HOUSE OF COMMONS

Public Accounts Committee

Oral evidence: Industrial Strategy Challenge Fund, HC 941

Thursday 4 March 2021

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Watch the meeting

Members present: Meg Hillier (Chair); Olivia Blake; Sir Geoffrey Clifton-Brown; Mr Richard Holden; Nick Smith.

Gareth Davies, Comptroller and Auditor General, Peter Gray, Director, NAO, and Marius Gallaher, Alternate Treasury Officer of Accounts, HM Treasury, were in attendance.

Questions 1 - 68

Witnesses

I: Sarah Munby, Permanent Secretary, Department for Business, Energy and Industrial Strategy; Professor Dame Ottoline Leyser DBE FRS, Chief Executive Officer, UK Research and Innovation; and Jo Shanmugalingam, Director General, Industrial Strategy, Science and Innovation, BEIS.

Report by the Comptroller and Auditor General

UK Research and Innovation's management of the Industrial Strategy Challenge Fund (HC 1130, Session 2019–2021)

Examination of witnesses

Witnesses: Sarah Munby, Professor Dame Ottoline Leyser and Jo Shanmugalingam.

Chair: Welcome to the Public Accounts Committee on Thursday 4 March 2021. We are here today to look at the performance of the UK's Industrial Strategy Challenge Fund, which was launched in 2018 with an eight-year £3 billion budget. So far, it has backed over 1,500 projects, spending a total of £1.2 billion. It is run by UK Research and Innovation, which is a public body funded by the Department for Business, Energy and Industrial Strategy. Funding is awarded to projects that meet four key themes of the Government's priorities for industrial strategy in the future. These are clean growth, the ageing society, the future of mobility around transport needs, and artificial intelligence and the data economy. We will be looking at what projects under those main headings are being funded and how well that is going, and asking some questions about the process involved in bidding for and achieving success in this area.

I am delighted to welcome as our witnesses today Sarah Munby, permanent secretary at the Department for Business, Energy and Industrial Strategy—welcome back, Ms Munby; Professor Dame Ottoline Leyser, chief executive of UK Research and Innovation, which manages the fund; and Jo Shanmugalingam, the director general at the Department for Business, Energy and Industrial Strategy with responsibility for the fund. We are going to ask, first of all, a couple of questions that are not directly related to the National Audit Office's excellent Report on this, and I am going to ask Nick Smith to kick off.

Q1 **Nick Smith:** I have a question first for Jo Shanmugalingam. It's about OneWeb, which was purchased, or part-purchased, last year for an investment of $500 million. The company has brought in other capital and investors since, but the UK is still a large shareholder. I have asked questions about the organisation recently, but it has been difficult to find out about its objectives and progress, and value for money. The questions that I have asked have had really poor answers, so I wonder whether you could say what parliamentary oversight we are going to be able to have of OneWeb.

Jo Shanmugalingam: Thank you, and sorry about the answers that you have received to date. The BEIS Select Committee is looking at OneWeb, and I think it has an inquiry under way. It took some evidence at the end of last year, and I think we are expecting it to have further hearings in the months ahead, so it is very focused on it already. We will report on it through our report and accounts in the normal way, and we are really happy to answer any specific questions that you have after this hearing.

Q2 **Nick Smith:** Can I ask some questions now and try to get some simple questions answered? On the face of it, this is a company that flies US-made satellites. It is backed by an Indian telecoms company, and it launches its satellites from Russian spaceports. It is nominally London-based, but can you update us on how many staff are currently based at the UK headquarters? OneWeb has plans for UK coverage of satellite broadband by the end of this coming year, so what is your estimate of the number of UK households that will benefit from enhanced broadband in the following 12 months?

The UK has a significant shareholder ownership of the company at the moment, and other investors, as I have said, have come forward. What is the Department planning to invest—UK funds—in the company for the coming 12 months? How much are you likely to allocate to OneWeb for the next 12 months?

Jo Shanmugalingam: I will do my best now, and if there is anything I do not respond to, I will be really happy to follow up afterwards.

As you say, this is a UK company, a UK-headquartered company, and that was one of the reasons why we saw the opportunity of the investment last year. We invested alongside Bharti as the core, founder shareholders when we took on the company in the transaction that completed at the end of last year. I do not have figures with me today on how many staff we have based in the UK—OneWeb is based in the UK—but I can get back to you.

In terms of coverage, what we are focused on with the company at the moment is getting the first generation of satellites operational. As you say, they launch from Russia at the moment. The first successful launch post bankruptcy happened just before Christmas. That was a really important milestone in getting the company back up and running. There will be further launches through this year. You need to have a certain number of satellites up in orbit to have your starting constellation to be able to provide services. Before then, you have the full suite of services you can provide from the complete first-generation constellation. I do not have a figure with me today for coverage in the UK at this particular moment, but I am really happy to get back to you on that. In terms of investment, as we said at the time, we have put in $500 million alongside Bharti, as part of the successful bid from the chapter 11 process. That investment was made into the company.

Q3 **Nick Smith:** Could I just push you, Jo? Have you got any money allocated for further investment in OneWeb in the coming 12 months?

Jo Shanmugalingam: Our investment was the £500 million that we—

Q4 **Chair:** It was dollars, wasn't it?

Jo Shanmugalingam: Sorry, you are absolutely right. Apologies.

Chair: I just wondered if it had gone up.

Jo Shanmugalingam: Apologies. The $500 million that we invested alongside Bharti is the investment that we have made into its company. We believe that investment can support OneWeb to deliver the generation one satellites, and success beyond that.

Q5 **Nick Smith:** So you don't anticipate investing any more money in OneWeb in the future?

Jo Shanmugalingam: We have no plans to do so. We believe we have backed a business that can secure the additional funding it needs to build out the satellites and make a commercial success of the venture.

Q6 **Nick Smith:** Okay, can I just press you on the Department's estimate of the number of UK households that will benefit from enhanced broadband in the coming 12 months? That is really where the organisation has ended up. At first, some quite grand plans were suggested, but it seems to have all become about enhanced broadband. If there is going to be coverage of the UK with satellite broadband at the end of this year, which is what the company says, how many UK households will benefit from it in the year after?

Jo Shanmugalingam: I am afraid I do not have specific data on that with me. As you say, OneWeb, by its nature, is going to be a global offering, which we will benefit from in the UK, but clearly many other parts of the world, where there is not easy access to broadband services otherwise, will benefit. The number of households that will benefit in the UK in part depends on the number of households who are not able to get other access to reliable broadband services, which most of us enjoy in most locations in the UK. I need to liaise with colleagues at DCMS about that, but I am really happy to get back to you after the hearing, if that would be helpful.

Q7 **Nick Smith:** I want to press you a little further on this, because it seems to me that it is what OneWeb is supposed to be about now. It is easier for people in the cities and towns to get access to broadband, but what is this $500 million going to buy for UK households? I think that is the key question that needs to be asked. Can you give us the best estimate that the Government have about that as soon as possible? We would be grateful.

Jo Shanmugalingam: Of course.

Nick Smith: Thank you.

Q8 **Chair:** It is worth reminding anyone watching that this did require ministerial direction for the purchase. I will not go through all of that again now, as it is not the main focus of our hearing, but I wanted to touch on ARIA with Sarah Munby, as permanent secretary. That is the additional fund that will be for innovation and investment, particularly around defence. As we understand it, Ms Munby, this fund will be launching next year, but it is not subject to FOI and it is not going to require tendering for the money that is going to be allocated. Is that correct? Can you give us any more information about what ARIA will do and what the governance of it will be?

Sarah Munby: Absolutely. That is correct, in the sense that that is what has been put before Parliament. Obviously, the Bill is now being scrutinised, so we will see what finally emerges from the process.

In terms of the plan that we have put forward, it is worth saying, just as a principle, before we go into the detail, that we are consciously proposing that ARIA be set up on a different basis from UKRI, for example, and other research institutions, and at greater arm's length from Government. That is because the evidence from international experience, particularly in the US, is that the freedom to make very high-risk, potentially very high-return, at the frontier of the frontier of research, is what makes it work. It is not an accident that we are doing these things to push ARIA further away from central Government control; it is absolutely essential and central to the strategy that underpins the organisation.

In terms of FOI, which you asked about, ARIA is going to be a relatively small organisation, but very high profile. We are trying to manage the challenge, which is that we think there will be a disproportionate number of FOI requests, and that could really bog down what is meant to be a fast-moving organisation. We do not think that is the right way to provide scrutiny.

Q9 **Chair:** We have the Freedom of Information Act, which, like it or not, is an Act of Parliament. It was the intention of Parliament that public bodies funded by the taxpayer would have to respond to requests for information, and you are saying that you have deliberately taken it out of the remit of the FOI Act.

Sarah Munby: Yes, because we think the goals of the organisation would not be well achieved if it were subject to that. Obviously, it will be subject to parliamentary scrutiny, but that is why we have done it.

Q10 **Chair:** Is this something that you are looking at in other areas of work? You are obviously funding quite a lot of research and interesting projects that might be bogged down, as you put it, by lots of FOI requests. Is this a moving trend in Whitehall, or is it just ARIA?

Sarah Munby: No, it is not. It is very specific to ARIA because of those three things that I described. One is that we are very consciously trying to make it exceptionally nimble. The second is that it is, in the grand scale of things, a small organisation. The third is that we think it will be of a lot of interest, so it is likely to receive not just a relatively low level turnover of FOI requests, as a local authority might, but quite a large volume. Those three things in combination make this an exception. We absolutely view it as an exception; it is not part of a broader approach or strategy.

Q11 **Chair:** I spent three years as the Minister responsible for freedom of information requests in the Home Office. There are a lot of exemptions under the Act that are legitimate. Surely the sensitive, very high-risk projects that you are talking about—some of them with a private sector element—would not be subject to FOI anyway. What you are saying, as I understand it, is that you want to take it out of the remit of the Act to save the admin of dealing with a lot of requests that, depending how deep they go, would not be able to get an answer anyway because there would be exemptions under the Act as it is. I just wonder why you have gone to the effort of taking it out completely. It seems like closing scrutiny of £800 million of taxpayer-funded investment.

Sarah Munby: As you rightly point out, handling a lot of requests and exemptions is also further pressure on an organisation of which the core principle of why we are creating it is to allow it to be exceptionally nimble and further away from central Government control.

It is worth saying, however, that this is not about taking the organisation away from scrutiny. It is a particular exemption around FOI. For example, ARIA would still be subject to NAO value-for-money controls. It will, of course, have a board to which the Secretary of State will be able to appoint, remove and so on. We have described processes for its procurement—that was the other piece that you asked about—which, rather than being subject to the normal procurement controls, work very much up front and will be subject to internal audit processes, which are being defined now and happen afterwards, so that we are reporting back in terms of what happened on procurement.

It does of course need very serious controls and governance around it, but we are deliberately trying to design the controls and governance in a way that does not impede the organisation from moving at pace, and does not subject the organisation to direct political control. The principle that enables it to operate at the frontier of the frontier, as I said, is really about scientists and exceptional individuals being able to make choices about where the really big breakthrough opportunities might lie.

Q12 **Chair:** You say very high risk, so that £800 million is all at very high risk. Is that the accepted situation?

Sarah Munby: Absolutely. It is high risk, with the potential for very high return. That is why it is only a small part of our overall R&D portfolio, which is made up of a full spectrum of different types of risk and return, one of which we are going to talk about today. This is one far extreme of that full, much bigger body of—of course, much more certain—programmes, many of which, of course, are run by UKRI, who are here today.

Q13 **Chair:** Okay. I would love to go into this more, but the key thing for me, in relation to today's hearing, is why ARIA is separate from the challenge fund that we are discussing today. Why was it set up as a separate fund?

Sarah Munby: Because they are genuinely two quite different things: the thing that they have in common is this dimension of going after particular challenges, and going after particular types of research. But in the case of what we are talking about today, these are challenges selected in partnership with Government, to go after particular—frankly, in the grand scheme of things—relatively near-term goals, so, for example, improving battery technology; supporting the electrification of vehicles; working on robotics or the nuclear industry. These are really important, but they are not the frontier of the frontier of scientific research. So that is one difference: the kind of research being done.

The second is the distance from central Government, where here the selection, which we will talk about I am sure in much more detail, of the challenges, is something that has been very much done in partnership with the Department. In the case of ARIA, we are giving much greater freedom to select challenges that could be much further away from what, today, we in Government would see as the near-term drivers of economic success, and are much more about breakthrough scientific research that is unknown unknowns—that no Minister is currently asking about because they don’t even know that the question is a question we could be asking.

Chair: Well, I have often said that Whitehall should be a bit more Shoreditch, a little less Whitehall, but I think we will be keeping a close eye, with the National Audit Office, on this £800 million—how it is spent and whether those lofty ambitions are met. One of those people who will be keeping a very beady eye on it, I know, is Sir Geoffrey Clifton-Brown. Over to you, Sir Geoffrey.

Q14 **Sir Geoffrey Clifton-Brown:** Thank you very much, Chair. I am sorry; could I go back to Ms Shanmugalingam, and Mr Nick Smith’s line of questioning, and just ask if you could tell the Committee what the Government’s arrangements are to protect and enhance our $500 million investment? You may want to write to this Committee, giving a bit of detail, but just very briefly: do we sit on the board? How do we exercise control over the company and protect it?

Jo Shanmugalingam: I am very happy to write with more detail but, yes, absolutely, we currently have three board seats. I am currently one of the non-exec directors while we are in the process of appointing non-executive directors. You might be familiar with UK Government Investments, who manage the shareholder interests on behalf of Government: they are leading this work for us and they will, on an ongoing basis, have a shareholder director for us on the board. We have a shareholders’ agreement, which sets out our rights in relation to the investment and our relationship with the other shareholders, but I am really happy to provide more detail afterwards.

Sir Geoffrey Clifton-Brown: That is very helpful. Thank you.

Chair: Thank you very much, Ms Shanmugalingam.

I am now going to turn to Richard Holden MP—who has dropped off the screen, I fear. *[Interruption.]* I think we have lost Mr Richard Holden for the moment, so in that case we will go into the main session; but I will bring in Mr Holden, who had a question about the Budget, later. We will go into the main session and to Mr Nick Smith, but at the right moment we will come back in again on the Budget; I just warn our witnesses we are going to be asking some questions about that.

Mr Nick Smith is going to kick off for us, to discuss the Industrial Strategy Challenge Fund. Over to you, Mr Smith.

Q15 **Nick Smith:** Thank you, Chair. As NAO Reports go, this is broadly positive. It is also, as we were saying at the top, very well done in pivoting a pre-existing vaccines project to support the covid vaccines programme. That has helped our country a lot—thank you to the teams that did help with that.

I am going to ask what is probably an unfair question, but I think it needs to be asked anyway—and I know this programme has only been going for three years, but it is particularly to you, Sarah Munby, given your experience in R&D development in your previous roles. One of the overall objectives of the Department and its programme is to increase the amount of GDP in the UK spent on R&D. I understand that the objective is 2.4%. I understand, but I am not sure, that it is currently above 1.8%, so the objective is to double it. There are 1,600 projects working on this programme at the moment. How, and by when, will we see a 50% increase in investment in R&D as a percentage of UK GDP?

Sarah Munby: I am going to pass that straight to Jo.

Jo Shanmugalingam: The data on overall levels of R&D investment is collected and published by the Office for National Statistics. The latest data it published is for 2018, which shows us, I think, at 1.7%, but it is publishing the 2019 data next week—a little bit delayed because of the covid impacts on being able to collect the data last year.

We hope to start to see then the significant increase in public investment that we have made over the last five years, and that that had been specifically targeted, as you see through this fund, at how we can better leverage private investment. I hope we see some improvement there, but as you say, these are really long-term investments. The target is that we get to 2.4% by 2027, and we need to make the sustained investment through programmes like the ISCF over a period of time to realise and get to those targets.

Q16 **Nick Smith:** Okay, thank you. I looked at the programme, and there is a big emphasis on input. There is, I think, insufficient explanation for how, from the current £1.2 billion—half a billion has also been brought in by the private sector—you are going to get to £2.4 billion in six years. It seems an awfully big challenge, and it is not clear from the investment you have made so far that you are going to do it. Show us what the link is between the inputs you have employed and the outputs in investment and R&D that you hope to see.

Jo Shanmugalingam: I will start, and then Ottoline Leyser might want to talk about some of the work that UKRI do here. The Chancellor announced last year that we are doubling public investment in R&D over the course of this Parliament, increasing it to £22 billion by 2024-25.

At the moment, all public R&D is about a third of the R&D invested in the UK—the rest is from businesses, charities and universities' own resources.

What we are doing through programmes such as the ISCF—but not only the ISCF—is ensuring that we leverage further private investment. You might have seen that the Chancellor also announced yesterday a review of R&D tax credits, to ensure that those are playing their part as well in making sure that we incentivise that really critical private R&D investment.

Ottoline might be able to talk a little more about the specific programmes in UKRI that incentivise the investment.

Professor Leyser: I think this is a really important point. As you rightly highlight, the UK invests only 1.7% of GDP in R&D, which is well below the OECD average of 2.4%. Personally, I think we should be aiming to be considerably above average. Germany, for example, is currently at 2.9%, and their public-private ratio is quite similar; that public-private ratio is probably about right.

There are really important systems considerations about how to ensure, as you quite rightly point out, that that public investment really leverages the private investment and drives up overall R&D investment for the UK and, crucially, translates that into higher productivity, which is one of the main goals that we need to address in ensuring that all that public and private investment actually translates into prosperity, value and high-quality jobs for the country.

So, for me the key element from that point of view is that our system, which is incredibly high quality in many ways—we really have fantastically high-quality R&D outputs right across the fundamental research base and into industry; some really exceptional, highly innovative and highly productive companies. But the system is far too balkanised. It is too fragmented, and people, ideas and networks linking the system are few and far between. As a result, a lot of the value that we could create from the parts that we currently have winds up going out of the country. Therefore, a key goal is to anchor that value in the country and for the UK really to capture the benefit of the highly creative and innovative system that we have.

The creation of UKRI is a fantastic opportunity to do that, because it brings together the seven disciplinary research councils that invest in the university sector and in building those collaborations with business and—crucially—Innovate UK, the UK's innovation agency, which is very much a hub for all this activity, along with Research England, which invests the block grants into universities and which also has a huge amount of expertise in catalysing knowledge transfer and agglomeration around those universities. All that collective expertise together, under one umbrella organisation, offers exactly the opportunity to do this joining up that I think is so crucial.

For me, the Industrial Strategy Challenge Fund is a really iconic example of the kind of thing we can do now that UKRI exists, to bring together all that expertise and join things up.

Q17 **Nick Smith:** Professor Leyser, thank you for that explanation about the balkanisation, research and development, your encouragement of people to work together and the fantastic ambition and the concepts that you outlined. Do you think the UK will reach its target of investment of 2.4% of GDP in R&D by 2027—yes or no?

Professor Leyser: I think it is a very challenging target and I think that the hit to the economy from covid makes ensuring and prioritising that public investment challenging. If we can keep that public investment rolling through and we can keep the momentum that we have generated through activities such as the Industrial Strategy Challenge Fund, I think that 2.4% target is plausible. I also think that ambitious targets are really important; otherwise, one won't even meet unambitious targets, let alone ambitious ones.

Q18 **Nick Smith:** Thank you for that. We'll try and hold you to it, but we understand how difficult it is. And fair wind to your efforts, really.

Professor Leyser: Thank you.

Q19 **Nick Smith:** You have sort of answered this question, but this one is to you, Professor Leyser, and to Sarah Munby. How has this Industrial Strategy Challenge Fund allowed you to do something that you couldn't do before—because there are other initiatives, such as the Future Fund, which have similar ambitions to boost R&D and to get people working together, haven't they? What is really special about this fund that will make the difference?

Professor Leyser: Who would you like to go first?

Nick Smith: Let's hear Sarah Munby, please.

Sarah Munby: This is a question that lets us talk about why this programme is genuinely exciting. Lots of the specific projects that sit under these challenges could be funded, of course, through other processes. Individual groups of universities coming together to do some particular piece of research absolutely could have applied under existing frameworks. What makes this programme different is the ability to marshal a whole set of programmes against a specific goal. Let me just do one minute and I will try not to go on too far, to bring that idea to life.

Let us talk about batteries. What are we doing in batteries? I think that is the single largest one of these challenges—the Faraday battery challenge—at £318 million. What this fund lets us do is a combination of, first, cutting-edge research programmes, where many universities are coming together; each individual project usually has five or six universities working together on something like the future of solid-state batteries, or how we really move forward with sodium ion instead of lithium ion. That is one piece.

Then, sitting next to that, you have major innovation partnerships—usually a combination of a university, a big prime and some smaller companies. It might be something like how you put batteries together physically into a pack to get them into a car, and you have Warwick University, Jaguar Land Rover and Delta Motorsport partnering. It is those sorts of things—practical, and turning that cutting-edge research into innovation.

Then we are going right through into supporting scale-up. One of the big challenges in batteries is that you can make it work in a lab, but you can't actually build it at scale. UKBIC is just outside Coventry. It is like a big factory, and you can go in and test out your ability to manufacture your new battery at scale.

All that adds up into something much greater than the sum of its parts, because it is about really putting the UK at the frontier of battery technology—right from cutting-edge research, through to innovation and scale-up. It is the package, going against a specific goal, that is really important for our net zero target. I think I am coming back to you next week to talk about that.

That is what is special. It is bringing a whole series of things together to deliver against a target that matters for the country, even if pieces could be done elsewhere. That is unique to this programme.

Q20 **Nick Smith:** Professor, do you want to add to that?

Professor Leyser: I very much agree with the way Sarah has framed it. It is absolutely about that synergy, which we haven't been so good at capturing in the UK in the past. The focus of a lot of the way we assess and monitor research has been more on individual companies and academics. Thinking about how we bring all that expertise to bear on key national challenges is exactly how we have to go and exactly the opportunity we now have with UKRI.

Q21 **Nick Smith:** Thank you both for that. It is great to see the emphasis on incubation, and industry and academia working together, and you are practically developing the innovation. But what will success look like for this fund in five years, so that you can say, "This was worth the £3 billion"?

Sarah Munby: Let me go first, and then Jo and Ottoline can come in. The Report talks quite a lot about the challenge of defining genuine fund-level objectives. It is quite hard, because the truth is that success for this fund can't be summed up in one number or even three numbers because it is about the success of the individual challenges. We could talk about what it would mean for our investment in batteries to be successful or what it would mean for our investment in transforming construction to be successful, but it is really difficult to say what it would mean for the whole thing to be successful as a whole.

Obviously, the slightly more input-related targets described in the document are right. Greater business-academic collaboration is important. Obviously, collaboration between small, medium and large businesses is important. But at the end of the day, those things are slightly second order to the question of whether we are really succeeding in delivering against the individual challenges. That question, depressing as this answer may feel, can only really be answered at a challenge level.

Our current evaluations, as described in the Report, are showing pretty green across the challenges. The answer is that if all the challenges, or a decent proportion of them, are delivering against their individual goals, that for me personally is how I will know this has been successful. I can't sum it up for you in one overall number, because it would have to capture such a broad range of critical, scientific and innovation breakthroughs.

Q22 **Nick Smith:** Professor Leyser, I wonder whether you can try to answer that question. I looked at the objectives, and three of them are what Sarah Munby has described as second-level objectives. Working together and co-ordination are important objectives, for sure, but I kept thinking, "I'm not sure when we will see something that amounts to more than a hill of beans." Give us something that is more tangible, please. I want you to—I really want you to.

Professor Leyser: Absolutely. I think what we are fundamentally talking about here is the difference between the contributions to particular challenges with individual parts of the portfolio: do we have fabulous new battery technology for electric vehicles, and so on and so forth? Those things are very tangible, very output, and very realisable, but at whole portfolio level, as I have described, we are fundamentally interested in effectively reconfiguring the system so that it works better together as a system, and we can then operate in this really high-connectivity environment, such that anything that we think the UK economy needs to do in the future can be driven quickly by co-ordinating new challenges around those activities.

I think we have seen really impressive examples of that through the covid crisis where, because all of these people are together, because they are now more used to working together, and because of that really crystal-clear national focus on what needs to be delivered, we can harness the power of all the expertise we have and drive it towards producing vaccines at scale, based on our fundamental research activity pulled right through to deliver against that challenge, or ventilators or whatever it is. I agree in many ways that that is a more difficult thing to measure: it is about capabilities and competencies in the system, and those are hard, but they are absolutely crucial. If one loses focus on those and gets instead focused entirely on the details of a specific challenge, then the overall goals of this scheme will be diluted. That would be a shame, because those multi-scale deliverables are really important: individual challenge level, but also whole systems level, in terms of capabilities and competence, adoption, diffusion and productivity. Those are absolutely key challenges for the nation.

Q23 **Nick Smith:** One final question from me, then. How confident are you that the fund can make a difference when the resources, this £3 billion—I used to think that £3 billion was a lot of money before covid—are actually spent across a very broad range of objectives: you know, 24 different challenges. You could argue, I am sure, that you could spend a very large chunk of this money on half a dozen of those objectives. It all feels very thinly spread to me, when you think of the range of objectives that you have.

Professor Leyser: That is a really important point: trying to balance focus and, therefore, ability to deliver on these key challenges with breadth against the very large number of things we could deliver on. This actually loops back a little bit to a point that Sarah was making earlier: a key goal for this fund is to deliver on ministerial priorities about where we think the UK should be focusing its industrial efforts, for example on the new and emerging opportunities in quantum in the life sciences, and of course on these key policy objectives, such as net zero. Those national priorities provide the focus that we need to target the challenges in the right areas, and achieving that balance between focus and covering the opportunities and the basis is a key element of why this integrated approach, which looks across all of the challenges together in a single board, is the most effective way to deliver.

Q24 **Nick Smith:** Ms Munby, are you spreading your bets too widely?

Sarah Munby: It is a balance, and I do not think there is one right answer. You could have a more focused approach; you could have a broader approach. They each have pros and cons. I do not think this is the wrong answer, but am I going to say we've got exactly the perfect balance? Of course not; there are pros and cons of both.

I would just make two minor points. One is that of course, it is not just public funding: the £3 billion of public funding is supported by a further £3 billion of private funding, and I still think we should think about £6 billion as a big number. The second thing is that these are in themes, so you sort of go up a level from the individual challenges to the grand challenges, and these are complementary. A good example of that would be—I realise you are going to think I am obsessed with cars—

Chair: You've been reading up for next week, Ms Munby.

Sarah Munby: Batteries are one of the challenges; electric vehicles are another challenge; and self-driving vehicles are another challenge. Those are all complementary to each other. You could say the same about some of the health-related challenges. The challenges aren't all independent of each other; they are driving bigger goals, and I think that helps with, although doesn't completely close off, your point about spread.

Nick Smith: Thank you for your answers.

Chair: We now have Mr Richard Holden back with us, so we are going to pick up on this very issue, actually, but also what the Budget means for some of these projects.

Q25 **Mr Holden:** Ms Munby, I am very happy that you are obsessed with cars; I say that as someone representing the north-east, where we have Nissan. This is great news for the supply chain in my constituency. But the key thing that the Chancellor raised in the Budget was that you have £3 billion going into R&D on this, plus the extra £3 billion from the private sector. The Chancellor has just announced a £25-billion tax cut essentially to drive the level after what you guys are talking about here today, so the jobs, essentially, from the innovation, and the productivity gains from that. Is that the right direction to be travelling in now? Is that enough money? Is it too much money? Is it well focused? Could you give us your take on that, Ms Munby?

Sarah Munby: Sorry, are you asking about the Budget overall, or the super-deduction for—

Mr Holden: The super-deduction specifically.

Sarah Munby: First of all, give me just one second on what we are hearing from stakeholders, and then I'll give you my view. What we are hearing from stakeholders is that, particularly in the context of the corporation tax move, the super-deduction is very helpful for business. It's very helpful, particularly, by the way, for manufacturing businesses, given the focus on plant and machinery. So, is it a good thing for converting some of the things we have been talking about into real, practical investments that will create jobs? Absolutely.

Q26 **Mr Holden:** Professor Leyser, you mentioned productivity earlier. All of what we are talking about today in this session is about the research behind that, which can help drive that. In terms of this money, is this the best way, as far as you can see, of focusing that drive towards actually turning what we have just been talking about, which is the ministerial priorities—my constituents' priorities are good, well paid jobs, and productivity growth is basically the only way you are going to deliver long-term wage growth. Is this a step in the right direction? Could you give us your views on the productivity side?

Professor Leyser: Yes, I think it is absolutely a step in the right direction. As I have tried to emphasise, for me the key is connecting things up together better, right through from the fundamental research base into adoption and diffusion across the private sector. And that is a multi-directional thing; it's not just that things go in one direction, from discovery into business. The discovery base needs to understand much better the business pull and how to feed into that.

We talk a lot in the UK about the so-called valley of death, where we have this very high-quality discovery base right across the public and private sectors but, somehow or other, we don't manage to translate that into high-value, high-productivity jobs in our economy. It's a question of really thinking about that whole gap between those two things and the multidimensional aspects to it. Yes, that's about investment, right across the TRL levels, as you have described, but it's also about people, ideas and networks and how they move across that gap. I think the Industrial Strategy Challenge Fund is a key element in delivering both those things—in de-risking early-year stages of that gap and bringing together all the different parties across that. In the context of investment in plant, for example, a lot of what has gone on in the fund is investment in those kinds of demonstrator activities that are so key in allowing businesses to take that first step into a new way of working, a new manufacturing approach.

An example would be the new glass-firing facility in Merseyside that is allowing the glass industry to innovate with alternative, greener ways of producing glass. That kind of demonstrator activity, where you can dip a toe in the water, is crucial, and, linked through to incentives to invest then in your own plant—I think it's that join-up that we really need to think about.

Q27 **Mr Holden:** We agree on the join-up, but Ms Munby, this scheme is only due to last for two years, from my understanding. I know Ms Blake and Sir Geoffrey Clifton-Brown will come in later on this point, but is that long enough to ensure that all the cash you are spending on research and investment, which takes a long time to go though, will enable the jobs and spin-offs of what you are helping to fund to actually come through? Or is it too a short a window to deliver the long-term productivity goals we are after?

Sarah Munby: It's a trade-off, isn't it? Longer has benefits; shorter also has two benefits. One is that this is very expensive, so every year you do it costs more money and that has to be raised somewhere. The other is that—

Q28 **Mr Holden:** It is a trade-off, Ms Munby. In your view, is it the right trade-off that we are striking?

Sarah Munby: Let me say what the other factor is, because it is important. The other factor is that this is about trying to get investment to happen now. The longer you extend it, the less you drive that incentive for people to bring forward investment and act now, which is when we need change. For that reason—net-net—it is a reasonable judgment that this is the right timing.

Mr Holden: Chair, that's it from me.

Q29 **Chair:** That issue about the alignment of all these things is really important. I wanted to ask about alignment with other Departments that will be working on some of these areas of challenge. How are you ensuring that the work that you are doing, Professor Leyser, is linking up with other bits of Whitehall that might also be investing in some of these sectors, separately from the challenge fund?

Professor Leyser: This is something I am really keen to do. Again, for me, a huge advantage of UKRI, as a single umbrella organisation that spans the system, is that we can provide that single point of contact for other Government Departments that are interested in accessing the expertise of the research posts that we have.

We have worked very successfully and closely with Government Departments across Whitehall to engage in the research priorities that those Departments have. In the life sciences we work closely with the Department of Health and Social Care and NIHR, but we also have high-quality interactions with the Department for Transport, with DCMS and, increasingly, with DEFRA.

One positive thing about the outcome of the spending review was the ambition to increase dedicated R&D budgets for Government Departments across the system, so that all of them can consider and drive forward their R&D priorities in an appropriately collaborative way, ensuring much better cross-Government understanding where key cross-Government objectives, such as net zero, can be co-ordinated and delivered in a more collaborative way.

Q30 **Chair:** This Committee is looking at the net zero agenda a lot, which brings me to you Ms Munby, on how this is structurally done. R&D has gone to Departments to deliver on objectives, which are sometimes match or challenge funds, but is that ring-fenced and guaranteed? When budget cuts happen, which I can't believe won't happen because of where we are with covid, Departments often have the tendency to cut their research budgets, because they don't deliver something immediate that is going to be noticed. Is there a risk that some of the funds that Professor Leyser has just talked about won't be there in the future?

Sarah Munby: Clearly that could happen, but I don't think that currently the incentives work that way. R&D is one of the areas of Government spend that, from a technical point of view, we would describe as a different colour of money. You can't cut your R&D and use that to fund your people. We are not allowed to do that.

Because we are trying to meet the targets that Jo was talking about earlier, about getting up our aggregate R&D spend, we don't think that there is a departmental incentive, typically, to cut R&D. Of course, they could move R&D from net zero to something else. That is why we have got a great deal of investment made specifically in ring-fenced net zero R&D, much of which is run out of our Department.

Q31 **Chair:** Is it only net zero R&D that is ring-fenced?

Jo Shanmugalingam: Shall I come in? The other two main R&D investing Departments are the Ministry of Defence and the Department of Health and Social Care, as Ottoline said earlier. The Treasury allocates, as Sarah says, specific R&D for each Department. DEFRA and DFT got very significant funding in the last year for their contribution to net zero.

On net zero, specifically, we have a net zero innovation board, chaired by Sir Patrick Vallance, on which some of the executive chairs from UKRI sit, to make sure that all the investments across Government are co-ordinated with the work of UKRI.

The other relevant thing here is the work that Patrick Vallance is doing on science capability within Government, and making sure that we, as customers of research in each Government Department, are really clear about our needs and about how the work that we do in each Department contributes to our overall R&D objectives. That is a programme of reform that he is taking through Government at the moment.

Q32 **Chair:** Okay, I will come back to that in a minute. I want to go back to some points that you made, Ms Munby, when I was talking to you about

ARIA and you talked about the very high risk there. I will start with Professor Leyser. This is taxpayers' money—£3 billion, of which you have spent £1.2 billion or thereabouts—that you are investing in cutting-edge technologies. They are not as risky as ARIA, as we heard earlier, so what is the tolerance of risk, how are you managing that, and how, in governance, do you ensure that you are assessing where you are spreading the risk in those various different strands of work?

Professor Leyser: This goes back a little to the multi-layer structure that the projects have. If you think of it at challenge level, the challenge director will be looking across their portfolio of projects and balancing the risk level across that portfolio. One can think about this similarly to an investment portfolio. If you are a portfolio manager trying to maximise return on your investments, you want to develop a portfolio of activity that has those quite safe, important investments that will chug along nicely earning you lots more returns, but also some high-risk, potentially high-return investments. It is that portfolio that gives you the reassurance that, overall, the work will perform well. That is the benefit of bringing together these multiple projects under one challenge, all focused on ultimately delivering one goal—a very clear target—which also allows one to balance risk across the portfolio. It is important to think about it like that.

Q33 **Chair:** So it is like a pension-fund investment portfolio or something like that—

Professor Leyser: Exactly.

Q34 **Chair:** Then, as a board, how do you assess those higher-risk projects? Even with an appropriate appetite for risk, it is a risk with taxpayers' money, so it is not your money you are spending. With a project that sounds very exciting, when you have scientists coming in telling you the fantastic work that they are doing, and it is all very breathlessly interesting but there is a risk involved, can you talk us through what due diligence you would take to assess whether it is worth backing?

Professor Leyser: For an individual project, we would ask for a detailed proposal about what exactly was planned, and we would have that peer-reviewed—assessed by experts across the field. We would then assemble a panel with relevant expertise to tension the alternative bids into the fund against each other, and pick that balanced risk portfolio. We have a lot of input from experts across the system to weigh the risks and benefits.

There is always a danger in a system that involves the opinions of lots of people. If you are not careful, you actually wind up reducing your risk appetite so that it is too low because, collectively, there is always going to be someone who is anxious about something. Ensuring that your portfolio remains broad and really is willing to take those high-risk bets is crucial. Again, that is easier to do if you are looking across a portfolio, and the Industrial Strategy Challenge Fund has managed to balance that quite well to ensure that we are making progress towards those clear goals for individual challenges, using that portfolio approach.

I would also like to mention that our risk appetite is appropriately high for the technologies and the approaches that we are using to address the challenges. Obviously, in terms of managing public money, we are really careful about the due diligence and the way that the money flows into the system, ensuring that the companies we are investing in are going concerns, and so on and so forth. In that element we need to have a very low-risk appetite. We are not interested in funding in unstable ways and we are obviously very careful about fraud and so on and so forth, but in the projects, we have to have that high-risk appetite to ensure we create the appropriate balanced portfolio.

Q35 **Chair:** We have talked a bit before about some of the ways you measure success, and Mr Smith was asking and pushing a bit on that. One of the challenges is that some of the information data you inherited wasn't in a good place. How is that improving, and will that mean that we can actually see, across the portfolio, a better way of you flagging what you think success would look like, and being able to measure that better at board level? Professor Leyser, I will start with you.

Professor Leyser: There are two elements to this. UKRI is still a relatively young organisation, created by bringing together nine existing organisations with nine different information systems and nine different ways of recording things. We are on a journey to try to capture the benefits of that diversity in a way that we really can pull through into thinking about the system in the more integrated way that I have been emphasising. We have made significant progress with that, but there is still a way to go in modernising and updating our DDaT system so that the information really flows easily through the organisation. Again, ISCF has been a really useful pioneer for us in doing that, and we now have a very high-quality data management system that is allowing us to capture that input data right across the organisation much more effectively. I actually think that is independent of the bigger question you asked about how you really understand whether your systems are working, or what your monitoring and evaluation criteria are in terms of outputs, because, as is really well highlighted in the NAO Report, that is a notoriously difficult thing to do for research and innovation, where we will not see a lot of those outputs for quite some time down the road—

Q36 **Chair:** Which is an absolutely fair point. I think what was concerning me about your responses to Mr Smith is that both you and the permanent secretary were saying how difficult it is to measure success, but we are looking at long-term success here. If you take the equivalent of financial fund management, you don't look at it in the short term—it is not about whether a fund performs well in year 1, 2 or even 3; pension funds work over a long period of time. From what you say, you are looking over that long period, so over that long period of performance, what does success look like? Afterward, I am going to ask Ms Blake to come in on some more detailed points.

Professor Leyser: In all our challenges, and in fact all our work right across UKRI, we commission downstream—after things have finished—a detailed external evaluation, which includes quantitative but also a lot of qualitative measures. That is extremely important to us. In a lot of our reporting systems—for example, the research councils capture outputs associated with funding through a system called Researchfish—we ask for annual returns from the people we have funded over a very long period of time, so they are able to update and provide outputs that they associate with those investments over many, many years. Through that kind of approach, we can build up a very rich understanding of the long-term impacts of our investment. Thinking about how we do that much more broadly and systematically into the business system is a current priority for us.

Chair: That is interesting. We did our work on the vaccines programme a few weeks ago, so it is interesting to hear how you are making those judgments and measuring success. No doubt we will be focusing on that in our report. I will turn now to Olivia Blake MP.

Q37 **Olivia Blake:** Thank you, Chair. Professor Leyser and Ms Munby, why did it take 72 weeks—over a year—to select and approve the challenges?

Sarah Munby: I'll go first on that one. The short answer is because it was hard. I will set out some reasons why it was hard, but before I go into that, it is important to say that we think it was too long, and we definitely think it will be a lot faster next time. I am not saying that it was the right length of time. We think it should have been considerably faster, and next time it will be.

Why did it take a long time? As you will see in the Report, it is broken down into two phases. The first one is about selecting the right challenges. The change we made in wave 3 was to be much more open in receiving ideas for challenges, and that takes time. Simply the process of gathering the ideas takes time, and then working through the over 250 challenge proposals that came in took time. That was the big driver of the first batch.

The second set of weeks shown in the Report was about signing off the business cases. It is worth saying that, at the time, we were working on 11 business cases—the business case for the wave overall, and then the business cases for the individual challenges that sit under that. Each of those business cases was being asked to deliver not the same co-investment level that we had in waves 1 and 2, but a much higher co-investment level. Actually getting a business case that works with that level of co-investment is challenging, particularly because we were rightly under a great deal of scrutiny to demonstrate that we were funding research that would be genuinely incremental. By the time you have a lot of co-investment coming in, the questions about whether this would have been done anyway and whether these companies would have funded this themselves become tougher, so balancing those things took time.

The other thing is that, throughout that process, we were really working in wave 3 to make all this add up to something that was more closely tied into the industrial strategy and the grand challenges. Balancing those considerations with Ministers, with the financial control within the

Department and the Treasury, took time because it wasn't easy and we wanted to put the money into the right places. The NAO acknowledges in the Report that, in terms of control of public money, we did pretty well. In terms of timing, we didn't do so well. There was a bit of a trade-off between those two things. That is why it took a long time.

At the same time, I think we would all say that it needs to be a lot faster. The fact that we have built our muscle is what will make it faster next time. It isn't so much about saying, "There are these two exact changes to the process," although we can talk about a couple of things that we would change. It is about the fact that we have a very speedily maturing UKRI. We have much better capabilities now for doing that work with those high co-investment levels. We see the businesses cases improving with each wave.

Olivia Blake: Professor Leyser, do you want to come in on that?

Professor Leyser: What we are seeing is a new organisation working in new ways to do new things. Something that is really positive it the NAO Report is the characterisation of UKRI as a learning organisation, which is something that I am quite determined that we will stick to in continuously improving the ways that we work right across the system.

I echo Sarah's point that what we always seek to do is balance some of the things that we have talked about already—assurance mechanisms, quality and co-investment, reaching out into the system as deeply and as far as we can to support EDI and those kinds of things. It is about speed of movement in a rapidly changing technology landscape. Balancing those things is quite tricky, and we have been learning as we go through where the right balance lies. We are building the capability—the muscle, as Sarah says—to do this really well and effectively in the future.

Q38 **Olivia Blake:** Do you both feel—the Report hints at this—that the two-year wait might have been a considerable deterrent for certain bidders? Why were the decision processes done sequentially, rather than in a more joined-up and quicker process?

Sarah Munby: Let me come in on the sequential point, and then I will ask Ottoline to comment on whether she thinks applicants went away or were deterred.

It is easy to say that of course we should do all the business case approvals sequentially between, for example, HMT and BEIS. In reality, the process feels much more like an iterative one. The point is that the business case has to be good enough to get through the HMT process, and it should be, right? We all want it to have smart objectives, to really demonstrate that it is incremental. It is the time to get that right that runs the clock; it's not the sort of process point of getting the meeting in the diary.

Yes, you might get a bit of benefit from doing things in parallel, but it doesn't fundamentally speed up the process of iterating a business case that is challenging, to get to the point where you are really confident that you are spending public money well. Ottoline, why don't you come in on the question of how much this put people off?

Professor Leyser: It is clearly very frustrating to businesses wanting to get going on projects if it takes a really long time. One has to balance that, as I say, against the fact that a big chunk of the time, as Sarah described, was in early engagement as widely and as broadly as we could across the system nationally, to ensure that we were reaching all the businesses that would want to and be able to contribute. However, I think one would have equally frustrated businesses if they felt things had been rushed through and they had not had the opportunity to bid into the system. For example, 73% of the businesses that participated in the funds had never had an interaction with UKRI before. Our ability to reach parts of the system that we weren't reaching previously has to be tensioned against the speed at which we operate through that process.

Another thing that I hope has emerged from this is higher quality business case production within UKRI. We now have a hub that works exclusively on producing these cases, to help speed them through the system and ensure that they have all the information up front, and trust across the system between the various actors, so that we are more confident that we can work through together to ensure that the outcomes are high-quality and good value-for-money smart objectives.

Q39 **Olivia Blake:** Ms Munby, you said that you were quite confident that the next round of funding would be faster and, Professor Leyser, you have just outlined some of the reasons why you believe that. Do you feel that those things are concrete enough to produce that change, or do you think that more work needs to be done in the planning phase for the next round of funding to reduce time?

Sarah Munby: Of course, to make concrete the new way of working that the muscle we are building enables, we need to lay that out, describe it and work it through. I did not mean to suggest that there is not some codification that probably needs to happen. However, it is important to say that the big driver of why things will be faster is that we will have got a lot better at it. The trade-off between quality and speed, which I think felt really quite sharp and difficult first time round, does not go away; it is just that it softens, so I hope that next time we can be equally high quality and a lot faster at the same time.

Olivia Blake: Would you like to add anything to that, Professor Leyser?

Professor Leyser: I absolutely agree that, as I have stressed, this has been a massive and very exciting learning process for us. I think we now in a position to understand the best way to do this kind of work, and we are really interested in building that capability—that muscle of challenge-led funding within UKRI—into a much more flexible approach that we can deploy right across our activity, as and when that seems like the most effective and appropriate way to do it, much more quickly than we were able to do when we were learning how to do it.

Q40 **Olivia Blake:** I guess time will tell on that. We have mentioned co-investment. Do you think that with the increase in co-investment there has been an impact on the type of applicant that has come forward? Ms Munby?

Sarah Munby: Yes. I will answer that question, but could I just present a tiny piece of evidence? You said time will tell. I would point to the speed with which we have acted during covid, as just—

Olivia Blake: I will come to that later, as well.

Sarah Munby: On co-investment, I don't think we can absolutely prove that the reason that we saw about a 10 percentage point drop in the proportion of the applicants who were small businesses between waves 2 and 3 was solely and entirely due to the increase in co-investment, but it seems reasonable to believe that that was a really big factor. It makes sense, right? It is harder for small businesses to meet these co-investment targets. It is also true that the co-investment targets are really important for what we were talking about earlier—generating the private investment that is going to push up our overall R&D figures. I don't think there is a sort of magic wand you can wave to make that trade-off go away. To some extent that trade-off probably exists. Working really hard on engaging with small businesses in the way that Dame Ottoline has described is the right way to soften that challenge.

Q41 **Olivia Blake:** I will come back to SMEs in a second, but I just want to draw on some of the evidence we had about the bid process. We had some evidence that suggested that the lead-in time for institutions to bid didn't seem sufficient. I was just wondering if you think that that could have been a disadvantage for certain regions. What did you do to make sure that it was clear who could bid, and when? Do you agree with that evidence that we had that perhaps there wasn't sufficient lead-in time for some institutions?

Chair: It was Universities Scotland, if you look at the evidence.

Professor Leyser: I think we worked very hard—it is one of the reasons it took such a long time for the challenges to be agreed—to engage very broadly, bring in as many people as possible, use the knowledge transfer network to hold national workshops right across the country, to engage and ensure that everybody knew where we were going, what was happening, and so that when we got to the point when we really were bidding for input, everybody was teed up and ready to go.

One can always look more carefully and specifically. One of the issues here is that we have been tending to work in fairly generic ways—for example, in the context of co-investment, but also these kinds of things, where we have particular time targets that we apply across the whole fund, where actually I suspect we need more specific consideration for each challenge, where the communities we are engaging with are different, where the mix of big and small players is different, so we need more flexibility within the system to target the timings and so on according to the particular challenge, particular task, particular community that we want to engage.

That flexibility, I think, would be particularly valuable in improving across the piece the quality of what we are doing.

Q42 **Olivia Blake:** That is very helpful, because there seems to be a bit of disconnect, but that explains why that might be. Another piece of evidence that we had was about what happened once bids had been approved. Tees Valley local authority says the bids commenced in early 2018 but meaningful work was yet to commence because of the ongoing process associated with managing the funds. That is what the evidence says. Could you explain why it is taking such a long time to get these projects off the ground once the bid has been enabled?

Professor Leyser: We have a series of due diligence checks that we do once we have agreed to fund a project. That is a series of iterations between UKRI and the businesses and so on who are receiving grants. I absolutely agree that that is taking too long, and some of that we can speed up within UKRI. Some of that requires that the companies are responding promptly to our checks that we need to make into companies. It is one of those things where there are a large number of particular things that need checking, to ensure all of those things that we talked about earlier: that we are putting public money into a place where it will be spent well on the things that it was intended to be spent on, that the delivery plans are high quality, and so on. That is an iterative process and it can drag on for far too long.

That is an iterative process and it can drag on for far too long. We need to find effective ways to catalyse that, but I do not want to compromise on the quality of that process, because it is really key for delivering value for taxpayers' money.

Q43 **Olivia Blake:** I want to pick up on the approval process again—sorry to jump back. It would be really good for us to hear what the three Departments will do differently, in more specific terms, to make the process better. I am sorry that I keep going back to this but, given that the Report was quite supportive, this was the key area that really stood out to me, so if you would each in turn like to come in, that would be great.

Jo Shanmugalingam: As Sarah said before, a lot of this is about every element of the system working better—the machine being better oiled. It is really striking that UKRI was created on 1 April 2018, just as we were launching wave 2, and was only a year old or less than a year old as we were in the guts of identifying the challenges for wave 3 and then developing those as business cases. UKRI has come an enormous way over that time. The Report comments on some of the staffing challenges early on. Now, with its data much better and clear plans for improving in the future, that will really help UKRI. As Sarah says, within Government we now have a better understanding of some of the trade-offs, how you really identify the sweet spot between research that would have happened anyway and research that is so far back in the system that it is not going to attract the co-investment yet, and how we work with UKRI to identify the objectives to do it.

I think the other thing—it goes to your question about how we bring in the most diverse set of partners—is that this was obviously a programme without a brand when it started. No one had heard of the ISCF, whereas if you look at the States, DARPA is a really well-known institution, with well-known programmes. If somebody tweeted about a DARPA programme or call, everyone would understand and share, etc. I think that, in lots of ways, from the appointment of challenge directors to getting and attracting the broadest range of partners to work with, the fact that the ISCF has been established now as this successful programme will help oil all the wheels of how we work together for the next phase.

Q44 **Olivia Blake:** Thank you—that gives a little bit of clarity. Can I move on to regionalities? Obviously, as a Yorkshire MP, this is of great interest to me, having seen the maps in the Report. Can I ask why almost two thirds of the funding has gone to three areas in the country?

Jo Shanmugalingam: Shall I take that question, Sarah? First, there are a couple of things on the data, which the NAO helpfully set out; there are a couple of caveats on the data. The first is that they recognise the data is to do with the headquarters of commercial partners and not necessarily where the R&D activity takes place, because that is not how the data is provided. You can take Rolls-Royce as a good example. They are headquartered in London. You will probably know their nuclear advanced manufacturing research centre in Sheffield—

Olivia Blake: Yes.

Jo Shanmugalingam: —where lots of their R&D activity takes place, so there is some balance on the data itself. When you dig into it, if you compare the spread of the ISCF funding with normal or average R&D expenditure from business and from the public sector, what you see is that in London it is very comparable—the investment through the ISCF and the investment that happens anyway across the economy. In the south-east, it is about one third up for the ISCF. The difference is really in the west midlands, where it was over twice the level of investment with the ISCF as you see normally, by the nature of some of the challenges that we chose, looking particularly at mobility and thinking about the advanced manufacturing base in the west midlands.

We published an R&D road map last summer, and that really set out how we are now thinking about levelling up for R&D. R&D has a really important place in that, and there are three core elements, which we will be taking forward both with challenge funding and more generally. The first is place-focused funding. As well as the ISCF, we set up the Strength in Places fund with UKRI, at the same time as the National Productivity Investment Fund, which is specifically designed to support and enhance excellence right across the UK. Ottoline might be able to talk about that a bit more.

Then, with programmes like the ISCF, there is how you think about place—it is the same for all our programmes—while, as the Report recognises, making sure that you do not obscure what you are trying to do with so many objectives that you do not achieve your primary goal.

The third element, which I feel hopeful Members will welcome, is the importance of engaging with local leaders—political, academic and business leaders—about the right R&D investments and the right opportunities in those local areas. Those are not something that we can see and dictate at a national level. To be successful, there has to be an important dialogue with local leaders.

Q45 **Olivia Blake:** That is interesting about the headquarters, but given that this is also trying to attract SMEs, which usually have a regional base, it would be interesting to look at that further. I was interested in what you were saying about place. Have you looked at other countries with lower regional inequalities, such as Germany, to see how their research funding looks at place, as well as excellence? What lessons are there to learn internationally about looking at place?

Jo Shanmugalingam: Every country has quite specific research structures. One hallmark of the UK is on the academic side; I am usually focused on universities as the engine of our research. Germany has quite a different model, but we look at that. The Chancellor announced yesterday, in the Build Back Better plan for growth, that we will be setting out an R&D places strategy later in the year. Absolutely, we are looking to learn all the lessons that we can internationally about how we can increase the benefit of R&D right across the UK, to see what an important economic driver it can be, and it needs to be in the future.

Q46 **Olivia Blake:** Do you view the programme as a contributor to the Government's levelling-up agenda or do you think it is separate because of the multiple objectives?

Jo Shanmugalingam: Ottoline will want to talk about UKRI overall, but all R&D funding can play a part. As I said, we can think about place in everything we do, but we need to have specific interventions that support the develop of R&D in those areas of the country where there is less intensive R&D today, and make sure we do not confuse the two. Place should be a factor we think about in everything we do; it really should. Ottoline might be able to talk more about UKRI is thinking about this overall.

Professor Leyser: This is a really important agenda. I have set as the mission for UKRI to build a research and innovation system in the UK, to which everyone has the opportunity to contribute and from which everyone can benefit. That is crucial to bring far more people into the system and to embed the system as the core of our society and our economy. That is something that the UK is really good at and we should all feel part of that. That is key; that is the big, overarching thing.

From the point of view of policy in R&D, this is quite a pivot. Explicitly, the system has been about concentration for quite a long time. I think that relates partly to the fact that we invest only 1.7% of GDP and the idea has been focusing on a small number of places. With the ambition to drive rapidly up to 2.4% and beyond, and to address the equalities that there are across the country—all kinds of inequalities, including in productivity, as we have talked about—we now need to pivot policy to think much more carefully about that place part of the agenda.

Here is a particularly important moment to focus not on inputs but on outputs. There is lot of analysis that is very input focused. You see lots of money going into place X and you think, "Oh, that's not good." We need to distribute the money more evenly, but there is good evidence that thinking about it in terms of inputs results all too easily in ineffective, poor value-for-money investments. One of the really fantastic things about the Strength in Places fund, which Jo mentioned, is that it starts in places and it asks communities and all the relevant stakeholders to come up with a really high-quality, specific scheme for how our R&D investment can best be leveraged in those places. I am very keen to think about specific, targeted investment that delivers locally in a way that is very place-specific, rather than focusing too much on maps that make one anxious about input inequalities, because it is those output inequalities that we really—*[Inaudible.]*

Q47 **Olivia Blake:** I do not necessarily disagree. However, there is also the added issue of mobility of researchers and the brain drain effect that we have seen in a lot of northern institutions. What can we do to make sure that this fund is not taking talent away from those areas that have not been as successful?

Professor Leyser: It is absolutely crucial that we have these two things going on at the same time: more money coming into the system, which is terrific—additional money is key—and a really strong national focus on levelling up and bringing those places up to the position where the highest-performing, high-productivity and high-quality job places are. Those two things together really give us the opportunity to deliver exactly in the way that you say—to create in an integrated way. It is not just the R&D input; it is infrastructure and creating cities that people want to live in all over the country—really attractive places for people to build their lives. It is not just the R&D investment, but co-ordinated in the way described in the plan for growth. It is a very exciting opportunity, and I really hope that UKRI will have the opportunity to play our part in delivering that and thinking about that agenda right across everything that we do.

Q48 **Olivia Blake:** Finally, going back to SMEs, clearly they have been affected in the third wave of the funding. What action are you taking to attract the smallest organisations to the fund in future rounds, and what assessment have you done of SMEs' capacity to horizon-scan? Could the fund be used in more innovative ways to allow HE to be supportive of SMEs locally, or do you not see that as an issue?

Professor Leyser: As we discussed, probably the strongest hypothesis for the reduction in small and micro-companies participating in wave 3 is the co-investment requirement. As I said, being more flexible on creating more specific goals or requirements for specific challenges or specific types of organisations will really encourage the consortia that we are interested in. That will be the lesson from that going forward.

Building those local clusters of SMEs around universities is a really exciting way to go. If we are to get to the 2.4%, we need to think not only about the really well-established industries with high R&D investment, but about those nascent companies and activities—digital, quantum and particularly the creative industries, which are much more driven by a network of small companies working together and are much less dominated by a small number of large players. Creating policies, networks and infrastructures that support the diversity of activity across the economy is really important. I absolutely agree with you that universities, as agglomeration centres, are really key to that. There are some really good examples of that around Dundee and the creative industry clusters around Glasgow in quantum, where that network of small companies is really supported through HE engagement, but more broadly.

Olivia Blake: Thank you.

Chair: Thank you very much, Ms Blake. Now we go to Sir Geoffrey Clifton-Brown MP.

Q49 **Sir Geoffrey Clifton-Brown:** Perhaps I could start with you, Ms Shanmugalingam. You said just now that you thought that the increase in co-investment was a disadvantage for small companies. The Chancellor yesterday announced different rates of corporation tax for small and large companies. Could you not have different rates of co-investment for small and larger companies to encourage greater take-up by SMEs and micro-businesses?

Jo Shanmugalingam: I will pass to Ottoline in a minute, who will be able to talk about how the co-investment works at a challenge level, so that the challenge directors can look at how to make sure you have a range of businesses involved. As Sarah was saying before, and as the NAO Report sets out, we cannot say that there is a causal link today between the increase in co-investment and what we see in SMEs. As the Report sets out, the data on wave 3 is still quite early and it is a smaller sample size, so we may see that changing over time. Ottoline might be able to set out how it operates at a challenge level to adapt to the needs of different partners.

Professor Leyser: Absolutely. Those co-investment targets are at challenge level, but none the less when they were significantly increased for wave 3 at challenge level, it naturally shifted the focus of challenge directors towards companies that are able to leverage that kind of higher investment. I completely agree with you; I am much more interested in a more "horses for courses" approach, where the goals of bringing more companies into an ecosystem that is really driving up these innovative adoption-diffusion networks is exactly where we need to go. We need to make sure the incentives to do that are right and appropriate for the companies with which we are trying to engage. That is crucial, so I would be very interested in exploring the kind of model that you have described.

Q50 **Sir Geoffrey Clifton-Brown:** I want to go back to the line of questioning that Ms Blake put to you, in terms of timetables and how long it takes you to evaluate the various bits. You have had significant vacancies in staff. They have gone up from 40% to 60% within waves 2 and 3, and it has taken you 37 weeks to recruit staff. Surely if you had a full complement of staff, you would be able to evaluate these projects much quicker.

Professor Leyser: From a staff point of view, there are two different layers to it. There are the core staff in the team—the NAO Report represents a snapshot that was unfortunately not a good time for us in terms of appointments. We have now improved that appointments process, and we are not looking at those big capability holes any more; the team is reasonably well staffed. The other really relevant recruitment issue is around the challenge directors themselves who, as we have heard, are absolutely core in pulling together these programmes and in driving and steering things through in the effective ways that we have discussed right across this hearing. There, what I would ideally like to be able to do is to appoint the permanent challenge director much earlier in the process.

Q51 **Sir Geoffrey Clifton-Brown:** Will you be making that change?

Professor Leyser: I would like to be able to do that. It depends on our delegations from BEIS.

Q52 **Sir Geoffrey Clifton-Brown:** This is really interesting; I want to come on to the delegations from BEIS in a second. Are you looking carefully at your evaluation methods to see how you can shorten the time it takes to evaluate a project? There are various phases in it. You have got to peer review it, check the finances and so on. Are you looking to have a standard evaluation process so that you can cut the time that the whole process takes?

Professor Leyser: Absolutely. We have a number of programmes ongoing that are completely focused on minimising what we would call unnecessary bureaucracy. For example, we are making sure we ask for information only at the moment we need it. Rather than asking for all the details up front for a project, we would ask for a lot of those financial and due diligence details only after we have decided that the project as a whole is worth investing in. There are key elements in the current system that we absolutely can streamline.

Q53 **Sir Geoffrey Clifton-Brown:** What do you think should be the target time that it takes from receiving a project to your organisation approving it?

Professor Leyser: Here again we are talking about trade-offs. An absolutely critical element that we cannot miss is really high-quality evaluation of the project through expert input. And if you are asking experts to give you their high-quality opinion about a project, that will take time. During the pandemic, when we were—

Q54 **Sir Geoffrey Clifton-Brown:** No, no, I’m not talking about the pandemic; I’m talking about normal times. If you do not give your organisation and your staff a clear indication of the timetable whereby you expect to evaluate a project, you cannot be surprised when the whole thing drifts. So I ask the question again: what should be the ideal time that it takes from receiving a project to approving it?

Professor Leyser: Those timetables are set out for each call. There is a call deadline, which we have heard about and which sometimes people would like to be longer—the time between announcing the call, and the deadline. Then, because most of these things are driven by a peer review expert panel, we arrange the meetings of those panels ahead of time. There isn't a drift in that sense; there is a timetable, and that timetable depends a bit on the project. Are you talking about some huge, consortial project, in which case it is going to take you longer, or are you talking about a small number of very specific single-investigator projects? In the typical response mode rounds that we operate through research councils, it is typically in the order of six months at the moment. One's ability to reduce that depends on those quality balances and—

Q55 **Sir Geoffrey Clifton-Brown:** Okay. The proof of the pudding is in the eating. Irrespective of the time it takes, what percentage of the projects that you put forward to BEIS and the Treasury are eventually approved?

Professor Leyser: I don't know. I can get you some—

Sir Geoffrey Clifton-Brown: Ms Munby or Ms Shanmugalingam, can you shed any light on that?

Jo Shanmugalingam: There are different layers. The ISCF team made sure that bids were qualifying, as it were—they met the core terms of the particular challenge and competition. As I recall, then—I think—a quarter of bids were successful, but if that is not right, we will clarify it to the Committee.

Q56 **Sir Geoffrey Clifton-Brown:** That wasn't the question that I asked. The ISCF having done their evaluation and put projects forward to your Department and to the Treasury, what percentage are eventually approved?

Jo Shanmugalingam: If I may start, our role is improving the challenges.

Sir Geoffrey Clifton-Brown: Right.

Jo Shanmugalingam: We agreed and went through, as we have discussed and Sarah mentioned before, quite an iterative process with wave 3, asking people for their thoughts on the challenges, shortlisting them with—through—UKRI, with expert advisers, and establishing whether we could get more value for the public expenditure by increasing the co-investment. And then, once those challenges are approved, it is for UKRI, through the ISCF steering board, to identify the projects that are supported for each of those challenges.

Q57 **Sir Geoffrey Clifton-Brown:** Yes, but that's what I'm asking. Once the ISCF have received projects and done all their evaluation, their due diligence and everything else, they put them back to you for approval and back to the Treasury for approval. All right, how does the process work then?

Professor Leyser: Once the overall challenge is approved through all those processes and the challenge director is then running individual project calls, those are all within our delegation limits to approve ourselves, so we do that. Across the whole ISCF, the proportion of bids that come in to us that are then approved is about 25%, because it's very competitive—we get far more bids in than we have the funds to support. But that's not quite the question that you are asking. The ones that we decide to support, we have decided to support, and they go forward in the way that we have previously discussed.

Q58 **Sir Geoffrey Clifton-Brown:** Again, I'm a little bit puzzled, Ms Munby and Ms Shanmugalingam. If the ISCF are doing all the evaluation work and they're delegated to approve, or not, these projects, why is it taking BEIS and the Treasury 74 weeks to go through all this process?

Sarah Munby: That is the process to sign off the challenge-level business case. That is separate and happens prior to the UKRI process, which is about signing off the individual calls and projects within a challenge. We need to decide, for example, how much money we are putting into accelerating the detection of disease, why, what kind of projects are supposed to be inside that programme, and whether we are confident that there will be the right level of co-investment inside the programme. That is the process that we were describing earlier—the selection and sign-off of the challenges, and hence the overall wave business case, which is separate from the delegated process that goes on in UKRI about signing off projects. Of course, one of the reasons that we have to sign off very clear business cases with a clear understanding of the benefit that we are getting is that, after that point, it is for UKRI to take the decisions about which individual projects to fund. That is our moment, if you see what I mean.

Q59 **Sir Geoffrey Clifton-Brown:** Can I just say that I think two years to complete that process between your various organisations, plus the co-funding increase, must be a huge deterrent for small and micro-businesses? After all, they have had to put the work in and make the investment, and they aren't getting any sort of help from Government if they are successful for two years. That must be a huge deterrent.

Jo Shanmugalingam: Ottoline, maybe you could explain at what point the calls go out to businesses, and therefore they start getting invested in the progress. Obviously, it is the very start of the process that you are describing. As Sarah said, we absolutely accept that it needs to be faster in the future, as we learn. The start is us identifying challenges, rather than saying to businesses, "This is a particular area. Would you like to come and form a consortium and bid for it?" The businesses and research partners come in later, but Ottoline might be able to describe that further.

Q60 **Sir Geoffrey Clifton-Brown:** Time is moving on, and I have two fundamental questions. First, Ms Shanmugalingam, you said something very interesting in one of your answers, and it is this. How do you set the

ISCF parameter? Basic research and commercial development will happen anyway in this country, but this country is very bad at the gap between the basic research—coming up with an invention or idea—and it actually going into commercial production. How does ISCF fulfil that role?

Jo Shanmugalingam: You are absolutely right. When Theresa May launched the ISCF in 2016, that is exactly what she described. It is about helping to address our historic weakness and commercialising the excellence of our research base. That therefore goes to the process of identifying challenges where we see great economic opportunity for the UK. They are addressing global issues where we have particular comparative advantage because of, say, our life sciences base, our expertise in AI or our great manufacturing and automotive base. We are identifying where there is opportunity for us to bring together research and our industrial and tech base. The mechanism of the ISCF, as Ottoline has described, is that you are asking groups to come together to address these challenges, and you are committing public funding alongside that private funding. It is the model that helps to bridge that gap. We think that the early signs, as set out in the Report, are that it is proving a successful model and a new part of our suite of R&D investments.

Q61 **Sir Geoffrey Clifton-Brown:** You describe what I was about to ask about in the next question—the bridge. I like the expression "bridge". You are bridging from the pure research to the commercial development. As it is public funds that are going into forming that bridge, is it not reasonable, if it is a highly successful commercial development, that public funds should benefit from that? Is it not reasonable, therefore, that your Department in some way should have an intellectual property right on some of those ideas? If so, what are you doing about that?

Jo Shanmugalingam: The design of this programme is about how we can bring forward other investment by providing some cornerstone public funding and, as I said, by bringing together the different research partners for the overall economic benefit to the UK of supporting that research and therefore the development of those products and services, which UK businesses and citizens will benefit from. There are obviously other things that we do. The Chancellor announced yesterday the new future fund breakthrough scheme, which is about—

Q62 **Sir Geoffrey Clifton-Brown:** With respect, Ms Shanmugalingam, that is a very interesting answer, answering a lot of different questions, but I asked you a very precise question: why is your Department not taking intellectual property rights in this process?

Jo Shanmugalingam: That was not the purpose of this scheme. The purpose of this scheme has been to accelerate R&D investment generally, not to seek to capture it for ourselves. It would go to whether we could attract co-investment if we were seeking to hold on to the IP. Ottoline, you might want to add something.

Professor Leyser: This is a very interesting question. The evidence about IP is a little bit complicated. It is not at all clear that retaining IP rights in particular parts of the system is necessarily the best way to recoup investment. This is true right across the system. A lot of university tech transfer offices are incentivised to capture IP, and there is an active debate about whether that is actually good both to promote commercialisation and for the generators of the IP to capture that benefit.

A more interesting approach, I think, is equity stakes, which we are certainly interested in exploring. Indeed, more generally, in that investment gap that we talk about, in the so-called valley of death, that is a really interesting approach. At various different stages one can think about whether public money should be going in just to attract the private investment, as Jo was describing, or whether we also need to think about appropriate moments where public investment might take an equity stake so that the return on that public money would come back into the system.

Q63 **Sir Geoffrey Clifton-Brown:** I am a little bit surprised by your reply on that, because taking IP rights is a relatively simple thing to do and taking an equity stake requires all sorts of skills—somebody has got to sit on the board and so on—so why do you not, as a matter of normality, take an IP stake? You could always give it back or sub-license it. You can do lots of things with IP agreements. I am amazed that you do not think about it as a matter of course.

Professor Leyser: We think a lot about IP as a matter of course. I do not think it is that simple. It is actually quite a lot of effort to protect IP in an appropriate way, and it is expensive—it costs money. Who puts the money in and how? And how is any potential return associated with that IP captured, and for who? There are many different ways to do that, and it is not, in my opinion, simple, cheap or low energy.

You are absolutely right that once you have the IP you can exploit it in different ways, but that freedom to operate is often something that companies value much more than lengthy negotiations about access to particular IP. Again, navigating that is not entirely simple. So I agree that these are areas where thinking about how one can get a return back for the public investment is really important. I do not think there is a clear "This is an easy way, that's a hard way" distinction that you describe.

Q64 **Sir Geoffrey Clifton-Brown:** Last question. I think what you are doing is giving us a lot a lot of excuses for why you do not want to do it. Why do commercial properties spend a lot of time and money protecting IP and their sister protections, patents, when you are not even thinking about it? This is public money and when it is a huge commercial success, the public ought to get the benefit of that. At the moment, they get no benefit whatsoever. Can we have an assurance from you that you—and the Department, Ms Munby—will seriously think about how the public purse can benefit when there is a huge commercial successful roll-out that has benefited from this bridge funding from the public purse? Ms Munby, perhaps you can answer that.

Sarah Munby: Absolutely. Look, we are happy to take away a task to synthesise our thinking about this, but this is not a new concept that we have never thought about before. I want to make one important addition to what Ottoline has already said. If there was a really good business case for investing in the IP—you look at it and think, "Right, I can spend a pound on this IP and I will get a great return in the future"—there are lots of other people who can do this. We have to invest in things that private investors would not invest in, which is why we are putting in public money in the first place. Every extra right that we ask for, in terms of future IP, means we have to put more money in. It's a straight trade-off.

Really, the question is: who is the best owner of the IP? I am happy to take away and look at whether there are specific exceptions where we should do something, but as a general rule, we think that the best owner of IP is usually the company or university, not UKRI. UKRI does not have a special skillset in owning and protecting IP, whereas these places do. The price that we would have to pay is usually not worth it, because we are better, frankly, at holding the cash, and they are better, frankly, at holding the IP. As a general rule, we think that if we did it more, it would not, in aggregate, add up to a better position for the public purse. There may be some specific exceptions, and we can come back to you on that, but that is why we do not do it as a matter of course, because we do not think we would get better financial return as a whole. Obviously, if we magically picked only the ones that were really brilliant and invested in that IP, it would be great. But that is not how we do that in the real world.

Sir Geoffrey Clifton-Brown: All right. Thank you.

Professor Leyser: Can I—

Chair: Sorry, Professor Leyser, but we are going to move on because of the time. This is an area of interest for the Committee generally. We see a lot of projects where IP is supposedly captured but does not always materialise. But your explanation earlier about the challenges was very helpful to our thinking, so thank you for that. We'll now go back to Olivia Blake for a fairly quick-fire bit about some of the impacts of the last year.

Q65 **Olivia Blake:** Just some very simple questions for Professor Leyser, if that's okay. What impact has covid-19 had on the fund's performance?

Professor Leyser: It is a simple question; the answer is not entirely simple. Obviously, covid has had a significant impact right across the whole sector. I would say that the team have worked extremely hard to try to mitigate any negative impacts. We have been able to mobilise both costed and non-costed extensions to projects where they have needed to adjust or adapt due to a whole range of issues associated with covid, be that facilities having to close or supply chains being disrupted.

We have also seen projects pivot in response to covid. For example, in the creative clusters, there is an Audience of the Future project, which is about bringing experiences with some of our cultural heritage, museums and so on to a much wider audience. A lot of that was targeted at public spaces, but they have pivoted that activity to be much more app-based, so that those experiences are now brought directly into people's homes. There have been particular project adjustments.

Then there have been projects, particularly in the life sciences sector, whose ability to deliver has been impacted by resource, focus and activity being taken by directly addressing the covid pandemic. Sometimes that has slowed down progress, which is an alternative challenge. But obviously, in the context of vaccine manufacturing, we have accelerated to deliver according to that—

Q66 **Olivia Blake:** I will just ask Ms Munby whether she can provide a current update on the new Vaccines Manufacturing and Innovation Centre for us.

Sarah Munby: We are expecting it to be fully operational next year but already starting to operate at a smaller scale in the second half of this year. As we discussed before, the original specification, in terms of the number of doses it could manufacture, was something like three. We are now at something like 60 or 70. We think it is progressing really well with the support of the extra funding provided through this process, and we think it will play a really important role in ensuring that we have both the manufacturing and of course the fill-and-finish capacity that we need, because it is able to support on both.

Q67 **Olivia Blake:** Thank you for that update. Finally, I am curious about the extent to which any delays to projects will affect your ability to spend the fund in the final years. What might be the pressures on the fund if there is scope for a compression of spending in the final years of the project?

Professor Leyser: The need to reprofile funds into later years does create financial pressures in those later years, and that is something that I am sure we will talk through as allocations and so on proceed, both for this year and into the future. I have to say, it would be much easier to manage a lot of these things if we had a multi-year settlement, which we have not had had for quite some time in this space.

Olivia Blake: Thank you, that is useful.

Chair: Sir Geoffrey, do you want to come back in?

Q68 **Sir Geoffrey Clifton-Brown:** I have a quick one for you, Ms Munby. I think Ms Shanmugalingam said earlier that the Chancellor is looking at how we deliver R&D, and that you will be coming up with a new policy later this year—I think that is what was said. If that is the case, is there likely to be a new remit for ISCF?

Sarah Munby: Well, we have promised in the "plan for growth" document that came out yesterday an innovation strategy for later this year. You will absolutely expect that in that innovation strategy we will describe the areas of focus for challenge funding—hence the ISCF—going forward. We think that this kind of programme—close to what this does—is definitely part of that innovation strategy, but the question about whether the grand challenges are still exactly right and whether you would adjust that—to give even more focus to net zero, for example--is what we will describe in that document.

Chair: Thank you very much indeed to our witnesses, Sarah Munby and Jo Shanmugalingam from the Department, and Professor Dame Ottoline

Leyser from UKRI, for their time. This is an area of interest to the Committee, and as the permanent secretary has highlighted, she will be before us next week to discuss some of the elements of this as it relates to net zero vehicles. We look forward to seeing you again very soon, Ms Munby—it will become a regular slot for you; we will give you frequent flying points. Thank you very much indeed. Our corrected transcript will be published on the website in the next couple of days.