see Government Departments incentivised to take genuine and measured risk. Not to be ludicrous, but there are some great opportunities and medical devices are a wonderful example. I spent a dozen years in the medical device industry in Scotland and, I should say, was happy to work for five or six companies that are no longer trading because they took risks. The learning opportunities are there and, like the Silicon Valley example, you find a job with the next company.

So, medical devices absolutely, but it does not necessarily have to be at the scale of an NHS rollout. It can be at trials and encouraging an SME to make the first 10 complicated instruments, knowing they are not perfect yet but having to get to that next level of confidence that then gives investors the next level of confidence to scale up to make 100 or 1,000.

Also in Defence, there are great opportunities. Defence suppliers are extremely conservative because they often sign up to decades' worth of guaranteed support services. So when new subsystems or components

come through, the Defence integrators can be very cautious about trying to adopt them. So perhaps Defence suppliers could also adopt more trial exercises. I should say that we do great work with the Defence Science and Technology Laboratory and the Defence and Security Accelerator—DASA. They are doing a great job as well.

In telecoms, for instance, where there is a national need for telecoms infrastructure, we could do some fantastic things. We could combine our interests—I say, "our", it includes Fraunhofer—in quantum and in space by procuring a satellite quantum key distribution network linking up Glasgow and Edinburgh's financial centres, all their airports, all their universities, with genuine quantum communications. If Government set the scene for an intervention like that, the suppliers like BT come in and they need to procure their components from the SMEs. All of a sudden you then have almost a predefined supply chain. The people who got it to work in their heroic demonstrations will then automatically be the people who are supplying in to the end product.

There is an expression from the old days of industry, "No one ever gets sacked for buying IBM." If Government Departments are going to do procurement and be encouraged to take risk I would hope that, in a few years' time, there would be some sort of measure where they looked back. If a Department was encouraged to spend 5% of its budget on risky activities and they were all successful, you would go back and tell them they were not taking enough risk and they would be marked down for that.

I went on a day trip to Knockhill Racing Circuit and before I went my brother-in-law—a big racing fan—said, "If you don't spin off, you won't know if you went round fast enough." I am all for measured risk. I had a helmet and a harness and there was a gravel trap, but it was fine; I spun off and it was great. I was less scared of the next bit, but you have to push these things and understand. VCs get it. As Hermann Hauser once said to me when he was setting up the Catapults, Government are in a position to look for a much longer-term view and take on risks that VCs would turn their nose up at. That is the sort of risk we really need our Government to be taking.

Q279 **Aaron Bell:** I like the analogy, and we can use the double meaning of spin off perhaps in the Report. Finally, the same question I asked to the previous panel about the overall levels of business R&D in Scotland; it is lower in the UK overall, and also lower than in many OECD countries. Why do you think this is and how can it be increased? I will come to you first, Mr Andrews.

Simon Andrews: Some points were made that higher education research and development was a great success. We are disproportionately university and research-heavy. I do not know whether the numbers are as bad as they seem, but I do think there is more to be done with the assets we have. Scotland has a large percentage of people in the public sector, which reduces your business expenditure on research

and development. There are some companies that are London-headquartered, and the reporting goes through there rather than acknowledging where the R&D actually takes place.

A lot of companies struggle to identify what is R&D activity, hence the huge underclaiming of R&D tax credits. The industry of people who are helping folk get R&D tax credits on a no win-no fee basis tells you there is a lot of untapped resource there.

We have some sectors which, rightly or wrongly, do not do a lot of R&D. Tourism is very important in Scotland; it does not do a lot of R&D. Food and drink is relatively low in R&D. Surprisingly, Fintech tends to be quite low on R&D. Some of those are factors.

We have about 6% of the UK's R&D employees in Scotland, with about 5.3% of the BERD. If we look at BERD over GDP over the last few years, Scotland used to be about 50% of the UK level; it is now at two-thirds, so it is improving. I would like to thank my good colleague at Technology Scotland, Leonardo Allan Colquhoun, for giving me most of those numbers in the last couple of hours in text messages.

What we need to do about it is realise there is that cluster, that momentum; there is enthusiasm and ambition in Scotland and there are great assets in our universities and translational institutes. We are living proof that the right stimulation helps it.

Some companies are incredibly active in R&D. They get it; they know the landscape. They have the strategy. Some companies lack a technology road map. We have sat with companies and said, "If in a year you did this, in three years you did this, where would you be?" because if you do not innovate, your competitors will and you will go out of business. They can take some encouragement and stimulation and if organisations like ours can help join things up and recognise someone potentially has an advantage in a component that might fit in with that company's end product then there is a role for us as well.

I am really sympathetic to the majority of the landscape stuff. There are something like 236 different organisations in the UK that are public sector research establishments, national labs, for-profit RTOs, not-for-profit RTOs, and Catapults. If companies are concentrating on this month's sales they are not looking around. They pop their head up over the factory wall every few years and ask, "Where has the Technology Strategy Board gone?", "We call it Innovate UK. It is part of UKRI," "What is UKRI?", "Well, we put it together quite a few years ago."

They don't know the language so there are barriers: the jargon, the schemes and so on all seem to be changing very, very quickly for those that are not very active. It takes encouragement and taking them through 10 questions and saying, "This is how you do it. Yes, I know you want to tell your story, but you really have to answer the question—that is how you win the project."

I think there is a place for organisations like our own, where we really see what can be done with the technology, but also the commercial view and really having that flowing through our veins—excellent science and engineering but with a real business brain and a real commercial outlook. There is a time and a place for organisations like ours to do that and I think we can do it really well.

Q280 **Aaron Bell:** Thank you; that is very comprehensive. Did you want to add anything, Dr Hannah?

Dr Hannah: Just a couple of things. I think that is certainly the case, looking at the university and research landscape here; more funding probably gets done. Some of that more fundamental-type research probably takes place in these sorts of settings rather than from, say, a business point of view. Looking at it as part of a bigger picture, it is almost unrealistic to compare directly maybe the Scottish ecosystem with places like London, Oxford and Cambridge. It is a very different set-up there and there is a different appreciation in terms of levels of risk, and also focus in terms of what companies are trying to do.

From my experience of bringing funding in—we have discussed that before—if you are an SME here, operating on maybe a relatively tight budget, there is going to be a push, as Simon alluded to, to really focus on that end product and making sales in that key area. Maybe you are not going to have the same amount of, I guess, baggage to be able to look at some of those things. That is principally where I am coming from on that.

Chair: I think the last question—if not the last word—should go to Carol Monaghan, as the Glasgow MP.

Q281 **Carol Monaghan:** My microphone is switched on and my brain is back on. Simon, I talked about the pandemic in your contribution but part of Covid recovery, of the pandemic, probably allowed all of us to have a think about the future, where things were going, tying that in with COP, climate change and all of that. Are you able to explain how applied photonics can play a role in combating climate change, and is any work being done in Fraunhofer specifically on that?

Simon Andrews: It was great having COP26 here and seeing what everyone was doing and making us think again about what we are doing. There are layers and layers of complexity to this. Lots of companies in Scotland are looking at themselves internally at what they do regarding their own carbon footprint first and foremost. Employees are becoming more and more demanding in their expectations of flexible working, and also in examining the green credentials of the company they about to join, so businesses really have to think about this very seriously.

Concerning the technology sector, we know that photonics is everywhere. The division of the UK photonics industry have their vision paper of trebling in size by 2030; so does Photonics Scotland. It is a huge growth

industry because it is transformative. We know electronics is everywhere, but photonics is everywhere as well.

I would give some key examples. In agritech and vertical farming we have been working with the James Hutton Institute through a new course about what sort of LED lights to have on at what time in the growth cycle of a plant to maximise its growth. The potential for vertical farming is absolutely wonderful—a closed environment, no pesticides, microdosing water, and growing factory-loads of fruit and vegetables all through the year right next to the city, and not transporting them.

From simple things like that through to wind LIDA. We are installing thousands of turbines around the world. A LIDA system measuring the wind coming towards the turbine can ensure that you have the right turbine in the right place, that it is operating properly and that you are adjusting the yaw and the angle of the blades to maximise the energy-efficient extraction of the wind. We have done a lot of wind LIDA work and if that means that it is 5% more efficient over its lifetime we will need fewer other power stations. It is not the most exciting application, but it is really important.

We have done a lot of work in hydrogen detection. I am actually doing the first live trial in Sellafield's warehouses. Long-term nuclear storage gives off tell-tale signs of hydrogen, which we are able to detect in a 3D volume. We are now looking at how you take that technology in a very controlled environment and make it more accessible for the hydrogen economies—when we are generating, storing and distributing waste, is it being done safely?—by measuring miniscule fugitive emissions of hydrogen.

Even offshore cable monitoring: the cables that bring back energy from wind farms have fibreoptics inside, which means you can interrogate that cable. Cables like that can strum in the tides like a guitar string, which would lead to their being damaged. We can even detect if a dolphin has touched the cable. We are working with the European Marine Energy Centre in Orkney and have done demonstrations with the Strathclyde spin-outs and Abtech and it is really powerful technology.

Around 85% of all insurance claims in offshore are to do with the cables. The cables break and get damaged and are hugely expensive to replace. Getting the whole economics of that industry has got photonics buried deeply in it and we are helping UK companies tackle these challenges.

Carol Monaghan: Thank you very much. I should declare an interest at this point, as the chair of the all-party parliamentary group on quantum and photonics.

Thank you, Simon. I know you are going to take a bit of time to show us some stuff so we are looking forward to that. Thank you both and all the witnesses this afternoon for joining us in Glasgow.

Chair: I will add to Carol's thanks to Simon Andrews and Stuart Hannah

for your evidence, and all of the witnesses we have had this afternoon. We have covered a huge amount of ground from space and satellites to research funding, the recovery from Covid, and looking at how we can best support innovative companies. We are very grateful to all the witnesses who have helped us today.

This feeds into a number of current inquiries and it is our practice to write to relevant Government Ministers with our reflections on the evidence panels that we have taken during these sessions that we have been having outside of Westminster, so we will do that.

In addition to today's witnesses, I also thank our House of Commons Committee team, who put this visit together and briefed us on all of the subjects that we have discussed, and our broadcast team who make sure that the public can follow our proceedings. A particular thank you to the University of Strathclyde, and to Sir Jim McDonald, its principal, for hosting us in this magnificent university this afternoon and allowing us now to go and inspect some of the facilities here. That concludes this meeting of the Committee.