



Science and Technology Committee

Corrected oral evidence: Delivering a UK science and technology strategy

Tuesday 8 March 2022

10.15 am

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Members present: Baroness Brown of Cambridge (The Chair); Baroness Blackwood of North Oxford; Viscount Hanworth; Lord Holmes of Richmond; Lord Krebs; Baroness Manningham-Buller; Lord Mitchell; Lord Patel (co-opted); Lord Rees of Ludlow; Baroness Rock; Lord Sarfraz; Baroness Sheehan; Baroness Walmsley.

Evidence Session No. 5

Heard in Public

Questions 32 - 39

Witnesses

Dr Garry Pairaudeau, Chief Technology Officer, Exscientia; Helen Kennett, Director, UK Government Relations, Rolls-Royce plc; Simon Bennett, Head of Research, AVEVA.

USE OF THE TRANSCRIPT

This is a corrected transcript of evidence taken in public and webcast on www.parliamentlive.tv.

Examination of witnesses

Dr Garry Pairaudeau, Helen Kennett and Simon Bennett.

Q32 **The Chair:** Good morning to our witnesses. Thank you very much for joining us today.

Before we start questions, let me remind you that today's session is being broadcast on the internet. A transcript of the session will be sent to you in a few days' time so that you can check it and send in minor corrections. If there is anything that you feel you did not get a chance to say, something that you want to clarify, or further information that you think would be helpful to us, please provide supplementary evidence in writing after the meeting.

If that is all clear and our witnesses are all comfortable with that, I will kick off with the first question. Before I do so, I must declare an interest of my own. I am a non-executive director of Frontier IP, which is an investor in Exscientia.

I would like to ask all our witnesses how important government support is to the R&D that they currently do in the UK. How does that government support in the UK compare with what you experience when, and if, you do research overseas? Helen, let me start with you and Rolls-Royce. When our witnesses first speak, can they say who they are and what company they are from?

Helen Kennett: Good morning. I am the director of UK Government relations at Rolls-Royce, the power systems group.

Government R&D is incredibly important to the Rolls-Royce group, principally in our civil aerospace business and our defence business, both of which have significant industrial bases in the UK. I will start with the civil aerospace business. We have been very pleased with, and are very grateful for, the government support that we receive for research in technology and development. We receive that support through the Aerospace Technology Institute—the ATI—which has been in existence since 2013. It was a pretty unprecedented funding package when it first started because it covered seven years, which is beyond an electoral cycle. That is very important when it comes to our taking confidence from the Government's support for the sector and being able to make long-term investments in a long-life-cycle business.

The other way in which the Government support us is through defence R&D. At the moment that is principally through the Tempest programme, which is looking at the next generation of combat fighter aircraft.

Compared with international funding agencies, the UK Government are very generous. They are the largest of all the funders that we have across the whole of the Rolls-Royce group globally. The ATI has been seen to be a standout funding agency, because it has had a long-term view and listens to the views of industry and because we are able to work together, to collaborate and to make bids.

There are other funding agencies around the world that also have a collaborative approach and a long-term view. I refer especially to LuFo in Germany. In the United States, NASA is obviously a very big funding agency. We always need to remember that there is a transfer of capability and skill set between the defence activity in the US and its civil activity. Where we compete with a global competitor that is based in the US, the UK always needs to think about how it can stay on top of the civil aerospace investment as compared with what is going on on the other side of the pond. However, I would say that the UK Government have been a very good investor in the ATI. We very much look forward to seeing the settlement for the ATI, which we have been waiting for for some months. We hope that we will be able to see those figures very soon, so that we can plan for the long term.

The Chair: Would you say that the US is rather better at channelling dual-use research funding through the military route than we are in the UK?

Helen Kennett: It is more permeable in the US. In the UK, we have not traditionally gone down that route. There are some crossover projects. As we look at Tempest, there may well be some electrification work that we can transfer from that project into some of the civil aerospace projects. In the past, defence has been the route to help civil aerospace. In latter years, it has been more the other way around: civil aerospace technology has moved over into defence. However, the increased funding in the defence space will probably help to increase the flow of technology back into the civil area.

Simon Bennett: Good morning, everyone. I am the head of research at AVEVA, which solely makes software. We are in the software business. Currently, we do not receive any support from the UK Government or any other national Government for the development of our software. All our investment comes from shareholders and investors across the business. There is one exception to that. We accept funding through EPSRC for university engagements, particularly with Cambridge University. We have done that successfully over the past few years.

The Chair: Do you feel that that has been a hindrance? Would it have been helpful for your competitive position if you had had more support, or has that just not been necessary for your company's development?

Simon Bennett: When it comes to public procurement, that may provide an advantage for our business. We are a global software business, so we are distributing our products around the world. We tend to follow the global trend when it comes to public procurement. Some of our software lends itself to that kind of acceptance. I am thinking of smart cities and other major infrastructure projects. I can see that we could get an advantage, but at the moment we are proving to be reasonably successful just by taking other money funds as well.

The Chair: One of my colleagues will ask you more about public procurement a bit later.

Dr Garry Pairaudeau: Good morning, everybody. I am the chief technology officer at Exscientia. We are an AI-driven pharmatech company. Like Simon's company, we do not receive any government support or funding directly. The company was in receipt of some seed funding right at its inception, probably 10 years ago, but I do not think that that has had a big effect on the company. We have been very successful at raising money over the last couple of years and have grown very successfully, so I think that is fine.

Where the Government really help us is through interactions with academia. I am thinking of things like the CASE award programme. We are a highly science-focused basic research company, so we benefit immensely from interactions with academia and the research that is done there. Things like the CASE programme, training of young talent and bringing that talent into the organisation are critical for us, so the UK education system is super-important. It is also good that the Government have enabled IMI grant collaboration with EU-funded activities such as the European Lead Factory and other big IMI initiatives to continue post Brexit. Those are probably the key things for us.

The Chair: Some of those areas will be followed up with more detailed questions.

Q33 **Baroness Sheehan:** What are Rolls-Royce's views on the Government's ambition to boost R&D spending to 2.4% of GDP? What do you think the Government could do to incentivise your company to spend more on R&D?

Helen Kennett: It is very welcome that the UK Government have that target. In the past, Rolls-Royce has benefited from quite a lot of funding from the UK Government. As we look at increasing the demands on companies to invest more, we need to understand that the investment that we have received has basically been a foundation. If companies are being asked to invest for the first time, that will be quite a big step for them. Rolls-Royce is an investor, and we invest alongside government, but asking new companies to go down that route will be quite a big step.

We need to think about how that will be achieved for some of those who are not familiar with the funding space and may not have the private investment to be able to do it. That private investment will not come only from companies like us. Companies may need to go to other sources of investment such as the equity market or venture capitalists. As we look at the structures for how companies are going to invest alongside the Government, how do we enable companies to do that in a way that matches their technology road maps and helps them to access alternative sources of funds if they do not have those sources themselves?

Will the Government's target incentivise us? It is always great to have a target to work to, but the thing that really incentivises us is if there is a very clear demand signal for the use of the technology that we are developing. At the moment, there is a very clear demand signal for our civil aerospace business and our defence business. Obviously, we need to

make sure that we are always match ready, so that we are able to be available for the next platform.

When we look at things like net zero, there is a point at which we need the demand signal from the Government. We need them to say, "This is what we want as a country. These are the capabilities that we want as a country". That will provide the certainty for us to want to invest alongside the Government. That demand signal has come through in the Government's 10-point plan for a green industrial revolution, but there is more that can be done to provide some certainty that those are the technologies that the Government really want to develop and to exploit here and to export from the UK. That will help to build certainty and make companies want to invest in R&D alongside the Government.

Baroness Sheehan: Great. I really want to move on to the other two witnesses, but first I want to ask you about smaller companies. You have talked about the difficulties that they could have. To what extent does Rolls-Royce rely on partnerships with those smaller companies?

Helen Kennett: We absolutely do rely on partnerships with smaller companies. Over 85% of the ATI funding that we receive is channelled through to SMEs and the university sector, so we are very dependent on them. Those are the routes that we will want to continue to use to make sure that SMEs are able to access that funding. However, if under a new strategy there are specific, bespoke activities with SMEs, we need to make sure that the model will work for them in their own right.

Dr Garry Pairaudeau: As I said earlier, we are a science-based company. Last year, we raised over \$750 million. We spend virtually all of that on R&D or R&D-enabling activities, because that is the type of company we are.

How could you incentivise us to spend more? I can outline some of the challenges that we have faced. One of them, interestingly, is access to facilities. We are based in the Oxford area. High-quality laboratories and science-based facilities, particularly in the golden triangle, are getting really hard to find. That is one way in which the Government could help. The other side is access to talent. It is just a war to get the best people. Ultimately, we end up going right across the world to identify the best talent. Anything that increases that groundswell of talent in the company will benefit us.

When I look at the ecosystem in Boston and the Massachusetts area, my impression is that they provide significantly greater incentives in the form of tax-efficient investments and motivation for companies to spend and invest in R&D. It is just more energised than the situation in the UK. The UK has fantastic science and fantastic companies, without a doubt, but it just feels as if there is more energy in the Boston area.

Simon Bennett: We currently invest around 13% of our revenues in R&D. That is pretty much best practice for software businesses and is very much in line with our shareholder value's return on investment. Our committed spend every year is basically driven by those expectations

from the City, in our profit margins and revenue generation, so it is not necessarily the case that the Government are influencing that directly.

However, the UK Government have a great influence on our market dynamic. I would reinforce what Helen has just said about buying signals. In areas of our race to net zero and the sustainability drives for our country, and around other tech centres and incubation centres, there will be a great opportunity for the UK Government to influence market dynamic changes. Naturally, we would respond to those because we are always listening to the market dynamics. Regulatory changes that influence and incentivise businesses, our customers, to change and accelerate will just end up with our spending more on R&D.

Baroness Sheehan: Dr Pairaudeau mentioned some of the barriers or challenges that his company faces. Do you agree with him? Have you identified those barriers yourself?

Simon Bennett: It is slightly different for us. It was very interesting to hear from Dr Pairaudeau, who is working in high science. In a software engineering business, we are really applied sciences. We are less affected by fundamental science research. We are much more affected by the global top 10 companies that have most of the intellectual property around technology: Google, Amazon and all those giants. When they are directing the globe's technology trends and differences, that is where we have to track harder. It is much more around the applied sciences. That means that access to AI, computer science and data science talent is increasingly hard because the market is very much demanding those skills. However, we hold the view that most numerate and logical engineers have the capability to convert to AI and data science skills. That just requires a little more investment on our part or the Government's part.

Baroness Sheehan: Excellent.

Baroness Blackwood of North Oxford: Dr Pairaudeau, you mentioned the comparative investment between the Oxford golden triangle area and Boston. I do not know whether you have heard rumours about putting the Oxford-Cambridge arc investment on the back burner. Do you have any comment on or reaction to that, given that those proposals were for transport investment, housing investment and lab investment? Do you, as a local company, have a view on that?

Dr Garry Pairaudeau: To be honest, I do not have a view on that, I am afraid. I did not know that.

Q34 **Baroness Walmsley:** I have no relevant interests to declare.

Here comes the procurement question to which the Lord Chair referred a few moments ago. The Government's Chief Scientific Adviser and others have talked about the value of public procurement in supporting R&D. Does public procurement already support R&D at your company or, perhaps, at your customers? Could that be improved? If so, how? Are any major opportunities being missed?

Simon Bennett: The technology that we provide supports national infrastructure such as water and wastewater management, power generation and electricity distribution. We work with companies such as National Grid and most water companies in the UK to provide sustainability solutions for them.

Most of that work is just business as usual for us, selling to organisations that support our national infrastructure. AVEVA believes, and I believe, that there are opportunities to incentivise a move to much more sustainable and smart cities. It is fantastic to see that the science strategy includes net zero, which will help to drive those incentives to national institutions. From our perspective, public procurement is very low. We do not tend to be supported by government purchasing. However, I can see how the Government will be able to accelerate that by helping to move us to digital twins for smart cities, which very much plays into my business's speciality.

Baroness Walmsley: Talking about net zero, is the smart grid a big opportunity for you?

Simon Bennett: Very much so. The smart grid involves technology. Sixty per cent of the shares in AVEVA are held by Schneider Electric, which is one of the main global proponents of that. We are very much tracking it and driving it technically. I can see that that would be an exciting business opportunity, should the Government push forward.

Dr Garry Pairaudeau: We have thought about this. Public procurement does not support Exscientia, and it is not easy to see how it would. However, I can stretch the answer a little. The interactions with the NHS could be incredibly powerful for the whole healthcare sector, and the drug discovery sector, in the UK. The UK has a unique position with the NHS. If we could capitalise on, and improve, the interaction between the NHS and research into new drugs and therapies, we could really streamline that process and have an incredible home advantage. This is an area where the UK is unique. Clearly, there are initiatives and work ongoing, but we could really lean into it and capitalise on that opportunity.

Baroness Walmsley: Is the blockage at MHRA or at NICE level? Where is it?

Dr Garry Pairaudeau: No, it is not. I was coming at this more from the research angle. There is an opportunity to support UK drug discovery efforts by making the process for running clinical trials more streamlined and effective. We should look at how that framework can be improved.

Baroness Walmsley: That is very interesting.

Helen Kennett: At the moment, Rolls-Royce benefits from the role of public procurement in our business, through the defence business. There is the research in technology and development that we are doing on the Tempest programme, as I said. We also benefit through the ongoing work that we do in our submarines business.

Public procurement is there where there is the need for an indigenous supplier that is funded by the Government. That is obviously very clear in

the defence space. The UK MoD has understood that buying commercial off the shelf is not always the way forward, not only when it comes to providing sovereign capability but when it comes to generating a UK industry that can then generate exports. I am therefore very pleased to see that there is much more investment from the MoD in R&T and R&D.

The role of public procurement is also very important where there is a market failure. There are long-term higher-risk programmes, especially in things like nuclear, where the market does not provide the certainty to get a product out to market. We see that with the traditional nuclear aspects. We have been supported by the UK Government when it comes to small modular reactors as well.

There are some other elements of the 10-point plan where there could be the opportunity for some direct government procurement, if the Government so wish, to make sure that the UK is able to capture that technology and to compete globally before others catch up with us. With a lot of these new technologies, it is basically a green-field space, because nobody has claimed the global position. If the UK wants to claim the global position, that can be done, either through direct procurement or by providing the regulatory environment in which those products have a faster route to market.

Baroness Walmsley: Talking about the very long term, are you involved with fusion?

Helen Kennett: We may be. We are on the fringes of looking at it.

The Chair: The point about regulation was a perfect entry for Lord Holmes.

Q35 **Lord Holmes of Richmond:** Good morning to all the witnesses. Thank you for taking the time to be with us, and happy International Women's Day.

The Government have talked about becoming a regulatory superpower, particularly in relation to life and digital sciences. Are unnecessary regulations preventing companies from engaging in R&D activities? What can be done to improve the regulatory landscape? I will start with Helen.

Helen Kennett: I am not aware of there being any regulations that inhibit our investment in R&D in the UK. Regulation can be a great innovation driver if it sets the direction of travel, the demand signal, that enables us then to invest and to innovate.

With regard to the aspiration to become a regulatory superpower, we have to remember where regulation is set. We are a global company that is headquartered in the UK. The sorts of products that we want to sell globally will need to operate in global markets. If the UK wants to be a regulatory superpower, it needs to understand how it works with the other international players that also want to set regulation. There is no point in having a regulation that works perfectly in the UK but which we cannot use globally.

Some of these regulations will be based on standards. Some will be international regulations. Some of the conversations that we are having about the regulations on sustainable aviation fuels will naturally be global conversations, because we need global uptake of sustainable aviation fuel. As the UK goes into its aspiration of being a regulatory superpower, it is worth understanding the wiring of how that will work across the world to make sure that we set the ambition to meet the global marketplace and not just for UK requirements.

Lord Holmes of Richmond: More specifically to one of your businesses, could and should the UK be doing more in relation to SMR technology, for example?

Helen Kennett: The UK has taken a fantastic leading position when it comes to SMRs. We are very grateful for the government support and funding that we have had through phase 1 and phase 2. In fact, only yesterday we announced that we are going into the GDA process for SMRs. That is a fantastic place to be, because it really sets out the regulatory road map for SMRs.

There is a lot of international interest. The world is watching what the UK is doing with SMRs to make sure that we keep to the ambition of trying to get one to market within the next 10 years. There is global demand anyway in relation to net zero, and now, especially when it comes to energy security.

Dr Garry Pairaudeau: I echo some of Helen's comments. As a pharma business, we play in a global market, potentially, so regulations expand across many nations. It is important to bear that in mind.

The really exciting thing for pharmaceuticals is the lessons that we will learn from the last couple of years of Covid about how quickly we can move medicines to patients and make a difference to them. I am sure that the Government are thinking about that. How are we looking really hard, in the light of what has been possible over the last two years, to streamline the processes for regulatory approval and the approval of clinical trials? How can we make drug launches in the UK faster and more effective? I would expand that out to clinical technologies. For all these health-enhancing approaches, the regulatory processes are lengthy. What Covid has taught us is that, with the right focus and the right desire, they can be done far faster. I am sure that you guys are definitely thinking about that.

I come back to this: how do we make it easy for UK companies to run trials within the NHS? How do we leverage that position? I would call out things like the Genomics England initiative. That is fantastic. It is the sort of thing, involving massive-scale activities, which the Government can sponsor and that will have a huge benefit across healthcare. Can we expand that to the UK Biobank and really leverage the power of biobanking tumour samples and so on? I realise that this all has to be done in a way that protects all the rights of the patients. That is why it is something where government can really take a lead and enable companies to access these things in an effective and respectful manner.

Simon Bennett: It is a simple answer from me. There are no unnecessary regulations that are preventing us from carrying out any of our R&D activities. I consulted deeply on that answer.

Lord Holmes of Richmond: That is very good to hear. It is very rare to hear that in this specific area there are no unnecessary regulations.

Q36 **Baroness Manningham-Buller:** Good morning to our panellists. One of you—I think it was Mr Bennett—referred to excellent UK science. There is a perception in the UK that although universities have the bright ideas, we have failed to commercialise them. Is that still true? If it is, what, if anything, can the Government do to alter that? Dr Pairaudeau, we had from you the comment that Boston felt much more energetic. Would you like to be the first to attempt to answer my question?

Dr Garry Pairaudeau: I would love to. Exscientia is a company that was born in the University of Dundee 10 years ago out of Andrew Hopkins' research group, so we are a company that spun out of a UK university. I guess that we are a good example of that.

It is difficult. There has been research published that suggests that UK universities can make it difficult for academics to spin out companies. There are specific examples. Cambridge has a different operating model that, on the face of it, appears to be more effective. It uses groups like Cambridge Enterprise to help people to spin out.

Fundamentally, the problem is that there is not enough money in the system. It is not necessarily difficult to spin out an idea, but driving that idea forward requires a lot of investment. At a fundamental level, there is not enough money in the system.

There may also be a cultural issue. It does not feel to me like it is necessarily a natural progression for an academic to want to spin out a company. I get the impression that in the US it feels like a much more natural thing to do. I wonder whether we should be trying to engender entrepreneurship in people much earlier, so that it becomes much more of a natural thing for people to spin out a company, try that, and then go back to academic research. There could be much more fluidity in the system.

Baroness Manningham-Buller: Have you noticed any difference between the attitude of older academics—we are generalising obviously, because plenty have spun out things successfully—and new people into the system? I have an impression that some of the younger academics are more entrepreneurial, but maybe that is just a myth.

Dr Garry Pairaudeau: I am not honestly sure. I think it is very individual-dependent. This seems to be much more individual. I do not know. I would not say it was an age thing.

Baroness Manningham-Buller: Thank you.

Simon Bennett: I would echo Dr Pairaudeau's comments. In 1967, the UK Government and Cambridge University created AVEVA, albeit it took

us 50 years to get to FTSE 50. It is a good example of the UK investing in great ideas and infrastructure. I would make two observations on this.

One is that there is some inhibition on us commercialising some of our university outcomes based on how IP is managed. Typically, the IP is owned by the university, and then we have to pay royalties to use that. In a FTSE-floated company, investment cases in our own developments are put under the microscope for return on investment. When you are carrying an overhead, or a potential risk of royalties, those cases fall a little weakly against the other competitive cases for developing new software. Anything that the Government can do to come up with new paradigms around IP sharing, royalty management or anything that can encourage us to give us more control over our future commercialised offers would be very exciting.

My second observation is on the speed of change in the high-tech sector. Going back to what Dr Pairaudeau said about high science in their business, we are not high science. We are very much influenced by the big players in technology. A good example is that, if you started a PhD today using the very latest technology stack in the software world, by the time you create your PhD thesis you could well be outdated, specifically in cloud, edge and AI tech. That means that academia's general, long-term, fundamental horizons are sometimes outpaced by changes in our businesses, and that is where we really struggle. It would be more helpful if the UK Government were to put more emphasis in future funding on incubation-type environments for us. In the software business, rather than creating a thesis as an academic outcome, we actually create a demonstrator, a prototype, something that could be shared with customers to get feedback from the marketplace.

That is something that we do internally. Clearly, we have to do that in a software business. Working with academics, you get fresh new ideas and challenging approaches to the way you can develop solutions. That would be one thing I would mention.

I will bring to the table an example of how it works in the real world for us at AVEVA. About four or five years ago, we invested with BP in PhD students at the University of Cambridge, who came up with some exciting intellectual property around capturing point cloud data for the creation of digital twins for our customers. That was really exciting. We want to commercialise it. We see great advantage. We have an IP patent issue. In order to accelerate that to commercialisation, which is now two years post thesis, we are now partnering with Shell in Brazil to help to take it to the next stage, because that phase of commercialisation is very financially risky for businesses like ours. Those are my two main observations.

Baroness Manningham-Buller: Thank you. Helen Kennett, what would you like to add to those answers?

Helen Kennett: I would like to add a number of points, if I may. One is about the relationship that we have with the academic sector. We have 28 university technology centres around the world, two-thirds of which are in the UK, and it is through that network that we do our fundamental

research. We also work with the advanced manufacturing research centres, which is a combination of large companies, small companies and the academic sector.

There have been some breakthroughs that we have been able to make in those advanced manufacturing research centres that have then moved into investment in the UK. We decided to invest in a new facility in Washington, Tyne and Wear as a result of the productivity gains that we made in the advanced manufacturing research centres. You can see that there is a direct spin-out of the work that we did with the academic sector into industrial capability and into long-term footprint in the UK.

To come back to what Garry and Simon said about the world of academia and how we work together, in terms of the incentives for the world of academia and the world of business, they are quite different, and it is about how those could be better aligned and some of the outcomes that Simon talked about there. Rather than, or as well as, producing a piece of academic research, producing a demonstrator—something that could be commercialised—does not always naturally sit comfortably in the academic world as being a sign of success. We need to look at how we can bring the two communities together to find a mutual way of understanding what a successful outcome might look like.

Part of that is down to culture, and Gary talked about culture. I am involved in Minister Freeman's culture work as part of the R&D strategy. There, it is about the transferability of skills between the different places—between business and the world of academia and government—and how that works together as a trinity of a flow of skills between the three that seems to work much better in other countries. For us to be able to have a successful science and technology strategy in the UK, we need to look at the skills piece, the flow of talent at that senior level, and at what is considered to be a good outcome for the UK. It might be the case that academics will continue, as they will want to, to have good academic papers, but it is about the applied research and what that means in terms of economic contribution to the UK.

Baroness Manningham-Buller: Do you think the situation is getting better, or is it much as it was when you first came into this world?

Helen Kennett: It is probably much as it was. It is probably going to require some structures to be able to create the culture. Culture, in my mind, does not happen overnight; it requires some stimulation, the culture will follow and then the culture gets fixed.

There is an opportunity, if we go back to what we were saying about net zero. That is a fantastic greenfield environment in which we can try to start again with some of these ideas and create new, innovative and bold structures, to be able to take advantage of that opportunity, but also to understand that it is something around which everybody can coalesce.

Baroness Manningham-Buller: Thank you very much.

The Chair: Do you think the research excellence framework is an inhibitor to the sorts of changes that you would like to see?

Helen Kennett: I do not think it is an inhibitor. It is how business can work better with that excellence framework and what that conversation will look like to get to the place where we want to be as a country. Maybe there needs to be a bit more discussion about that.

The Chair: If the main way we measure our science and technology academics is by their papers in *Nature* and *Science*, does that not inhibit them from delivering the demonstrations that you would like to see?

Helen Kennett: There is probably a bit of balance in the sense that we obviously do not want to turn off pure science. It is about how we can make sure that where there is the potential for applied science we can measure that in a slightly different way.

The Chair: The research excellence framework needs to address that, because at the moment it measures it all pretty much in the same way.

Helen Kennett: I think it could be tweaked, yes.

The Chair: Thank you.

Lord Patel: I have a follow-up question on your comment about the collaboration with academia to the level that you have succeeded in developing. How does that happen? Are you unique?

Helen Kennett: We decided that we were going to have our R&D activity through a network of universities rather than an in-house capability, so in that way it is rather unique, and it means that we have a very special relationship with lots of universities in the UK. Therefore, they understand our needs and they can basically work with us on that fundamental research. That was a deliberate choice from Rolls-Royce. We have the long-term projects and we also have the financial heft behind us, which it makes it easier for us to do.

Q37 **Lord Patel:** I would like to hear your general views about intellectual property laws and how they operate in the United Kingdom. How does it affect the Government's ambition to become a science superpower? How does it affect industry's collaboration internationally? Also importantly, how does it affect industry's relationship with academia, particularly universities? Is that an advantage, or is it a conflict?

Helen Kennett: We are very happy with the UK's intellectual property laws. In fact, in some ways, the UK is an intellectual property superpower, and we would not want to change that. As we do international collaboration, we need to try to see if there is a way for the harmonisation of intellectual property rules globally to make it easier for us to collaborate and work. That is principally about the issue of grace periods, which is the point at which you file and you then get the patent. It is different in the UK from other places around the world.

This is coming up as the Government discuss free trade agreements. I do not know whether the committee knows about this, but IP is one of the FTA issues that often comes up. The UK should not be overly worried about its position on intellectual property rules; it is just how we make sure that we can apply those globally.

As to collaboration and how we see this, intellectual property allows us to collaborate. It basically provides a safety net under which we can innovate, and we know that the innovations that we are going to be able to create will be protected. In that way, we are very content with the rules as they stand at the moment.

Lord Patel: You mentioned international trade agreements. Is the UK selling its intellectual property rights to other countries to make a trade deal?

Helen Kennett: It is a topic that is coming up. We in the UK are quite keen to make sure that any FTAs reflect the current UK position, and that is an ongoing conversation. The DIT is listening to that point, and it absolutely understands that point.

Dr Garry Pairaudeau: I have a slightly different perspective. There are a couple of ongoing discussions at the moment about IP and we are really interested in how they will play out. The first is on the clarification of the role of artificial intelligence in inventive step, which is an ongoing discussion. As the use of artificial intelligence becomes more prevalent in the discovery of inventions, clarifying where we stand on that will be really important in the future. Certainly, if we create laws that inhibit the use of computational methods, that will significantly inhibit the UK's ability to create inventions in the future.

I also think that this is not specifically about the laws; it is more about the process and the mechanisms. I do not think, certainly in the pharmaceutical area, that patents have really kept up with the digital age. They feel very much like a paper invention rather than a digital invention. We need to think about how the information is disseminated in digital, machine-readable forms that allows people to use it. At the end of the day, that is what the patent is supposed to be about, is it not? It is about disclosure in return for protection. Given the way people consume information now, I do not think that the way patents present that information is appropriate, so I definitely support moving to a more digital, machine-readable-friendly dissemination of the information and data in patents.

Lord Patel: Thank you very much.

Simon Bennett: I cannot really comment on IP law specifically, but I will just reiterate what I said previously. For us, it is about the royalty and ownership of intellectual property when it is shared with an external agency. Internally, I run plenty of programmes to capture patents from within our software and technology business, because we want to be in control of that for perpetuity. We want to be able to commercialise to the maximum what we have invented. When we work in partnership with academic institutes and there is a potential for that ownership not to be our own, we are very cautious because we see financial risk in the royalty potential of it. If an idea is particularly popular, we put ourselves at more risk, sadly.

Also, just as a backdrop to this, we have to put in context that the software giants of the US dominate IP capture to an enormous extent

when compared to us in straight software businesses. It is not really the Government who are providing us with anything that is stopping us from being successful; it is more the nature of our general business area that is extremely competitive when it comes to IP.

The Chair: Helen Kennett, you talked about all your university technology centres. Do you not find that you have challenging intellectual property issues with some of the universities involved?

Helen Kennett: I am not aware of any, no.

The Chair: Okay, thank you.

Q38 **Viscount Hanworth:** My question has been largely pre-empted by the previous questioner. Nevertheless, I will ask it. How close are your organisations' links with the academic sector in the UK? Are there barriers for academics in collaborating with you on research? Perhaps we can descend into specifics. Might I begin by asking Helen to give an account of the experience of Rolls-Royce and direct you towards the matters of nuclear research?

Helen Kennett: Is there a particular aspect of that that you would like me to comment on?

Viscount Hanworth: To what extent are you drawing on academic expertise for the SMRs and advanced reactors that are in the offing? I know you have relationships with Manchester University and other. Can you describe how those work? I will then ask you a supplementary.

Helen Kennett: We have relationships, as you say, with the University of Manchester, and we are also talking to some of the advanced manufacturing research centres about the potential when it comes to the point of the production technology that we will need around small modular reactors. As you know, the small modular reactor programme is still relatively early on in its maturity, so we are still working on the concept design. As you know, that is going through the GDA process. The SMR consortium will be pulling on the resources of Rolls-Royce and its UTC network as and where it needs to. Because of the work that we have previously done through the submarine business, we are well plugged into the nuclear research academics in the UK.

Viscount Hanworth: You already have a tremendous amount of experience in metallurgy, so I doubt whether you have to apply to academia for that.

In the late 1940s, most of the nuclear research was done at Harwell Atomic Energy Research Establishment. It designed Calder Hall and the Windscale Piles. I get the impression that all that has now dwindled and that connection has ceased. Am I correct? If so, is there some replacement for that activity, which was foremost in the early years of the nuclear industry?

Helen Kennett: I cannot comment on that, so maybe I could come back to the committee on that particular point. As we can see a resurgence in nuclear interest in the UK, there will be increasing demand for nuclear

skills. That will be across the projects that we have already described as well as with Hinkley Point C as that starts to move into the next phase of its project. There will be a need for greater nuclear skills and probably for more nuclear research, and I know that the UK Government are looking at that.

Viscount Hanworth: I asked specifically about our government research establishments. Do you expect to receive any substantial help from such establishments?

Helen Kennett: I am not expecting us to need any substantial help as we work on the SMR programme.

Viscount Hanworth: That is very different from the early years of nuclear. I will move on to Dr Garry Pairaudeau, if I have pronounced it correctly.

Dr Garry Pairaudeau: Yes.

Viscount Hanworth: Can you add anything to what you have already said, which is considerable?

Dr Garry Pairaudeau: Maybe to reinforce. Exscientia has incredibly good links with academia, and it is really important. When I worked at AstraZeneca, it also had incredibly extensive links to academic research. That is really important for driving fundamental science. Recently at Exscientia, we worked with Queen Mary University to set up an AI drug discovery programme for bringing students into Queen Mary University, part of the Government's initiative on AI across the country. We have professors at Exscientia who are still actively working at universities. Having that blend is really important.

The CASE Awards programme works incredibly well. That is a really important ground-level link to academic research. What works really well in the UK, though, are some of the big initiatives such as the Diamond Light Source and the Rosalind Franklin Institute. Putting these big structures in place and putting something physical in place so that you have something to interact with, creating the environment for research and investing in big strategic things, is absolutely the direction of travel that I would support, because that fosters lots of individual academic contributions.

Viscount Hanworth: I get the impression that the fluidity of the relationship between academia and industry is much greater in the life sciences than elsewhere. Is that your perception, or would you deny that?

Dr Garry Pairaudeau: I absolutely think it is. There are IP barriers, though. There is almost a bit of a conflict in that if you want to create start-up organisations, you need to preserve the IP so that you can start up a company. If you want to collaborate with an existing company, we want to have access to whatever technology and research has been discovered. It almost feels like there is a tension between those two things. Thinking about how we can resolve that is really important. My experience is that a lot of academics just want to see their research used,

and that is proof enough for them, whereas the university wants to put a lot of hurdles in place to protect whatever is being used.

Viscount Hanworth: Simon Bennett, do you see the same sort of fluidity between academia and industry in software as we witness in the life sciences, or do you see a difference?

Simon Bennett: It is slightly different because of the applied science nature of our business. There is a much greater pool of talent that is potentially able to enter software businesses. You do not have to have a data science PhD or an artificial intelligence PhD to enter a software business. You can train your skills across to those capabilities by working in a software business. There is a grey space between pure academics who might exit universities and high-quality students who enter our business.

We have a very small research team in AVEVA—you are pretty much looking at him—so we do not have any major constraints except for our ability to respond in terms of time and effort in order to make this happen.

To go back to something you mentioned about nuclear, AVEVA software has been used on the ITER project in France for scale-up for fusion, and we have also been working with Commonwealth Fusion Systems to try to use our technologies to help with the design and construction of these as facilities in the US. That is not fundamental science; that is application of existing software technologies for engineers. The way we blend with universities is a crossover. There is only one small pocket in our business, which is high science around process simulation, but the rest of it is application of science in terms of technology stacks, and some major barriers.

Viscount Hanworth: Would it be true to say that your basic demand is for well-educated and good programmers?

Simon Bennett: Highly numerate, logical, engineering-type people.

Viscount Hanworth: Thank you.

Q39 **Lord Rees of Ludlow:** I have a comment and a question. The comment is that 90% of the world's clever ideas, sadly, do not come from the UK. Would you agree that academics can be important as consultants and disseminators of information if they are plugged into that?

I also want to ask about something that concerns me as a university professor in Cambridge. Too many people who are well trained in engineering in particular go into the finance sector because they get more money there and they see more flexible and quicker promotion than in a large engineering company. Would any of the panellists like to comment on either of those two points?

Helen Kennett: In response to your first question, yes, we need to make sure that we stay plugged into what is going on internationally. As a global company, we need to do that to be able to stay globally match-fit.

On the second point about the attractiveness of careers other than engineering for people who have studied engineering, we are fortunate in Rolls-Royce because we are able to attract some incredibly gifted talent. But in all the years that I have been working in industry there has always been a STEM skills issue, and the UK has never been able to get in front of that. The fact that we do not seem to have enough STEM-qualified people is a long-standing issue.

If we look at the demand signal in relation to the net-zero opportunity, that in itself should be a stimulus for people to want to have the right academic skills in those STEM subjects to be able to apply to companies such as Rolls-Royce. We need to make sure that that happens. The crucial thing is how we make sure that the 10-point plan for a green industrial revolution is connected to the education policy of this country and how we make sure that we get that pipeline of talent. So far, I have not seen that wiring.

Lord Rees of Ludlow: Too many people with those skills are going to work in hedge funds.

Dr Garry Pairaudeau: I would like to add a comment on the last point, if I may. I agree. I do not have direct experience of engineering. I am a chemist by training, and it is probably as bad in chemistry as it is in many other sciences. We really need to start thinking about this very early. I have noticed with a number of young people coming into Exscientia that they are very excited by the mission and by the opportunity to use their computational expertise to help patients and change people's lives. They could all get jobs in hedge funds and probably earn more money, but people are very passionate about the mission.

If you feed that back and think about how to get really young people excited about science and STEM subjects in schools at a very early age, there is a whole feeling in society that going into law or becoming a doctor is seen as a very important career path, and yet going into science, technology and engineering is seen at a slightly lower level. We need to completely change that public perception and think about how the media, the BBC and public culture influence that, and really get to people much earlier on so that they are passionate about science, technology and engineering, and they take that forward.

Simon Bennett: Software companies are attractive to young people exactly because of what Lord Rees mentioned, which is attractive salaries, apparently—maybe not the same as hedge funds. However, we seek different channels to get STEM into our organisation. We run sustainability competitions with international students at universities around the world to try to attract them to our business. Back to what Dr Pairaudeau said, purpose is incredibly important to this generation of young students. I have met a number of PhD students at Cambridge who have lectured me about the lack of my purpose or the lack of my business's purpose, and it is fundamental for choice in young people entering our business. Net zero will create all the correct market dynamics to draw those to our businesses. That is important to emphasise.

The Chair: We need to close the session there. Thank you very much indeed to all our witnesses for your interesting testimony to us. As I said at the start, if there is anything you want to clarify or if there is further evidence that you would like to submit to us, we would be very pleased to receive that in writing. For now, thank you very much and goodbye.