HOUSE OF LORDS

Select Committee on Science and Technology

Corrected oral evidence: Science and Technology in the Industrial Strategy

Tuesday 21 March 2017

11.45 am

Watch the meeting

Members present: Earl of Selborne (The Chairman); Lord Borwick; Lord Broers; Lord Cameron of Dillington; Lord Fox; Lord Hennessy of Nympsfield; Lord Hunt of Chesterton; Lord Mair; Lord Maxton; Baroness Morgan of Huyton; Baroness Neville-Jones; Lord Oxburgh; Lord Rees of Ludlow; Viscount Ridley; Lord Vallance of Tummel; Baroness Young of Old Scone.

Evidence Session No. 3 Heard in Public Questions 20 - 33

Witnesses

Sir Michael Arthur, President of Boeing Europe, Managing Director of Boeing UK and Ireland; Professor Jackie Hunter CBE, Chief Executive Officer, BenevolentBio; Neil Woodford CBE, Founding Partner, Woodford Patient Capital Trust.

USE OF THE TRANSCRIPT

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

Examination of witnesses

Sir Michael Arthur, Professor Jackie Hunter and Neil Woodford.

Q20 **The Chairman:** On behalf of the Committee, may I give a warm welcome to Sir Michael Arthur, Professor Jackie Hunter, who returns once more, and Neil Woodford, who join us in our third evidence session on the industrial strategy Green Paper. We are very pleased to have the opportunity to hear your thoughts on the emerging issues. We are being broadcast, so I will ask for the record if you would introduce yourselves. If you would like to make an opening statement, please feel free to do so.

Sir Michael Arthur: Thank you. I am Michael Arthur, the president of Boeing Europe and the managing director of Boeing UK and Ireland. I will not make a long statement, but I will make just two or three points to situate our discussion with the Committee.

Boeing has had a long relationship with this country, but in the past 10 years it has transformed. We are growing very fast here across the country and across a diverse range of Boeing businesses. That is set to grow further and continue. Secondly, a significant element in what we do here now is in the science and technology area—we will come back to that in the discussion. We are looking to this as one of the most important places in the world for S&T and R&D in our area. A third, situational, point is that an aeroplane is an aeroplane, but how you make it, what goes into it and the services that come with it are changing radically. We are a company that is innovating all the time, and very deliberately so, and we see the UK as one area where there is innovation that is relevant to us. We are keen to work with this country on that in digital, avionics and all sorts of new ways of producing aeroplanes.

Professor Jackie Hunter: Good morning. I am chief executive of BenevolentBio, which is the UK's largest private artificial intelligence business. We aim to apply initially artificial intelligence to the process of drug discovery and development. We have ambitions to be a $5 billion company and to expand AI into other sectors. We are looking to an industrial strategy that supports and has the same sort of vision and ambition. I should add that I have some non-executive roles. I am a former head of one of the research councils and past senior vice-president of a large global pharmaceutical company. So although I am focusing primarily on the needs of our growing AI and life sciences company, I can represent a broader set of views.

The UK has an opportunity to be a global leader in the AI sector. The application of AI impinges on all other forms of business—we have heard about aerospace—and a number of really important sectors for the UK economy. We must make every effort to become a dominant player. The world has not yet settled on a really dominant player in this sphere. We are well placed to take that position. The threat is that if the UK does not do this, industries that rely on this technology will look outside the UK and place their investment elsewhere.

One of the most important things for any business is the availability of capital, both fiscal and human. It is clear that we need long-term capital to grow businesses and that this has not been incentivised sufficiently in the UK. As a consequence, many businesses are forced to sell early and not realise their full potential for the UK economy. A classic example is Heptares Therapeutics, which was acquired by Japanese company Sosei in February 2015 for the same amount up front as the company raised in the subsequent 12 months in up-front deal terms with pharma companies. If it had held out for just a bit longer, it would have been able to continue to grow and thrive as a UK business. It was a great deal for Sosei, but less so for the UK.

On the point about what the UK has done, the EIS and the Patent Box are valuable incentives, but more needs to be done and we must be competitive globally. In terms of human capital, it is important that the UK continues to attract and retain the best scientific minds. Over half our staff were born outside the UK. It is really important that, whatever happens post Brexit, businesses such as ours can attract, employ and retain the talented people from overseas we need to help our businesses thrive. The Government are to be commended, though, for putting an industrial strategy in place. I am very pleased that we are being given the opportunity to comment on it.

Neil Woodford: My name is Neil Woodford. I am a fund manager. I have been running retail funds and investing in British businesses and international businesses for more than 30 years. A while ago, I ran very big funds working for a large UK fund management business. Three years ago, I left that business to set up my own business and we have been reasonably successful in the first three years. So I have an odd fund management employee perspective, but equally an entrepreneur's perspective on some of the issues that are raised in the industrial strategy document.

I suppose I am here not because I am a fund manager but because I have been investing not as a conventional fund manager principally but in early-stage British science and young scientific businesses internationally. The focus of my effort has been on investing in disruptive, scalable early-stage businesses here in the UK for more than 20 years. I am probably the biggest private sector investor in those early-stage businesses here in the UK, so I have a perspective on the capital question. That is crucial to the whole debate about the industrial strategy and what the UK has done well and has not done well, and where the gaps are in driving a more successful economy and wealth creation in the future. I have a particular perspective with respect to the provision of capital, which Jackie has just touched on.

Q21 **The Chairman:** Thank you to all three of you. It would be very helpful to follow up Neil Woodford's observations about disruptive early-stage investment and what needs to be done to address some of the issues to which this Committee has returned from time to time. I know that all three of you will have a perspective on this, but perhaps as Mr Woodford raised the subject I could address the following question to him. To what extent do you think the Green Paper addresses the issues that it is clear should be foremost among the issues that the Government need to address? Do you think that the excellent science base is being put to good use on behalf of wealth creation and quality of life, or are we missing something?

Neil Woodford: The short answer is that we are missing something. I do not think that we are making the best use of our remarkable science base here in the UK. The document draws attention to the disparity between the excellence of our university sector and the excellence of our science. We rank very highly in the world league table. You could argue that we are the most productive nation in the world in translating money into great science and great scientific output, but we are absolutely rubbish at translating that into scaled commercial success that then generates the wealth that we can then recycle into funding even more research and development and greater research establishments. The bit that is missing, from my point of view, is the scale-up capital piece. We are great at creating lots of small businesses.

I was told recently that the data is debatable but that we create more young technology businesses than the US economy does. What we do not do is scale them. There are no big FTSE 100 companies now that have grown from that science sector. Arm was our only company that followed that path, but it was very recently acquired by SoftBank. We are very poor at translating great science into scaled commercial success. The sector that is glaringly responsible for that failure is my own industry. It is the failure of the fund management industry, the capital allocation industry if you like, to embrace the long-term patient capital approach that is required for success in this sector. It is a fundamental problem in the fund management industry, which is multifaceted and is principally the product of an obsession with short-termism. It is a failure of the industry, and the regulator in my view, to embrace what is required for success here.

The Chairman: Would Sir Michael or Professor Hunter like to add anything?

Sir Michael Arthur: I hear what Neil says, and it is a very familiar message. I would say three things. First, in the aerospace industry it is a little different. We as a company have acquired British companies that have been small start-ups and we continue to operate here. They happen to have a Boeing badge, although not always; sometimes they do not have even that. The ownership might change, but the economic activity is still growing in this country.

Secondly, one thing that we are growing now is our work with universities with which we have partnerships to link some of that research not straight into our own work but to our supply chain in the UK. I can give you some examples of that later, if you like. That is quite an encouraging sign in a big sector where big companies play rather than small ones.

Thirdly—I will take off my Boeing hat here—I used to be a British diplomat, an ambassador, abroad. Certainly seen from outside, what we do in Britain is often admired; the Cambridge Science Park is a classic example of a very innovative way of translating pure research into start-up businesses. When I was in India and in Germany, we would have people coming to see that and admiring that. Where we have perhaps not been as good as others in the past is in the immediate transition of near-market research. When I was in Germany—again, in my former career and not in my career in Boeing—we tried to get the Fraunhofer concept translated into the UK. That started with catapults, which Jackie has been closer to than I have. We are picking up even from that previous gap, and I am slightly more positive than Neil is about the direction of travel.

Professor Jackie Hunter: I support what Neil has said. Innovate UK, for example, has done a very good job of supporting the early transition of research out of universities, but it is the next stage, the scale-up stage, where much larger and longer-term funds are required. There is a lot of evidence, some of it presented in the industrial strategy paper, that the actual amount of investment, either series A or B, in a company is much less in the UK than it is, for example, in the US. That means that they do not have the capacity to withstand some of the natural ebb and flow of what happens in managing a business—especially in life sciences, which is inherently risky. We need larger-scale investments and ways in which we can incentivise long-term investment, both inward investment through things like tapered relief and other types of investment; Australia, for example, requires that a certain amount of its pension funds are invested in R&D. We do not do that currently in the UK. That is another way in which capital could be accessed more easily.

Lord Hunt of Chesterton: I want to ask Sir Arthur—

The Chairman: It is Sir Michael, actually.

Sir Michael Arthur: It is very complicated when you have two Christian names.

Lord Hunt of Chesterton: I was taking the Indian approach, having just been in India.

I do some work with Airbus, which very interestingly is extremely open in its science and technology all across Europe. It participates in all these networks and has helped to build them up. Boeing is practically absent from a large part of these networks and is quite a secretive organisation. One important way in which big companies can contribute is by participating in its networks. When Rolls-Royce gave evidence to us here, it was critical of the way we did that. Is it a reasonable thing to ask of big foreign companies coming into Europe? Will they really participate and help these organisations Europe-wide, which we hope will continue in some way after Brexit?

Sir Michael Arthur: I hear what you say about our lack of openness on that, but with respect I am not sure that I completely agree. The UK is Boeing’s showpiece in the European area, so this is where we are investing most. Of our 4,500 direct employees in Europe, just under 2,500 are in the UK and the number is growing fast; we are hiring over a person a day on average—high-end engineers mostly. We are very plugged in here. For example, with my Boeing hat on, I am a board member of the National Centre for Universities and Business, which seems to me to be an organisation that is there to do just what you described. We have formal partnerships with six universities and relationships with more beyond that. Perhaps the most obvious one is in Sheffield, where we recently announced a big new manufacturing plant.

Lord Hunt of Chesterton: I am well aware of that. That is extremely good.

Sir Michael Arthur: We were also founder members of the AMRC. We have been there for a decade, and I do not think there is any secret about that; we have been rather proud of our association with the AMRC. As I see it, we are keen to do more in the UK and elsewhere in Europe. We also have quite a lot invested in Germany, but not in France, on the research side. We see the link between business and universities, which the Committee is looking at, as a growth area for us, as it is for the country, in the coming years. So for us the industrial strategy document fits well into the scenario that we want to grow.

Q22 **Lord Maxton:** My question is mainly to Mr Woodford, but first I should declare that my father was an agricultural economist.

Is the problem really that the investment industry in this country, particularly the banks, are risk averse? I remember people in California telling me that they would invest in a company, in people, only if they had gone bust at least three times. In this country, that is not the case. Is the problem that we are risk averse?

Neil Woodford: It is not so much the banks that are risk averse, in my view, but the asset management industry, which in some cases is owned by banks but is actually a separate entity. It has spent the last 30 years—my career, basically—becoming more risk averse. About 8% of pension funds, for example, are now in UK equities. Even a decade ago that number was, I think, over 40. We have seen the traditional asset owners, who would have been natural investors in early-stage patient capital investments, gradually move away from this type of investing. There are lots of reasons for that. There is a problem with short-termism, with regulation, with performance measurement, with how fund managers are remunerated. It is a multifaceted problem, which I have witnessed for the past 30 years, but it has aggregated to the point where we now have an industry, my industry, that thinks that what I do, investing in early-stage illiquid businesses that require patience and lots of engagement, is an extreme minority sport, and very few do it. Literally a handful of investing institutions now invest in early-stage businesses, such as Benevolent.

We bump into them regularly, we see them regularly; it is a very small club of investors. It is a major problem. I am worried about this situation and it has been very difficult for a very long time, but things are getting a lot better now, not because UK institutional investors are changing their mind about anything—they are continuing to move away from the sorts of things that they should embrace—but because international long-term patient capital providers such as sovereign wealth funds, the super funds in Australia, Asian sovereign wealth, Middle Eastern sovereign wealth and, indeed, US VC money are now recognising this gap, the gap being that there is great science here but no scale-up capital. They are stepping into that gap. It is really exciting to see that foreign capital—

Lord Maxton: It is a foreign investment.

Neil Woodford: Yes, it is.

The Chairman: A lot of colleagues want to come in, but Baroness Neville-Jones was next.

Baroness Neville-Jones: I want briefly, Chairman, to pursue the question that you have raised, which seems pretty important. It seems that our witnesses have identified a sort of cultural issue in this country: declining interest and participation in the seeds of wealth. What do you think public policy could do to counter what you have just described? Professor Hunter mentioned one or two measures, but is there something bigger than we can do to start to move the dial in the other direction?

Neil Woodford: Yes, I do think that there are things that the Government can do. Indeed, I have made my views clear to the Government through the patient capital review, and I am working with John Bell on the life sciences piece of the industrial strategy. I have submitted my views in those two work streams. In brief, to lay the problem in front of you, the problem is not that the mass affluent, which are the savers in this economy, are not interested in investing in early-stage businesses—I think they are. My own business has undertaken quite a lot of market research in this regard. We launched a fund off the back of that market research just over two years ago dedicated to investing in early-stage businesses. There is an appetite in the saving community. The problem is the bit in the middle: the advisers and the fund managers do not have the mindset to invest. That is where the problem lies. The Government can incentivise more capital to flow from savers into early-stage disruptive scalable science here in the UK through carefully targeted fiscal incentives, such as inheritance tax incentives. Targeting them at a specific type of investment would catalyse my industry to create the products that would capture that flow. That flow would then go to where it is needed most, which is in those young businesses that need scale-up capital.

Lord Fox: That was exactly my question.

Q23 **Lord Vallance of Tummel:** What Mr Woodford is saying is music to my ears. This is multifaceted. It is a big cultural thing and probably a bit out of our area. In our area, one problem is that the financial markets do not understand technology. The people who put the money in do not understand it. In a way, Innovate UK is there to address part of that market failure. If there were the opportunity for equity to be invested in a portfolio of Innovate UK activities, do you think that would be attractive?

Neil Woodford: I do. What Innovate UK is doing is fantastic. The problem is not that it does not help to create businesses and to nurture those really young businesses. The problem comes after Innovate ends and mature developed capital markets step in. It is the bit in the middle that is often the most difficult to navigate—the scale-up, the commercialisation, the proving of the technology. That bit is very hard and long. It requires a really grown-up relationship between capital provider and business. It requires a partnership, which is how we describe it. That is the bit with an absence of capital. There are great businesses coming from that early-stage creation piece; it is that scale-up bit where we are failing most.

The Chairman: Professor Hunter, would you like to comment on investment and Innovate UK's portfolio? You have had some experience, I know.

Professor Jackie Hunter: I think it would be very valuable. Innovate UK has a great track record. One almost wants an Innovate in the middle. We have Innovate in the earliest phase; the catapults look more at the later phase. We want a larger-scale, Innovate-in-the-middle fund that would help to attract inward investment and matching funding. It would be similar to what the catapults do, but it would be at a targeted phase of the development of companies.

Q24 **Lord Hennessy of Nympsfield:** You have talked a good deal this morning about patient capitalism, but we are looking at patient policy-making. This is the ninth industrial strategy since 1945. It is a big one—132 pages long. Can all three of you succinctly cheer us up by telling us the ingredients that you have discovered in these 132 pages that will last longer than the previous eight industrial strategies?

Sir Michael Arthur: I will just comment on the last eight or nine strategies, or however many there were. In a sense, the picture that I have been painting of Boeing being here is down to some of the earlier strategies having delivered some good things, and now this one has come along let us talk about where it will go next. However, you have an AMRC type of operation in Sheffield precisely because successive Governments have wanted to create a strong aerospace sector here. It was not always called an industrial strategy. Governments of both complexions have nurtured the aerospace industry to the point where we are the second-biggest aerospace economy in the world and look like staying there, too. That is a positive reflection on some of those earlier attempts.

What we find attractive about the new strategy that is being discussed is that it looks at the fundamental issues of finance skills and infrastructure—the cross-cutting things—and has a bit of sectoral focus. The sectoral focus cannot be too wide or it loses focus. In our view, it does not need to go just for heritage industries. We are a heritage industry, but we are changing all the time, so aerospace is not to be seen as a heritage industry. There is quite a nice balance in this paper between that range of fundamental functional issues and targeted sectoral issues. We are quite positive about that.

Professor Jackie Hunter: I do not have huge experience of all the other industrial strategies, but the life sciences strategy that was set up before has been very successful in marshalling and having a clear framework, such as for the biomedical catalysts. The opportunity for a joined-up industrial strategy is really important. It is important that a balance is maintained between established industries and the new fundamental underpinning industries. I would say that, because I believe fervently that artificial intelligence is one of them, but more broadly the digital strategies are really important. Having more clarity about the financial incentives and the potential for tax incentives, and about how the various pillars across the strategy will join up, will be important in ensuring that it is a well-implemented strategy.

At the moment, although the strategy talks early on about the reinforcing nature of the various pillars, there is very little cross-referencing between chapters. The devil will be in the detail in ensuring that there is joined-up thinking such that there are long-term objectives. Access to data is very important, and the UK has a big opportunity there, but there may be very short-term drivers, such as access fees to that data, which only large companies may be able to pay. A data economy could drive the development of small and growing businesses, but that means having to take a longer-term view rather than going for short-term gain. There is much to commend in this strategy, but a lot of detail needs to be worked out. A better framework for connecting the various threads of the strategy will be really important.

Sir Michael Arthur: I will add just one point to what Jackie said, with which I agree. It is not just the linking up within the strategy; it is also the linking up with other areas of government strategy, such as the defence industrial strategy, which is 10 years old but is being refreshed. There needs to be some tie-in. The aviation strategy is another example, from the Department for Transport. There needs to be a cross-government look at these issues.

Professor Jackie Hunter: Especially with the Treasury.

The Chairman: I am going to move on, if you agree, to Lord Oxburgh.

Q25 **Lord Oxburgh:** Can I pursue the topic that we have been talking about? We have mentioned risk averseness and the general difficulties there. About 10 years ago, this Committee conducted an inquiry into the development or success of UK small electronics firms going through the growth stages that you have described. We did quite a detailed comparison between what went on in this country and what went on in California. We noticed that in California investors, investment companies and venture capitalists were much more technically aware than was the case in this country at the time. The way to manage risk is to have people who know what they are doing. Our observation was that venture capitalists and investment houses in California had significant technological in-house expertise, which incidentally followed the progress of the companies under their tutelage for many years and helped them. That expertise was significantly higher than anyone was getting in this country, where the approach seemed to be much more scattergun: "We have 10 interesting start-ups here. We can't distinguish between them, so we'll back them all and maybe one will work". Is that an unfair categorisation of the situation in this country?

Neil Woodford: I think that it is a fair reflection of the facts. In my community of the fund management industry, there are not that many groups that specialise in the sort of activity that we are talking about, because they do not have funds to deploy in that way. I am a great believer in the expertise being there, or the ability to attract the expertise, if you show a commitment to invest. If you have the right institutional approach to investment, with more people believing that this sort of investment could deliver great outcomes for investors and at the same time do good for the economy, there would be no problem in attracting all the talent that you need. We have had no problem in attracting the talent that we need to undertake this sort of investment.

Lord Oxburgh: To extend this a little in the direction in which the Chairman wanted me to go, can we encourage this process either by changes in taxation arrangements or regulation? Again, you have all touched on this, but not hit it straight on.

Neil Woodford: I would say both.

Lord Oxburgh: So how would you change things?

Neil Woodford: I would do what I have alluded to already. It would be hard to catalyse change in my industry by imploring fund managers to embrace a more long-term perspective. That might work eventually, but time is short, so we do not have that luxury and I do not think that is the path that we should pursue. We should incentivise the flow from savers. If you do that, you force an industry that is quick to adapt to create the structures that will capture that flow and direct it to where it is needed.

Lord Oxburgh: We have the EIS system at the moment, which is quite good, but you want something stronger than that.

Neil Woodford: It is, but venture capital, EIS, all that—

Lord Hunt of Chesterton: What is EIS?

Lord Oxburgh: The enterprise investment scheme.

Lord Cameron of Dillington: You do not pay any capital gains tax. It is a good scheme.

Neil Woodford: It is important, but again it tends to be focused on early-stage businesses and the creation of businesses. The big problem that we need to address is the scaling up, which requires substantially more capital and arguably a longer-term approach.

Lord Oxburgh: So you would have a reward for investors that stayed.

Neil Woodford: Yes—taper relief or IHT relief for a minimum holding period of seven to 10 years, for example. Those are the sorts of things that we are proposing in the document that we have submitted. Regulation needs to change, too.

The Chairman: Is this document in the public domain?

Neil Woodford: The document was submitted earlier this week to Damon Buffini's patient capital review.

The Chairman: If it is available for us to look at, we would like to see it.

Will you send it to the clerk?

Neil Woodford: I will do that.

The Chairman: We have a very interesting theme here to develop.

Q26 **Baroness Young of Old Scone:** You could typify the strategy as seeing government as having an enabling role rather than a directive role. You can understand why government is nervous about backing winners. Is that the role that you want from government, or is there another leadership role that you would like to see? We have heard about the creation of fiscal and tax incentives, but are there other leadership roles that you feel government needs to adopt? I direct that towards the sectors that are barely able to stand up and wave and are not going to self-organise particularly effectively.

Professor Jackie Hunter: I think that government plays a big role. We have talked about tax incentives, but there is a clear correlation—this is in the document—between government support and the level of private inward investment. There are ways in which the Government can ease regulatory burden. Money and ideas flow like water; they go down the path of least resistance. Making it easy for people to invest, having joined-up thinking with, for example, the new Department for International Trade, and knowing where the regional aspects of excellence are, both commercial and academic, are important roles for government. Making available funding schemes that attract inward investment and match funding, such as through Innovate—those sorts of things are important. The Government has an important role to play.

The strategy also mentions infrastructure. Infrastructure is important. I might be wrong, but I do not think I saw anything about broadband. Delivering on the broadband strategy for the whole UK would be an important enabler. There are many ways in which the Government can take leadership. Focus is important. We cannot do everything. If we spread our resources too thin, we will not have enough, so it is important to focus, but we need to focus on both established and developing industries.

Sir Michael Arthur: I agree, but I have three points to add from my perspective. First, the Government’s emphasis on skills, particularly STEM skills, is vital. We have to do more in this area just on basic education in the next generation of technologies. Secondly, one thing that is distinct about the UK compared with other places for inward investment in this sphere is the fact that the Government provide grants, not loans, for some of the research work. That is important for business. Thirdly, going back to my earlier career, I think that the Government are active and need to be active overseas in selling the opportunities here, particularly in trying to attract inward investment. We have rightly put a lot of work into exports and trade promotion, but embassies and government more generally have a real role to play in sending the message about the welcome for inward investment in these new sectors.

Professor Jackie Hunter: The skills point is important. The strategy focuses very much on schools, apprenticeships and technical skills, but industries such as ours need highly-skilled graduates and postgraduates, including those with an interdisciplinary view. I know that you were talking to UKRI earlier. It is important that we come up with new ways of funding and incentivising interdisciplinary research, because it is at that cutting edge of disciplines where you get real breakthrough innovation. For example, with a lot of our funding schemes, people who do two PhDs, one in one discipline and one in another, are not eligible for follow-on early-stage fellowships. Businesses also have to look at how we can incentivise that interdisciplinarity. From a government point of view, enabling interdisciplinarity where we have excellence in many sectors and bringing those together could really drive value for the economy.

Q27 **Lord Rees of Ludlow:** I live in Cambridge and I am saddened by the number of promising start-ups that sell out before the IPO, often to people from the US. How upset should I be, and what are the realistic aspirations for small companies? I suspect that they are different. If you are working in the aerospace sector, you are never going to be another Boeing or British Aerospace, so you will have to sell out at some stage, whereas in the IT area—I do not know what Professor Hunter thinks—is it not rather sad if people do not have the aspiration to build up a big company which could develop without being taken over?

Professor Jackie Hunter: I completely agree with you. There have been some amazing companies such as Solexa, which was bought by Illumina.

Lord Rees of Ludlow: Those are examples of companies that were taken over.

Professor Jackie Hunter: From a Benevolent point of view, we want to grow and be a big company in the UK. We want to be able to use our IT not only for commercial benefit but for that of the UK economy and UK health and well-being. I feel passionately that we need long-term, patient investors to enable that to happen. We have the science, we have the technology. As Neil says, there are outside investors willing to come in. It is just a shame that there is not more liquidity in the market here to enable it to happen.

Sir Michael Arthur: I do not disagree at all, but I will say a word for the global companies, particularly ones like ours. When we do invest here and get the small start-up, we do not take it away; we just grow the business. It happens to be an American parent, but the economic activity carries on here. I go back to Lord Oxburgh's point earlier about how you integrate things. Global OEMs also integrate. For example, in the Boeing business in the UK, one bit now talks to another in a completely different field and they work together. That is quite creative, so I think that we have a positive role to play in this.

Neil Woodford: All those points are right, but I am not sure that the UK outside the European Union can take the risk that foreign ownership necessarily ensures that jobs and investment come to the UK. In the more protectionist world that we might be moving towards—if you believe what Mr Trump says—Boeing might be incentivised to invest more domestically rather than in the UK. The way to ensure that we do not bump into that problem is of course to grow our great science base into great-scale scientific businesses that dominate the FTSE 100. That is what I see happening. It is a great shame that we have not already done it, but I am very excited that over the next five years FTSE 100 companies will emerge that the market has not heard of today—like Jackie's business; there are about five or six other such companies ready and waiting to burst on to the scene right now. The story is getting better, but we just have to do more.

Lord Rees of Ludlow: Will they go the way of ARM?

Neil Woodford: No. I hope that our businesses will acquire others internationally.

Q28 **Viscount Ridley:** Can I push you a bit more on regulation? I think that Mr Woodford was about to start talking about it in answer to Lord Oxburgh, but for some reason the conversation went off in a different direction. You mentioned Brexit. One of the supposed benefits of Brexit, some of us believe, is that we can remove some of the obstacles to innovation that are found in regulation. Sir John Bell, whom you mentioned earlier, wrote in the *FT* last August: "A failure to implement sweeping changes to regulation and its institutions in the UK would be to miss an … opportunity". He went on to mention data science, which Professor Hunter has talked about, of which genomics and regenerative medicine are examples. Could you, and perhaps Sir Michael, give us examples of regulations that you would like to see dropped as part of the Brexit process?

Neil Woodford: My perspective is financial services regulation. I have spoken to John about how Brexit is an opportunity not to abandon regulation but to tweak it to make the UK more competitive. There is plenty of opportunity to do that in medical sciences, for example. From my perspective in financial services, the problem that we have had in the past is that the regulator has a great focus on liquidity in retail funds and on the valuation of hard-to-value securities. If a company is not quoted and its share price is not established in a market, it is hard, although not impossible, to arrive at an acceptable value that you can carry in a fund that retail investors are investing in. The regulator has been very focused on the valuation of hard-to-value securities. Those two issues could be changed: the obsession with liquidity and the focus on hard-to-value securities. It is really about approach and the tone of voice used by the regulator when it engages with the companies that are investing, as I am, in such businesses. If the tone of voice were to change, I think there would be less disincentive to invest in these things.

Sir Michael Arthur: A tiny comment. It is slightly different in aerospace. Regulation is a route to market. Consumers tend not to want aeroplanes to fall out of the sky, so we need certain minimum levels of regulation. We work at the moment with EASA for Europe and the FAA for America. We as a country now have a choice as to how we take that forward after Brexit. Do we work in the future with EASA in some way or do we rebuild the CAA to have global authority and the same recognition? That is perfectly possible, but it will need to be done. If you have lower standards, aeroplanes cannot be sold globally. It is as simple as that.

Q29 **Lord Cameron of Dillington:** I am glad that we have made it to Question 2. Sir Michael talked about the benefits of overseas investment. More than 50% of business investment in R&D in this country comes from firms headquartered overseas. I know that Mr Woodford is suspicious—perhaps that is an overly strong word—about it, but in my view we need this overseas investment. Does the industrial strategy Green Paper encourage more overseas investment? Can we do more to encourage it? If the Government are to take some action to prevent the sort of takeovers that Mr Woodford is worried about, does government intervention in this area disincentivise such investment? I would think that it did, but please discuss.

Professor Jackie Hunter: I look at it from the point of view of a smaller company. I look abroad and I see a lot of incentives. At a board meeting, one of our board members was talking about a company in the US. New York and New Jersey were vying to attract the firm to put its headquarters in their state and they were talking sums of $30 million—and that was not for a big company. It is really important that the UK continues to benchmark itself and, especially in a post-Brexit world, make itself an attractive place. It should not be afraid to offer incentives—that is where joined-up working with the Treasury also comes in—to stimulate that inward investment. Tax incentives and other support mechanisms are really important. There could be more mention of those in the industrial strategy.

Sir Michael Arthur: From our point of view, government incentives are necessary but not sufficient. There are Governments all around the world who want us to go and invest in R&D. We would not dream of doing it in many places. It is helpful to have that here, but the fundamental driver for why we are here is because it is a strong aerospace industry with world-class research capability. So the three come together.

Neil Woodford: I may have given an impression that I should not have done. I am not against a market in corporate control; I would absolutely support that. I was trying to suggest that if we create businesses to be as successful as I believe we can be and they are rated as highly as they should be, they almost price themselves out of the corporate control market. If we were to impose too high a bar on public-interest controls on takeovers, it would disincentivise foreign investment in the UK, so we need to tread very carefully there.

The Chairman: For the sake of progress, Baroness Morgan, would you like to take us on to distribution of economic growth?

Q30 **Baroness Morgan of Huyton:** Professor Hunter touched on this earlier. One issue that the Green Paper emphasises is geographical spread, both of economic growth and of R&D. Do you think that is right? How realistic is it? Do you have any practical suggestions for how that spread can be done in a way that builds success rather than backs potentially not very successful enterprises? Are there any lessons from other countries? I am thinking here of Sir Michael's experience in Germany in particular. We have been looking at statistics that demonstrate a really unbalanced position in R&D, with a pretty strong concentration in the south-east and East Anglia, which I guess is the Cambridge area.

Sir Michael Arthur: You raise issues of public policy, which are not really for Boeing to answer on.

Baroness Morgan of Huyton: From your previous life.

Sir Michael Arthur: In terms of our own footprint here, we have six strategic partnerships with UK universities and relationships with a number of others. They range from Strathclyde through Sheffield to Southampton. We have the full diversity. We are there because there are centres of excellence that we wanted to partner with. That is the pure reason for us; we do not do public policy, we do centres of excellence.

Back to my earlier experience, Germany's is a much more decentralised system anyway, with quite a lot of fiscal power at Länder level and a whole different structure for financing research, but quite a lot of central direction. If you look at the Humboldt institutes, of which there are many all around the place, you see that quite a lot of politics goes into where they should be set up. So Governments have a role if they want a geographically dispersed research capability.

Q31 **Lord Fox:** Catapults were mentioned briefly earlier. They are perhaps one of the agents that try to drive a more regional approach and create a focus of excellence for different elements of industry. Have you had any experience of catapults where you felt that they were successful in helping to drive innovation and bridge the gap? Do they have a regional role, or is something else needed?

Professor Jackie Hunter: The catapult model can be very productive, but for us and in general for the country you have to build the catapult around a centre of excellence. A high-value manufacturing catapult has been very successful and driven some regional growth, but that has been built around excellence.

Lord Fox: So the excellence has to pre-exist. You cannot create excellence by creating a catapult.

Professor Jackie Hunter: I absolutely agree with that. From our perspective, we work with the best. We do all our research—actual wet work—virtually and deal with academic groups all over the country. We go to where there is excellence in what we need. To be perfectly honest, being incentivised to go and work somewhere where there is no excellence would not work for us because it would be counterproductive. It is really important that you have that.

One important thing touched on in the report is the variation in technology transfer offices across the country. Some academics are very engaged, but their TTOs might slow us down, so I strongly support the recommendation for a best-practice review. Universities play an incredible role in generating that excellence, but there are also pockets of real excellence in manufacturing across the country, especially in life sciences.

Lord Fox: Just to go back to that technology transfer point, is it that they are trying to hold on too much or are not co-operative? Where does the variation come?

Professor Jackie Hunter: It comes in wanting too much equity. What technology transfer offices should really care about is that if the invention makes a shedload of money, they get a share of it. That is the really important bit, rather than arguing about whether you should pay £10,000 or £50,000 up front. For me, it is having that business nous.

Lord Fox: That is exactly what I thought you would say.

The Chairman: I will try to squeeze in three quick questions from Lord Mair, Baroness Neville-Jones and Lord Borwick.

Q32 **Lord Mair:** We have already discussed sectoral approaches. Can I go back to STEM skills? My question is for Sir Michael. You know Germany very well and have mentioned Fraunhofers and Humboldt institutes. What do you see as the important difference between Germany and the UK in STEM skills, and how good is Germany at the things that the Fraunhofers and the Humboldt do, such as translating science into commercial enterprises? Are there important differences between Germany and the UK in the way a much higher proportion of young people are well educated in science?

Sir Michael Arthur: There are two fundamental differences, which are cultural and social. One is the whole Mittelstand culture, whereby small, sometimes quite big, but privately-owned family firms reinvest, sometimes countercyclically. Their ambition is not to IPO themselves and go off to the golf course but to have this for their great grandchildren. That is a fundamentally different business approach.

The second difference, as we all know, is the divided German school system. Lots of people have a technical path, which leads to technical excellence and different types of skills from those acquired at university. That has proved its worth for the German model, although people nowadays ask, "Is it really working?" They are self-critical about that, too. We have now put a lot into the core STEM skills in this country. I would not say that a typical German child was better at mathematics than a typical British child, but I am not an expert in that.

Lord Mair: But more of them are perhaps.

Sir Michael Arthur: Perhaps. Others know more than I do about that.

Baroness Neville-Jones: May I follow that point? One thing that happens in Germany is that young people go and get a qualification at Siemens, which is possibly more highly regarded than going to Bonn University. Is that part of the cultural picture that you are painting?

Sir Michael Arthur: That is beginning to change here, too, with apprenticeships. At Boeing, we are employing apprentices all the time as well as graduate engineers. My close colleague, the CEO of Boeing

Defence UK, a billion dollar company, started life as an apprentice and celebrates that. A lot of our senior leadership are like that. The culture is changing here and we have to value that. The more we, the opinion leaders, all value it, the stronger it will get.

Professor Jackie Hunter: There could be more opportunities for interplay between academia and industry. There was a movement to more centralisation of PhD studentships and CASE studentships with industry. From an SME perspective, it would be great if that was more available, especially in order to be able to train people in disciplines additional to those in which they have a first degree.

Q33 **Lord Borwick:** I have yet another question about selling out too early. It is really a question for Mr Woodford. Is it true that the return on capital for the entrepreneur is best in the beginning of the process of moving from nothing to an enormous company? If he is looking for the return on his own capital, selling out is the logical thing to do. Is that true?

Neil Woodford: No, I do not think so. By the time businesses are selling out, it is normally not the entrepreneur, the founder, who is guiding what happens; it is the funders, the VCs typically. The problem with venture capital in the UK is that it is far too short term. The VCs are motivated to crystalize value too early to get exits so that they can then prove to the investors that they can make a return so that they can raise a new, bigger fund.

Lord Borwick: Yes, but the first decision was for the entrepreneur to sell to those venture capital funds.

Neil Woodford: Not really. If entrepreneurs have an idea about technology or some business idea, making that real requires capital. Some businesses do not require very much capital, particularly in the software and IT space. Sometimes you just do not need that much; they are not very capital-intensive businesses. But certainly in life sciences, translating great ideas into scaled success requires lots of capital and lots of patience. For an entrepreneur, academic or inventor to get a return on their investment, in so many cases they just have to get capital in, and it has to be the right capital.

In the early stages, the sort of capital that you need can be the sort that is provided by Innovate or EISs, but ultimately if you are going to get that sort of outsized return, you need the scale-up capital. Our experience is that you have a hockey stick relationship with returns; most of the really big returns come later in the life of the disruptive business. That has been the case in the US, it has certainly been the case here the UK, and it will, I think, be increasingly evident here in the UK.

The Chairman: I am sorry that I have to bring this session to a conclusion, because quite frankly you will have realised that we would have liked to continue it for very much longer. We have been very privileged to have all three of you here. It was particularly helpful to have the very protracted discussion that we had on the multifaceted problems of long-term investment, and in a way I got some encouragement from it, because although you will have recognised from Lord Oxburgh’s question that this Committee has been somewhat fixated on this issue for many years, you gave us some reason for optimism. You talked about international sovereign funds and others coming into this in a way that is rather better informed than might have been in the past. We have to build on that.

We are particularly interested to see the evidence that you submitted to the Green Paper, Mr Woodford, and if you would like to share that with us I know that we would find it very helpful. Indeed, I say to our other two witnesses that if there are other things that we have had to skate over rather fast, which always happens on these occasions, please feel free to send in any further evidence that you feel might be helpful.

We will talk to one of the Ministers next, and then we will produce what will effectively short letter but drawing attention to some of the points that you have brought out in evidence, and others. I hope that it will be seen as a useful contribution to this Green Paper, which after all is designed to do just that: to stimulate discussion. I think that today will indeed have proved to have been a helpful contribution to that discussion, and for that we are indebted to you three: Sir Michael Arthur, Professor Jackie Hunter and Neil Woodford. Very many thanks.